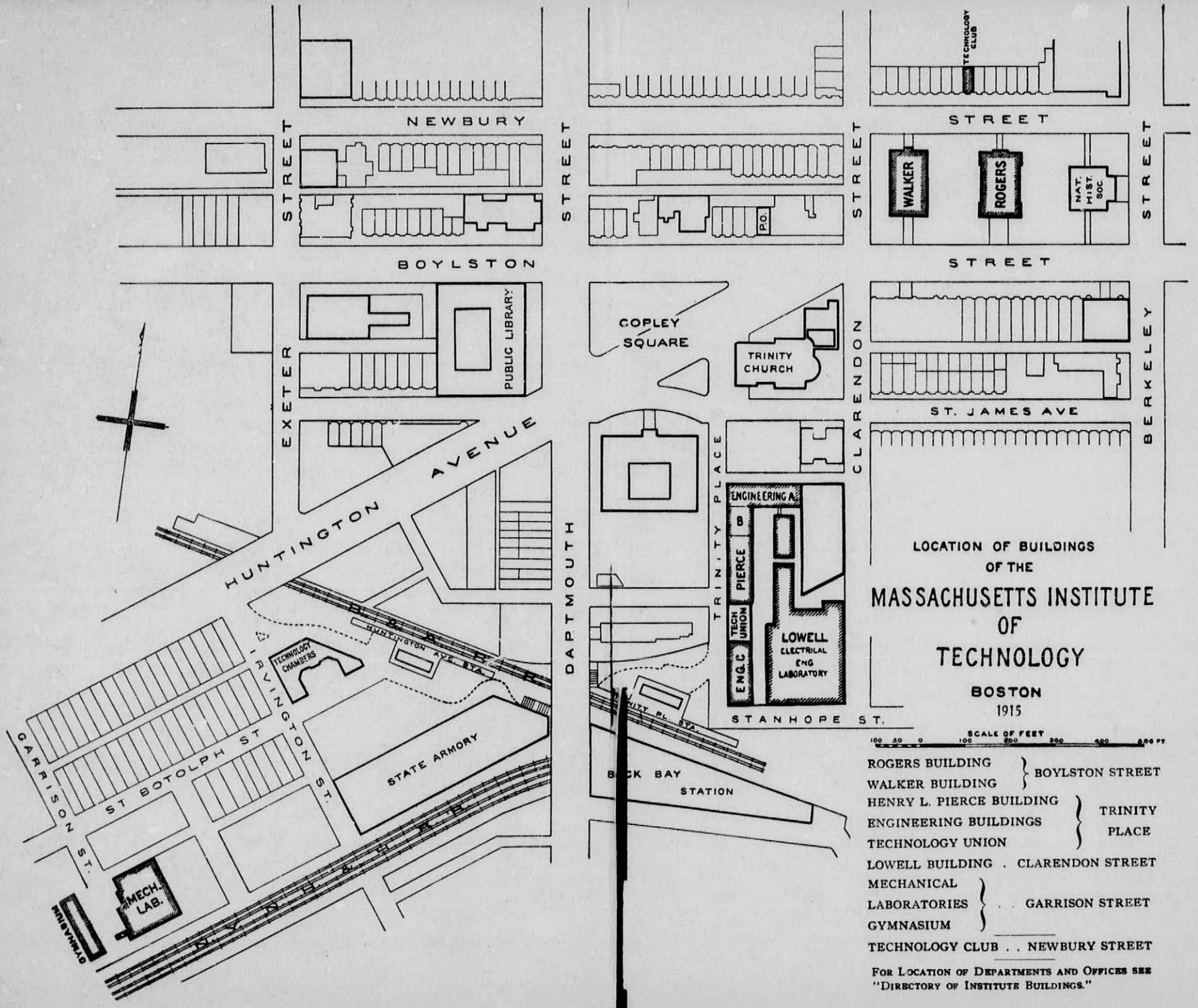


LOCATION OF BUILDINGS
OF THE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

BOSTON
1915

SCALE OF FEET
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ROGERS BUILDING } BOYLSTON STREET
WALKER BUILDING }

HENRY L. PIERCE BUILDING }
ENGINEERING BUILDINGS } TRINITY PLACE
TECHNOLOGY UNION }

LOWELL BUILDING . CLARENDON STREET

MECHANICAL LABORATORIES } . . GARRISON STREET
GYMNASIUM }

TECHNOLOGY CLUB . . NEWBURY STREET

FOR LOCATION OF DEPARTMENTS AND OFFICES SEE "DIRECTORY OF INSTITUTE BUILDINGS."

Volume 51 Number 1

BULLETIN

OF THE

Massachusetts Institute of Technology

BOSTON



CATALOGUE

OF THE

OFFICERS AND STUDENTS

WITH

A STATEMENT OF THE REQUIREMENTS FOR ADMISSION

AND

A DESCRIPTION OF THE COURSES OF INSTRUCTION

DECEMBER
1915

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YEARLY CALENDAR

1915

JANUARY

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CALENDAR.

1915.

Sept. 27, Mon.	FIRST TERM of the year 1915–1916 begins.
Oct. 1, Fri.	Limit of time for making up second-term deficiencies, except in Drawing and Laboratory.
Oct. 12, Tues.	Columbus Day (exercises suspended).
Oct. 13, Wed.	Stated meeting of the Corporation.
Oct. 30, Sat.	End of the first five weeks of the term.
Nov. 6, Sat.	End of the first six weeks of the term.
Nov. 25, Thurs.	Thanksgiving Day (exercises suspended).
Dec. 1, Wed.	Limit of time for making up deficiencies in Drawing and Laboratory.
Dec. 4, Sat.	End of the second five weeks of term.
Dec. 8, Wed.	Stated meeting of the Corporation.
Dec. 22, Wed.	Third year students file choice of second-term General Study.

CHRISTMAS RECESS DECEMBER 23 TO DECEMBER 29, INCLUSIVE.

Dec. 31, Fri.	First-year students file choice of Course.

1916.

Jan. 19, Wed.	Last exercises of the first term.
Jan. 19–29	Semi-annual examinations.

RECESS FROM JANUARY 31 TO FEBRUARY 6, INCLUSIVE.

Feb. 7, Mon.	SECOND TERM BEGINS. Registration completed.
Feb. 22, Tues.	Washington's Birthday (exercises suspended).
March 1, Wed.	Applications for Graduate Scholarships due for next school year.
March 8, Wed.	Stated meeting of the Corporation.
March 18, Sat.	End of the first six weeks of the term.
March 31, Fri.	Limit of time for making up first-term deficiencies.

1916.

April 10, Mon. . . . . Applications for Undergraduate Scholarships due for next school year. Applications for Cambridge Scholarships must be made in May or June.

RECESS APRIL 19, 20, 21 AND 22.

May 26, Fri. . . . . . Second-year students file choice of option in General Studies for third year, first term.
May 26, Fri. . . . . . Last exercises of the second term.
May 27, Sat. . . . . . Theses due.
May 27–June 9 . . . . Final Examinations.
May 30, Tues. . . . . . Memorial Day (exercises suspended).
June 9, Fri. . . . . . Stated meeting of the Corporation.
June 12, Mon. . . . . . Class Day.
June 13, Tues. . . . . . Graduation.
June 21–23, Wed. to Fri. . . Entrance Examinations of the Massachusetts Institute of Technology.
June 19–24, Mon. to Sat. . . Entrance Examinations of the College Entrance Examination Board (see page 65).

SUMMER VACATION JUNE 14, 1916, TO SEPTEMBER 24, 1916, INCLUSIVE

SUMMER SCHOOL (in June, July, August and September).

SUMMER SURVEYING CAMP (in August and September).

Sept. 14, Thurs. . . . . Advanced Standing Examination begins.
Sept. 16–19, Sat. to Tues. . Second Entrance Examinations.
Sept. 21, Thurs. . . . . Registration begins.
Sept. 25, Mon. . . . . FIRST TERM of the year 1916–1917 begins.
Oct. 11, Wed. . . . . . Stated meeting of the Corporation.
Oct. 12, Thurs. . . . . Columbus Day (exercises suspended).
Oct. 28, Sat. . . . . . End of the first five weeks of the term.
Nov. 4, Sat. . . . . . End of the first six weeks of the term.
Nov. 30, Thurs. . . . . Thanksgiving Day (exercises suspended).
Dec. 2, Sat. . . . . . End of the second five weeks of term.
Dec. 6, Wed. . . . . . Stated meeting of the Corporation.
Dec. 22, Wed. . . . . . Third year students file choice of second-term General Study.

CHRISTMAS RECESS DECEMBER 21 TO DECEMBER 27, INCLUSIVE.

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ARTHUR F. ESTABROOK.
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Term expires March, 1918.
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Term expires March, 1919.
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GERARD SWOPE.

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HON. ARTHUR P. RUGG, *Chief Justice of the Supreme Court.*
DAVID SNEDDEN, *Commissioner of Education.*

[1]Address correspondence to Professor Allyne L. Merrill, Secretary of the Faculty. (See page 14.)

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WALTER F. WYETH. *Assistant Treasurer.*	39 Chestnut Terrace, Newton Center.
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ALBERT S. SMITH. *Superintendent of Buildings and Power.*	32 Oakland St., Winthrop.

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CECIL H. PEABODY. *Chairman.*	293 Commonwealth Ave.
ALFRED E. BURTON. *Dean.*	32 Webster Ct., Newton Center.
ALLYNE L. MERRILL *Secretary.*	Payson Pk., Belmont.
WALTER HUMPHREYS. *Registrar and Recorder.*	249 Clinton Rd., Brookline.
O. F. WELLS. *Assistant Registrar.*	15 Fairview St., Roslindale.

Correspondence should be addressed to the Secretary of the Faculty.

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RICHARD C. MACLAURIN, M.A., LL.D., Sc.D. *President.*	187 Bay State Rd. Rogers.
GEORGE A. OSBORNE, S.B. *Walker Professor of Mathematics, Emeritus.*	249 Berkeley St.
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CHARLES R. CROSS, S.B. *Thayer Professor of Physics; in charge of the Department; Director of the Rogers Laboratory.*	100 Upland Rd., Brookline. 11 W.
GAETANO LANZA, B.Sc.; C. & M.E. *Professor of Theoretical and Applied Mechanics, Emeritus.*	Montevista, Philadelphia, Pa.
GEORGE F. SWAIN, S.B., LL.D. *Gordon McKay Professor of Civil Engineering.*	1988 Commonwealth Ave., Brighton. 46b Eng. A.; H. U.
FRANCIS W. CHANDLER. *Professor of Architecture, Emeritus.*	195 Marlborough St.
WILLIAM T. SEDGWICK, PH.D., Sc.D. *Professor of Biology and Public Health; in charge of the Department; Director, Sanitary Research Laboratory and Sewage Experiment Station; Chairman Administrative Board of the School for Health Officers.*	29 Commonwealth Ave. 27 P.
DAVIS R. DEWEY, PH.D., LL.D. *Professor of Economics and Statistics; in charge of the Department; in charge of the Course in Engineering Administration.*	2 Berkeley St., Cambridge. 40 R.
CECIL H. PEABODY, S.B. *Professor of Naval Architecture and Marine Engineering; in charge of the Department; Chairman of the Faculty.*	293 Commonwealth Ave. 31a Eng. C.
HARRY W. TYLER, PH.D. *Walker Professor of Mathematics; in charge of the Department.*	39 Gray Cliff Rd., Newton Center. 22 R.
ARLO BATES, A.M., LITT.D. *Professor of English; on Leave of Absence.*	4 Otis Pl.

[1] The following abbreviations are used in designating offices: R., Rogers Building; W., Walker Building; Eng. A, B, C, Engineering Buildings A, B, C; P., Henry L. Pierce Building; L., Lowell Building; Mech. Lab., Mechanical Laboratories; Gym., Gymnasium; H. U., Harvard University.

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C. FRANK ALLEN, S.B. *Professor of Railroad Engineering.*	88 Montview St., W. Roxbury. 51 Eng. B.
ALFRED E. BURTON, S.B., Sc.D. *Professor of Topographical Engineering; in charge of the Department of Drawing; Dean.*	32 Webster Ct., Newton Center. 12 R.
DWIGHT PORTER, PH.B. *Professor of Hydraulic and Sanitary Engineering.*	149 Hawthorne St., Malden. 46 Eng. A.
HEINRICH O. HOFMAN, E.M., MET.E., PH.D. *Professor of Metallurgy; in charge of the Department of Mining Engineering and Metallurgy.*	88 Robinwood Ave., J. P. 8 R.
HENRY P. TALBOT, PH.D. *Professor of Inorganic Chemistry; in charge of the Department of Chemistry and Chemical Engineering.*	273 Otis St., W. Newton. 30 W.
ARTHUR A. NOYES, PH.D., LL.D.,,Sc.D. *Professor of Theoretical Chemistry; Director of the Research Laboratory of Physical Chemistry.*	97 Hemenway St. 17 Eng. C.
THOMAS E. POPE, A.M. *Professor of Inorganic Chemistry; Retired.*	345 Crafts St., Newtonville.
HENRY L. SMYTH, A.B., C.E. *Professor of Mining and Metallurgy.*	Belmont St., Watertown. H. U.
CHARLES F. A. CURRIER, A.M. *Professor of History and Political Science; in charge of the Department.*	1 Webster St., Winchester. 34 R.
WILLIAM HOVGAARD. *Professor of Naval Design and Construction.*	91 Marion St., Brookline. 33 Eng. C.
ARTHUR E. KENNELLY, A.M., S.D. *Professor of Electrical Engineering; Director of the Research Division of the Department of Electrical Engineering.*	1 Kennedy Rd., Cambridge. 1 L.
THOMAS A. JAGGAR, PH.D. *Professor of Geology; Director of the Hawaiian Volcano Observatory.*	Volcano House, Hawaii.
HARRY E. CLIFFORD, S.B. *Gordon McKay Professor of Electrical Engineering.* (*Absent.*)	942 Beacon St., Newton Center.
FRANK VOGEL, A.M. *Professor of German; in charge of the Department of Modern Languages.*	95 Robinwood Ave., Jamaica Plain. 24, 33 L.

	Residence and Office.
DANA P. BARTLETT, S.B. *Professor of Mathematics.*	20, 26 R.
ALLYNE L. MERRILL, S.B. *Professor of Mechanism; Secretary of the Faculty.*	Payson Park, Belmont. 10 R., 30 Eng. A.
EDWARD F. MILLER, S.B. *Professor of Steam Engineering; in charge of the Department of Mechanical Engineering.*	538 Ward St., Newton Center. 10 Eng. A.
WILLIAM H. WALKER, PH.D., ENG.D. *Professor of Chemical Engineering; in charge of the Course in Chemical Engineering and Director of the Research Laboratory of Applied Chemistry.*	226 Bay State Rd. 55 P.
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General Information.

Historical Sketch.—The foundation of the Massachusetts Institute of Technology was laid in a "Memorial" prepared in 1859 by Professor William Barton Rogers, and presented, by a Committee, to the Legislature of 1860. In this Memorial "reference is made to the expected early establishment of a comprehensive Polytechnic College, furnishing a complete system of industrial education supplementary to the general training of other institutions, and fitted to equip its students with every scientific and technical principle applicable to the industrial pursuits of the age."

On May 28, 1860, a sub-committee, consisting of Professor Rogers and Messrs. E. B. Bigelow and J. M. Beebe, was appointed to "mature a plan for a polytechnic institution." To this sub-committee Messrs. M. D. Ross and C. H. Dalton were subsequently added, and for it Professor Rogers, during the summer of 1860, prepared an elaborate report entitled, "Objects and Plan of an Institute of Technology."

On April 10, 1861, an Act was passed by the General Court of Massachusetts to incorporate The Massachusetts Institute of Technology "for the purpose of instituting and maintaining a society of arts, a museum of arts, and a school of industrial science, and aiding generally by suitable means the advancement, development, and practical application of science in connection with arts, agriculture, manufactures, and commerce."

A lot of State land on the Back Bay in Boston was set apart for the uses of the Institute, with the restriction that

not more than one-third of the land should be covered by buildings erected upon it. The Institute was authorized to hold property to an amount not exceeding two hundred thousand dollars, and by a later Act (passed May 17, 1905) has been permitted to hold property up to any amount whatever.

The first meeting of the Institute for organization was held April 8, 1862. The Society of Arts began its meetings on December 17, 1862, and has maintained them ever since. The Civil War led to the postponement of the opening of the School of Industrial Science. A preliminary session of the School was opened on February 20, 1865, fifteen students attending. The regular courses of instruction began October 2, 1865.

By the Act of April 27, 1863, of the Legislature of the State of Massachusetts, the Institute was constituted the Land Grant College of Mechanic Arts of the State, and was awarded one-third of the appropriation provided by the United States Land Grant Act of July 2, 1862, for the "endowment, support and maintenance of at least one college [in each State] where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts. . . ." The same proportion of the proceeds of the land grants authorized by the Acts of Congress of August 30, 1890, and March 4, 1907, is also assigned to the Institute. These grants are subject to the condition that instruction in military tactics shall be provided, and that the Governor, the Chief Justice of the Supreme Court, and the State Commissioner of Education shall be each a member *ex-officio* of the government of the Institute. In addition, the Institute receives direct support from the State through an annual grant of $100,000 for ten years from January 1, 1912, to be used for its general purposes, and for the maintenance of eighty free scholarships granted through the State Board of Educa-

tion for the benefit of students from the various Senatorial districts of the State (see page 440).

Government.—The government of the Institute is vested by its charter in the Corporation. Its by-laws prescribe that the Corporation shall consist of not more than thirty-five life members, of the three *ex-officio* members, and of fifteen members elected by the Corporation, three each year for a term of five years, from a group of candidates nominated by those Alumni of the Institute who have graduated not less than five years previously.

The Corporation confirms appointments, confers degrees, authorizes the purchase and sale of land and the erection of buildings. It receives reports from the President, the Treasurer, and the Visiting Committees, and acts upon them. The President of the Institute presides at its meetings.

The Executive Committee of the Corporation consists of the President and the Treasurer and of five members, who are chosen by the Corporation from among its members for a term of five years. This Committee has power to appoint the President and Treasurer, also the professors and teachers and all other persons to be employed in any department of the Institute, subject to confirmation by the Corporation. It fixes the salaries and prescribes the duties of all officers so appointed and has power to remove them. It has charge of the buildings and other property of the Institute, and has the general superintendence of all matters relating to the School of Industrial Science.

In regard to other committees of the Corporation see pages 12 and 13.

The Faculty, which consists of all members of the instructing staff of the grades of Professor, Associate Professor, and Assistant Professor, has the immediate supervision of all matters relating to the courses of instruction and to the admission, registration and conduct of students. The degrees of the Institute are conferred upon the recommendation of the Faculty.

The Society of Arts.—This is a department of the Institute which is especially devoted to the general dissemination of scientific knowledge. It aims to awaken and maintain an interest in the recent advances and practical applications of the sciences. For this purpose meetings, over which the President of the Institute presides, are held semi-monthly from October to May, at which reports of inventions, discoveries, and matters of scientific and technical interest are presented. These meetings are open to students of the Institute and to other persons interested in the aims of the Society. The Society publishes the *Science Conspectus* in December, January, February, March and April which is sent to all its members. In this publication the Society aims to give, as far as possible, a general survey of the field of science and its applications in such a way that every article will have some educational value for every reader. All persons interested in the promotion of science or its application are eligible to membership.

The School of Industrial Science.—The School of Industrial Science constitutes the best known and most important part of the Institute. Its primary purpose is to afford to students such a combination of general, scientific, and professional training as will fit them to take leading positions as engineers, scientific experts, and teachers and investigators of science. It is also one of its important functions to contribute to the existing store of scientific knowledge and to the promotion of industrial development through the prosecution in its laboratories of original researches in pure and applied science.

The School consists of the Departments of Mathematics; Drawing and Descriptive Geometry; English; History and Political Science; Economics and Statistics; Modern Languages; Civil and Sanitary Engineering; Mechanical Engineering; Applied Mechanics and Mechanic Arts; Mining Engineering and Metallurgy; Architecture; Chemistry and Chemical Engineering; Electrical Engineering; Biology and

Public Health; Physics; Geology; Naval Architecture and Marine Engineering; Military Science; and Physical Training. A description of the organization of these Departments, of the general character and purposes of the instruction afforded, and of the specific subjects of instruction offered by them will be found on pages 169 to 406.

In connection with the School the Institute also maintains a Research Laboratory of Physical Chemistry, a Research Laboratory of Applied Chemistry, a Research Laboratory of Electrical Engineering, a Sanitary Research Laboratory and Sewage Experiment Station, and the Hawaiian Volcano Observatory.

The Institute offers to its students both Undergraduate and Advanced Courses of Study. The former lead to the degree of Bachelor of Science; the latter, to the degrees of Master of Science, Doctor of Philosophy, or Doctor of Engineering. It also affords to advanced students and to more experienced investigators excellent opportunities for the pursuit of original scientific investigations in its departmental special research laboratories.

The Undergraduate Courses of Study.—In these Courses, which are its most important and largely attended ones, the Institute aims to afford to students with the preparation furnished by the better High Schools, the additional instruction in English, Modern Languages, History and Political Science which are essential to a liberal education; to give them a thorough training in the fundamental sciences of Mathematics, Chemistry, and Physics, and in the important applications of the principles of these sciences to the various branches of engineering and applied science. It lays far more stress on the development of the power to deal effectively with new engineering or scientific problems than on the acquirement of an extensive knowledge of details. In order to attain these results, most of its class-room instruction is given to small sections of students, and in its laboratories and drawing-rooms students receive a large amount of per-

sonal attention. The independent solution of assigned problems forms a large part of nearly all its Courses. Its curriculum differs from that of technical schools of the narrower type in the respect that a large proportion of liberal studies of a literary and general scientific character are insisted upon, and in the respect that courses upon technological methods and other highly specialized subjects are largely excluded; for, while the latter are sometimes important in special industries, they are not essential to a broadly trained engineer, who can readily acquire later the necessary technical knowledge. Its system of instruction differs from the university plan of education in that cultural studies are closely correlated and interwoven with the professional work, while under the latter plan the two groups of studies are ordinarily pursued successively, in separate undergraduate and graduate schools. The Institute lays, moreover, especial emphasis on training in science and scientific method, not only as an essential to professional success, but as an important element in culture and in life. Its Courses differ, too, from those of many colleges in that electives are introduced to a much less extent, in the belief that better results are obtained by prescribing, after the student has selected the profession for which he desires to prepare himself, the principal studies which he is to pursue. He is given, however, the choice among groups of optional studies relating to different branches of his profession and between a variety of electives in the group of general studies. While the Faculty encourages a moderate participation of students in social and athletic activities and while it has welcomed the development of student life which has taken place in these directions in the past few years, it demands of its students a standard of scholarship which is inconsistent with an excessive devotion to such pursuits.

Four-Year Undergraduate Courses.—Regular Four-Year Courses of Study leading to the degree of Bachelor of Science

are offered in the following branches of science and engineering:

I. CIVIL ENGINEERING.
II. MECHANICAL ENGINEERING.
III. MINING ENGINEERING AND METALLURGY.
IV. ARCHITECTURE.
V. CHEMISTRY.
VI. ELECTRICAL ENGINEERING.
VII. BIOLOGY AND PUBLIC HEALTH.
VIII. PHYSICS.
IX. GENERAL SCIENCE.
X. CHEMICAL ENGINEERING.
XI. SANITARY ENGINEERING.
XII. GEOLOGY.
XIII. NAVAL ARCHITECTURE AND MARINE ENGINEERING.
XIV. ELECTROCHEMISTRY.
XV. ENGINEERING ADMINISTRATION.

In most of these Courses distinct Options are offered in the later years which enable the student to concentrate more of his attention upon some one side of his profession. In no case, however, is the specialization carried so far as to preclude a thorough training in all the fundamental branches of the subject. The more important of these Options are as follows:

CIVIL ENGINEERING.	1. *Hydraulic Engineering.* 2. *Railroad Engineering.* 3. *Highway Engineering.*
MECHANICAL ENGINEERING.	1. *Engine Design.* 2. *Locomotive Engineering.* 3. *Mill Engineering.* 4. *Steam Turbine Engineering.*
MINING ENGINEERING AND METALLURGY.	1. *Mining and Metallurgy.* 2. *Metallurgy.* 3. *Mining.*
ARCHITECTURE.	1. *Architecture.* 2. *Architectural Engineering.*

CHEMISTRY.	1. *Physical Chemistry.* 2. *Analytical and Industrial Chemistry.* 3. *Sanitary and Municipal Chemistry.*
BIOLOGY AND PUBLIC HEALTH.	1. *Bacteriology and Industrial Microbiology.* 2. *Sanitary Biology and Public Health.*
PHYSICS.	1. *Chemistry.* 2. *Mathematics.* 3. *Industrial Physics.*
ENGINEERING ADMINISTRATION.	1. *Civil Engineering.* 2. *Mechanical and Electrical Engineering.* 3. *Chemical Engineering.*

Descriptions of these Courses and of the professional work for which they afford a preparation, as well as schedules showing the subjects of instruction included and their arrangement, will be found on pages 83 to 131.

It will be observed that in addition to the Courses in the various branches of Engineering, the Institute offers Courses in the other important branches of Applied Science. Thus the Courses in Applied Chemistry, Metallurgy, Electrochemistry, and Sanitary and Industrial Biology serve to prepare students as scientific experts and for professional positions in manufacturing establishments and government laboratories. Thorough courses in pure science, namely, in Chemistry, Physics, Biology, Geology, and General Science, are also offered. These give the training required for teaching positions in technological institutions, colleges, and preparatory schools, and for research positions in the departments of the government and in private laboratories. The Course in Biology and Public Health furnishes, too, an exceptional training for the subsequent study of Medicine in Medical Schools of the graduate type.

The Course in Architecture, with its two options in Architecture and Architectural Engineering, is a course of an artistic as well as a scientific character, involving a large amount of instruction and training in the fine arts.

The Course in Engineering Administration provides a

training for men who expect to enter upon administrative work in enterprises which demand a knowledge of scientific and engineering principles.

All these Courses are identical, except as regards the Modern Language requirement, in the first term of the first year, and nearly so in the second term of that year. The student therefore makes a provisional choice of his Course of Study at the beginning of the second term of his first year, and a final choice at the beginning of his second year. In making this choice, the primary consideration should be the student's tastes and aptitudes, as shown by the results of his previous work at the Institute and in his preparatory school, rather than any supposed pecuniary or other advantages attaching to special professions. To assist students in making this choice, a special circular upon the Choice of Courses has been prepared and will be sent upon application.

Five-Year Undergraduate Courses.—Five-Year Courses of study leading to the degree of Bachelor of Science are also offered. These are designed to meet the needs of three different classes of students:—

First:—Those who wish to complete in five years the work of two allied Courses.

Second:—Those who wish to combine with the work of a single professional Course a larger proportion of humanistic studies and of work in general science.

Third:—Those who wish to distribute the work of a single Course over five years without undertaking additional required studies.

For all three classes the foundation is a common five-year schedule including all the studies of one of the professional Courses, the difference lying in the use of the free time not assigned in this schedule. In all cases, moreover, the work of the first year is identical with that of one of the regular Four-Year Courses, thus affording the student an opportunity to base his choice on a year's experience and on conference with members of the Faculty.

Under the first plan the work of the Five-Year Course is arranged so as to include all the subjects required in two of the professional Four-Year Courses (including two theses, one in each line of study); for example, in Civil and Sanitary Engineering, in Mechanical and Electrical Engineering, in Mechanical and Chemical Engineering, in Mechanical Engineering and Naval Architecture and Marine Engineering. Students pursuing such a double Course take in each year an amount of work approximately equivalent to that required in the regular Four-Year Courses, and upon its completion receive the degree of Bachelor of Science in two departments of study, instead of in a single one.

For certain combinations of Courses the student can, if he prefer, complete all the work required in one Course in four years, receiving the degree in that department of study, and then in a fifth year complete the remaining subjects required in an allied Course, for which he will then receive a second Bachelor's degree in the new line of study. Owing to the sequence of studies in the successive years, this plan does not, however, permit of certain combinations of Courses which can be arranged for only under a consistent five-year program laid out longer in advance.

A knowledge of more than one branch of science or engineering is so often required in professional practice that men who have received the double training which is given by such Courses are particularly well fitted to deal successfully with large industrial and engineering problems.

Under the second plan the Five-Year Course is arranged so as to include all the subjects of one of the regular professional Courses distributed over a period of five years, and supplemented by the introduction in the extra time thus made available of much additional work, which is in part elective, in General Science, History, Language, Literature, Art, and Economics. This Course provides in large measure the breadth of scholarship which a college course is designed to supply; but it does this by methods and in the atmosphere of the scientific school and with special emphasis upon general scientific studies as a part of a liberal education.

Under the third plan the work of the last three years of the regular Four-Year Courses is distributed over four years without additional requirements, thus reducing the number of subjects required in any term. This affords the opportunity for more thorough work in each subject by devoting more time to outside study and to practice in the laboratories, drawing-rooms and in the field, and for the pursuit, as electives, of general studies and collateral professional subjects which are not included in the Four-Year Courses. The standard of scholarship required of the student is in every way the same as in the Four-Year Courses, and so long as he maintains his standing in the Course which he is pursuing, he is classed in the year in which he takes a majority of his studies.

Definite schedules have been prepared for such Five-Year Courses in Civil, Mechanical and Electrical Engineering, and similar schedules will, so far as possible, be arranged for individual students in the other branches of engineering.

Opportunities for College Students in the Undergraduate Professional Courses.—Students who have attended other colleges or scientific schools granting degrees, and have had the approximate equivalent of the work of the first year at the Institute, are generally excused without examination from those subjects in the regular Courses of which they have already had a substantial equivalent. Graduates of such institutions are thus often able to complete the work for the Bachelor's degree after a residence at the Institute of two or three years, according to the length and character of their previous collegiate training. College students planning to enter the Institute with advanced standing will find it advantageous to arrange their college work with some reference to the requirements of the Course which they are to pursue at this institution. An opportunity to complete their preparation in some of the fundamental subjects required in the first and second years is offered by the Summer Courses of Instruction at the Institute. A special course in Descriptive Geometry for college students who may not have had this subject is offered

during the first term of each year. A special circular relating to the terms of admission of applicants from other colleges will be sent upon request. See also pages 79 and 80.

Summer Schools.—The Institute conducts summer school work of two kinds. Courses of instruction are offered which correspond to some of those given during the regular school year. The object and arrangement of these courses are described in detail on page 132, and in a special circular issued each year in April. Secondly, professional summer schools in Civil Engineering, Mining Engineering and Metallurgy, Chemistry, and Geology and Mineralogy are carried on either regularly or at intervals. Some of this work is supplementary to and different in character from that given during the regular terms, but much of it is now required in certain Courses. Further details will be found on pages 136 to 140.

Advanced Courses of Study and Research.—To graduates of the Institute, and to others who have had a training substantially equivalent to that given in any of its Undergraduate Courses, is offered the opportunity of pursuing a further year of advanced study and research leading to the degree of Master of Science. Such an advanced course serves to supplement the undergraduate work in the same field by more thorough instruction in underlying principles and their mathematical development, by a more specialized study of important branches of the profession, and by training in the investigation of scientific and technical problems. At the best it is difficult for the student to acquire an adequate professional education from an undergraduate course of four years, especially since much of this time needs to be given to preparatory and general educational studies. It is therefore highly desirable that at least one additional year be devoted to graduate work. The character of such work and the conditions under which it is carried on differ so much from those in the undergraduate courses that the fifth year is almost sure to give, not merely much additional professional knowledge, but a new and valuable kind of training. The

closer individual contact with the instructors, the general use of original articles and scientific monographs rather than text-books, and especially the larger proportion of time devoted to research, develop originality and independent power, and inculcate the principles and spirit of investigation, which are necessary to success not less in technological than in scientific pursuits.

The degrees of Doctor of Philosophy or Doctor of Engineering are awarded by the Institute for advanced courses of two or three years duration. Such courses serve not merely to give a more thorough knowledge of the branch of science or engineering pursued as a major subject and of the allied branches pursued as minor subjects, but also to train the student thoroughly as a scientific investigator, by far the larger proportion of the time being devoted to an extensive research of a scientific or technical character. Such courses give the thorough training needed by teachers in the higher institutions of learning, by scientific experts employed in government or industrial research laboratories, or by engineers who are to do creative work of the highest order in their professions.

Opportunities for such research work are offered in connection with all the Departments of the Institute and in specially equipped laboratories,—the Research Laboratory of Physical Chemistry, the Research Laboratory of Applied Chemistry, the Research Laboratory of Electrical Engineering, the Sanitary Research Laboratory and Sewage Experiment Station, and the Hawaiian Volcano Observatory.

For more detailed information see pages 141 to 168 and the special Bulletin on Advanced Study and Research.

Physical Training.—Provision is made for giving gymnasium instruction to all students at the Institute who desire it. In addition to this optional attendance, students in the first year are required to take two hours a week of physical exercise under the direction of the Instructor in Physical Training.

Bronze medals, known as the Cabot Medals for Improve-

ment in Physical Development, are awarded at the end of the school year to those men who have shown the greatest physical improvement during the year.

There is an athletic field on the Institute's property in Cambridge where opportunity is afforded for track-team contests and inter-class games. See page 184 for further information.

Requirements for Admission.—Detailed information in regard to the requirements for admission to the courses of instruction in the Institute will be found on pages 62 to 82. In general the preparation necessary to enable an applicant to pursue successfully one of the regular Undergraduate Courses corresponds with that afforded by high schools or academies of the better grade offering a four years' course of study. Applicants for admission as special students must be prepared in all subjects that are required for admission to the particular courses desired.

School Year.—The first term begins on the Monday following September 20. There is a recess of one week after the Semi-annual Examinations, and the second term begins on the first Monday in February. On legal holidays, for one week at Christmas, and for four days including the 19th of April, the exercises of the school are suspended. Graduation exercises are held on the first Tuesday after June 7 in ordinary years, and on the first Tuesday after June 6 in leap years.

Registration; Attendance Card.—At the opening of each term the student is required to fill out and present to the Registrar an attendance card, blank forms for which are supplied. The attendance card is the direct means by which the student places before the Faculty his wishes in regard to his professional Course or selection of studies. The card must be presented at the earliest possible moment, to give opportunity for the immediate determination of qualifications and status. *For registration after five o'clock of the*

first day of the term a fee of five dollars will be charged. All subjects applied for must be regularly pursued, and no others can be taken except by special permission of the Faculty, duly applied for by petition.

Attendance.—Students are expected to attend all exercises in the subjects applied for on their attendance cards, unless excused by special vote of the Faculty. With the exception of an interval of one hour in the middle of the day, exercises are held and students are in general expected to devote themselves to the work of the school between the hours of 9 a. m. and 5 p. m. There are no exercises on Saturday after 1 p. m., and the rooms are closed.

Status of Students.—The ability of students to continue their courses is determined in part by means of examinations; but regularity of attendance and faithfulness to daily duties are considered equally essential.

Examinations.—General examinations are held each year in January and in May. The January examinations are confined to the work of the first half of the year and begin on the Wednesday following January 12, extending through the Saturday of the following week. The May examinations may cover the work of the entire year. These examinations begin in ordinary years on the Saturday following May 21, in leap years on the Saturday following May 20, and continue through Friday of the second week following. In the fourth year the annual examinations may cover, in addition, professional subjects of earlier years. In certain subjects, students are marked upon term work without examinations, but in exceptional cases particular students may be examined.

Examinations for students conditioned in May in subjects of the first, second, and third years are held on the Thursday preceding the September entrance examinations and following days, and for first-term subjects at the time of the May examinations.

Intermediate examinations, the results of which are not

made a matter of permanent record, but are primarily for the information of students and their parents or guardians, may be held at any time in place of regular exercises.

Students conditioned in any subject and failing to make up the condition at the time appointed for the examination are not entitled to another examination, but will be required either to repeat the subject or to discontinue it, as well as all subjects dependent thereon, unless further time be allowed by special vote of the Faculty.

Students having clear records at the end of the first term of the first year are allowed to choose their Courses without restriction. Students will not be admitted to professional work of the several Courses without satisfactory records in those previous subjects on which the former especially depend. Exceptions to this rule may be made in individual cases after special consideration by the Faculty.

Reports of Standing.—Intermediate informal reports for all first and second-year subjects are sent during each term; formal semi-annual reports are sent at the close of each term; and special votes of the Faculty are transmitted in cases requiring consideration. These reports are sent to students, and to the parents or guardians of those not of age, but reports will be sent to a parent or guardian in any other case also on application to the Registrar, and notification will be made to parents or guardians in all cases of students advised or required to withdraw, or placed on probation.

Conduct.—It is assumed that students come to the Institute for a serious purpose, and that they will cheerfully conform to such regulations as may be from time to time made by the Faculty. In case of injury to any building, or to any of the furniture, apparatus, or other property of the Institute, the damage will be charged to the student or students known to be immediately concerned: but, if the persons who caused the damage are unknown, the cost of repairing the same may be assessed equally upon all the students of the school.

Students are expected to behave with decorum, to obey the regulations of the school, and to pay due respect to its officers. Conduct inconsistent with the general good order of the school, or persistent neglect of work, if repeated after admonition, may be followed by dismissal, or, in case the offense be a less serious one, the student may be placed upon probation. The student so placed upon probation may be dismissed if guilty of any further offense. This probation may be removed by the Faculty after a period of continued good conduct on the part of the student.

It is the aim of the Faculty so to administer the discipline of the school as to maintain a high standard of integrity and a scrupulous regard for truth. The attempt of any student to present as his own any work which he has not performed, or to pass any examination by improper means, is regarded by the Faculty as a most serious offense, and renders the offender liable to immediate expulsion. The aiding and abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Advisers.—The Dean is the general consulting officer for students, and coöperates with the President in matters touching discipline and other student relations. For the purpose of giving students the means of readily obtaining friendly advice, he assigns each new student to some member of the instructing staff, who acts as his adviser.

It is not intended by this rule that the advisers shall become, in any sense or in any degree, guardians of the students assigned to them; nor does the Faculty by this action assume any responsibility for the conduct and deportment of students outside the halls of the Institute.

Medical Adviser.—Dr. J. Arnold Rockwell, 26 Garden Street, Cambridge, a graduate of the Institute, is the medical adviser for students, and will address them during the year on personal hygiene. He may be consulted by students any Monday or Thursday afternoon between four and five o'clock in Room 21, Pierce, without payment of fee.

Requirements for Graduation.—To receive the degree of Bachelor of Science the student must have attended the Institute not less than one year, which must be that immediately preceding his graduation, except as postponement may be specially authorized. He must have completed the prescribed studies of the four years, and must, in addition, pass final examinations, if required, on subjects relating particularly to his Course.

The student must, moreover, prepare a thesis on some subject included in his course of study; or an account of some research made by him; or an original report upon some machine, work of engineering, industrial works, mine, or mineral survey; or an original design accompanied by an explanatory memoir. This thesis or design must be approved by the Faculty. Theses are to be written on one side only on paper of good quality, 8 x 10 1-2 inches in size, with not less than an inch margin on each side. Theses must be handed to the Secretary of the Faculty not later than the day on which the first annual examination occurs.

All theses and records of work done in preparation of theses are the permanent property of the Institute, and can not be published, either wholly or in part, except by authorization of the heads of the respective Departments. This rule applies also to the theses prepared by candidates for advanced degrees.

The degree of the Institute represents not only the formal completion of the subjects in the selected Course of study, but also the attainment of a satisfactory standard of general efficiency. Any student who does not show in the fourth-year work of his Course that he has attained such a standard may be required before receiving the degree to take such additional work as shall test his ability to reach that standard. This additional work shall consist in the preparation of a thesis during the last term of residence, unless otherwise provided by a special vote of the Faculty, and in the pursuance of such new studies and the repetition of such of those previously taken as may be required by the Faculty; and in general, an amount of work per term substantially equivalent to that involved in

the regular Courses of study will be required during any subsequent period of residence.

No degree can be conferred until all dues to the Institute are discharged.

Students leaving the Institute of their own accord before graduation are entitled to receive a statement of attendance from the Registrar.

For requirements for higher degrees, see pages 141 to 163.

Coöperation with Harvard University.—In accordance with an agreement between Harvard University and the Massachusetts Institute of Technology, male students registering at the Institute in September 1914, or thereafter, may receive certain benefits from the University. These benefits are confined to those students who register in Courses I, II, III, VI or XI, namely: Civil Engineering, Mechanical Engineering, Mining Engineering and Metallurgy, Electrical Engineering, or Sanitary Engineering. Such students will be entitled to the same rights and privileges as students in the professional schools of the University, and will be eligible for degrees from the University in addition to those that they may receive from the Institute. The opportunity of obtaining the degree of Bachelor of Science from both institutions will be confined to new students registering at the Institute in September 1914, or thereafter. Similarly, the opportunity of obtaining higher degrees from both institutions will be confined to those who began to pursue courses at the Institute leading to those degrees in September 1914, or thereafter.

Information regarding the School for Health Officers conducted in coöperation with Harvard University will be found on page 449.

Fees.—The tuition fee for students pursuing regular Courses, other than Courses XIIIA and XIIIB, is $250 per year, and must be paid *in advance* as follows,—$150[1] on or before

[1] Students entering the first year who have paid the entrance examination fee of five dollars mentioned on page 63, will be credited with this amount on presentation of the receipt

the last Monday in September, and $100 on or before the first day of the second term. No bills are sent. For one-half or any less fraction of the school year, the fee is $150. Payment is required also for chemicals used and for apparatus injured or destroyed in the laboratories, and for the cost of repair of damage by students to any other property of the Institute. Special students pay, in general, the full fee; but when a few branches only are pursued, and the time required for instruction is limited, application for reduction may be made to the Bursar. The fee for Course XIIIA for Naval Constructors is for the present year $500, but is subject to change according to arrangement with the United States Navy Department. The fee for Course XIIIB, Naval Architecture, is also $500 per year.

It is desired that students pursuing Courses of study leading to the Bachelor's degree whose financial necessities are such as to prevent their continuance at the Institute communicate with the Chairman of the Faculty Committee on Undergraduate Scholarships. For detailed information in regard to scholarships and fellowships see pages 439 to 448.

Deposit for Breakage.—No bond is required, but a deposit must be made to defray the expense of breakage. This deposit will be required of all students in the first year, but in subsequent years only of students taking work in the chemical, bacteriological or the mining laboratories. The amounts of such deposits will be as follows: for the first year, $15; for higher years, in the chemical laboratories $50, in the mining laboratory $10 ($20 in the fourth year); in the bacteriological laboratories $10. Any balance remaining at the end of each year will be refunded *on application*, or, if the student chooses, will be held to his credit for the succeeding year. No refund of deposits will be made during the school year except in the case of students leaving the Institute. All deposits must be made at the time when the tuition fee for the first term is due and students will not be allowed to enter upon laboratory work until all fees are paid.

Payments.—All payments should be made to Horace S. Ford, Bursar. *Students are strongly advised to make payments by mail, as they will find it greatly to their convenience to do so.* If by check, remittance from points out of New England should be in New York or Boston funds.

Residence and Expenses.—As the exercises of the school begin at nine o'clock in the morning, and end by five o'clock in the afternoon, students may conveniently live in any of the nearer cities or towns, on the lines of the various railroads, if they prefer to do so.

The cost of board and rooms in Boston and the neighboring cities and towns need not exceed six to eight dollars a week. The cost of books, paper, etc., exclusive of chemical breakage, is from twenty-five to thirty-five dollars a year. At the beginning of the first year about twenty dollars will be needed for drawing instruments and supplies.

Location.—The buildings of the Institute are located in the neighborhood of Copley Square, in close proximity to the chief collections and libraries of Boston. The Back Bay railroad stations and many street-car lines afford easy access from the southern and western suburbs, while the North Station is very quickly reached through the Subway of the Boston Elevated Railway Company. The free lecture courses of the Lowell Institute are held in the main buildings of the Institute. The location in the neighborhood of a great manufacturing district, with which the Institute maintains close relations, is of great advantage to technological students.

It is expected that the new site recently acquired by the Institute on the Charles River Basin in Cambridge will be ready for occupancy in 1916.

Buildings.—The buildings now occupied are the Rogers Building, on Boylston Street, devoted to instruction in Mining Engineering and Metallurgy, Mathematics, Literature, History, and Political Science, and containing the Adminis-

trative Offices and the General Library; the Walker Building, on Boylston and Clarendon Streets, devoted to the Departments of Chemistry and Physics; the Engineering Buildings A and B, on Trinity Place, devoted to the Engineering Laboratories, to instruction in Applied Mechanics and Hydraulics, and to the Departments of Civil and Mechanical Engineering; the Engineering Building C, on Trinity Place, devoted to the instruction in Mineralogy, Naval Architecture and Marine Engineering, and to the Research Laboratories of Physical Chemistry; the Henry L. Pierce Building, also on Trinity Place, occupied by the Departments of Architecture, Biology and Public Health, and Geology, the Laboratory of Industrial Chemistry, the Research Laboratory of Applied Chemistry, and the Sanitary Research Laboratory; the Lowell Building, on Clarendon Street, devoted mainly to the laboratories of the Department of Electrical Engineering, but occupied also by the Department of Modern Languages; a series of Mechanical Laboratories and a Gymnasium on Garrison Street; and the Sewage Experiment Station at Old Harbor Point in Dorchester.

Buildings are now in process of construction on the new site in Cambridge. It is expected that they will be ready for occupancy in 1916.

Laboratories and Libraries.—Information regarding the equipment of the laboratories, museums, and libraries, which form conspicuous features in the work of the Institute, will be found on pages 407 to 438.

The Technology Union.—In order to make better provision for the social life of the students, and to enable them to secure meals of wholesome quality at a moderate price, a building has been erected upon the Institute's land on Trinity Place. This building, which is known as the Technology Union, contains a large dining-room, two smaller dining-rooms for the meetings of the various student organizations, a social room, a library and writing-room, a mail delivery office, toilets, coat rooms, etc. It is open to all students free of charge.

Walker Memorial.—As an important part of its new development, the Institute will undertake to make adequate provision for the physical and social needs of its students in the Walker Memorial. Funds for this purpose were contributed some years ago by alumni and others in memory of the late President Walker. The income of a considerable bequest of the late Mr. Frank H. Cilley, of the Class of '89, is also available for purposes connected with the Memorial.

Student Employment.—To assist students in securing employment, either during the school-year or the summer, a Student Employment Office is maintained by the Institute. This Office is conducted by the Dean, to whom application may be made by students desiring to help themselves in meeting their expenses. Prospective students should, however, realize that the demands of the Institute curriculum are such as to make it impracticable to devote a large amount of time to outside employment during the school-year, and that therefore they should not rely mainly on such employment to provide the funds needed for their expenses.

Requirements for Admission.

Applicants for admission to the Massachusetts Institute of Technology are, in general, required to pass the entrance examinations of the Institute, or the equivalent examinations of the College Entrance Examination Board. Certificates of entrance examinations passed for admission to another college are usually accepted, provided they cover not fewer than three of the subjects required by the Institute. Persons who are considerably past the usual age who are engaged in teaching or technical pursuits, and also applicants who for satisfactory reasons desire only special courses requiring no previous training may be admitted, at the discretion of the Faculty, without entrance examinations.

ADMISSION TO THE FIRST YEAR.

The student intending to enter the Institute should bear in mind that the broader his intellectual training in any direction, and the more extensive his general acquirements, the greater will be the advantages he may expect to gain. The importance of thorough preparation in the subjects set for examination also is great; for the character and the amount of instruction given in the Institute from the outset leave little opportunity for one imperfectly fitted to make up deficiencies, and render it impossible for him to derive the full benefit from his course, or perhaps even to maintain his standing. The

training given in the best high schools and academies will, in general, afford suitable preparation.

The requirements of age and scholarship specified on pages 68 to 81 are regarded as a minimum in all ordinary cases, and only exceptional circumstances will justify any relaxation. Parents and guardians are advised that it is generally for the ultimate advantage of the student not to enter under the age of eighteen years, unless for a five-year course.

Entrance Examinations in Boston.—Examinations for admission to the first-year class are held *in Boston only* on the first Wednesday, Thursday, and Friday after June 15, in the Rogers Building, 491 Boylston Street. A second series of examinations for admission, and for applicants conditioned at the first examinations, is held at the same place, on the first Saturday, Monday, and Tuesday after September 11. (See Calendar, page 8.)

Applicants for admission after the September examinations will be received only when some good cause, such as illness, has prevented attendance at those examinations.

Students are advised to attend the June entrance examinations, if practicable, in order that any deficiencies then existing may be made up in September before entrance.

Entrance Examination Fee.—A fee of five dollars will be charged for admission to entrance examinations in Boston. This amount will, however, be credited towards the tuition fee for the first term of students who enter the Institute. A candidate who is rejected will be required to pay a second fee if he repeats the examinations, and his original fee will not be credited to him if he is ultimately admitted. A candidate dividing his examinations will pay a fee only for his first examinations. Fees may be paid to the Bursar at the time when the examinations are taken, or may be remitted in advance.

Order of Examinations in Boston.—The order of examinations for June, 1916, will be as follows:—

WEDNESDAY, JUNE 21, 1916.

8.45 to 9 A.M.	*Registration of Applicants.*
9.00 A.M. to 11.00 A.M.	Solid Geometry.
11.15 A.M. to 12.45 P.M.	History.
2.00 P.M. to 4.00 P.M.	Physics.

THURSDAY, JUNE 22, 1916.

9.00 A.M. to 10.45 A.M.	English.
11.00 A.M. to 12.45 P.M.	Plane Geometry.
2.00 P.M. to 4.00 P.M.	French (Elementary).

FRIDAY, JUNE 23, 1916.

9.00 A.M. to 10.45 A.M.	Algebra B.
11.00 A.M. to 1.00 P.M.	German (Elementary).
2.15 P.M. to 4.00 P.M.	Algebra A.

The order of examinations for September, 1916, will be as follows:—

SATURDAY, SEPTEMBER 16, 1916.

9.00 A.M. to 11.00 A.M.	Solid Geometry.
11.15 A.M. to 12.45 P.M.	History.
2.00 P.M. to 4.00 P.M.	Physics.

MONDAY, SEPTEMBER 18, 1916.

9.00 A.M. to 10.45 A.M.	English.
11.00 A.M. to 12.45 P.M.	Plane Geometry.
2.00 P.M. to 4.00 P.M.	French (Elementary).

TUESDAY, SEPTEMBER 19, 1916.

9.00 A.M. to 10.45 A.M.	Algebra B.
11.00 A.M. to 1.00 P.M.	German (Elementary).
2.15 P.M. to 4.00 P.M.	Algebra A.

A schedule of the September examinations for advanced standing will be mailed on application after June 1.

Examinations at Other Points.—*Examinations are now held by the Institute in Boston only. Candidates desiring examination at other points in June are expected to take the examinations of the College Entrance Examination Board. The conditions of application are stated below.* For detailed information candidates should address the Secretary of the College Entrance Examination Board, Post-office, Sub-station 84, New York, N. Y.

The entrance examinations of the College Entrance Examination Board for 1916 will be held June 19–24. A list of the places at which the examinations are to be held is published by the Board about March 1. Requests that the examinations be held at particular points, to receive proper consideration, should be transmitted to the Secretary of the Board not later than February 1.

REGULATIONS OF THE COLLEGE ENTRANCE EXAMINATION BOARD.

All applications for examination must be addressed to the Secretary of the College Entrance Examination Board, Post-office Sub-station 84, New York, N. Y., and must be made upon a blank form to be obtained from the Secretary upon application.

Applications for examination at points in the United States east of the Mississippi River (also at Minneapolis, St. Louis and other points on the Mississippi River) must be received at the office of the Secretary of the Board not later than Monday, June 5, 1916.

Applications for examination elsewhere in the United States or in Canada must be received not later than May 29, 1916.

Applications for examination at points outside the United States and Canada must be received not later than May 15, 1916.

Applications received later than the dates named will be accepted when it is practicable to arrange for the examination of the candidates concerned, but only upon the payment of five dollars in addition to the regular examination fee.

The examination fee is five dollars for all candidates examined at points in the United States and Canada, and fifteen dollars for all candidates examined at points outside of the United States and Canada. The fee (which must accompany but cannot be accepted in advance of the application) should be remitted by postal order, express order, or draft on New York, to the order of the College Entrance Examination Board.

The order of the College Board examinations in subjects required or accepted by the Institute for 1916 is as follows:—

MONDAY, JUNE 19, 1916.

9.00 A.M. . . . . Mathematics A1 (Algebra to Quadratics).
Mathematics A2 (Quadratics and beyond).
2.00 P.M. . . . . Mathematics C (Plane Geometry).
Mathematics D (Solid Geometry).

TUESDAY, JUNE 20, 1916.

9.00 A.M. . . . . English1 (Grammar and Composition).
English 2 (Literature).
2.00 P.M. . . . . Mathematics F (Plane Trigonometry).

WEDNESDAY, JUNE 21, 1916.

9.00 A.M. . . . . Latin 2 (Elementary Prose Composition).[1]
2.00 P.M. . . . . Latin 1 (Grammar).[1]
Latin 3 (Second Year Latin).[1]

THURSDAY, JUNE 22, 1916.

9.00 A.M. . . . . French A (Elementary).
French B (Intermediate).[1]
2.00 P.M. . . . . German A (Elementary).
German B (Intermediate).[1]

FRIDAY, JUNE 23, 1916.

9.00 A.M. . . . . Physics; Botany;[1] Zoölogy;[1] Biology.[1]
Chemistry.[1]
2.00 P.M. . . . . History A, C (Ancient History; English History[1]).
History B, D (Mediæval and Modern;[1] American).

Each examination two hours. Candidates taking two examinations on any morning or afternoon begin the second examination at 11.10 A.M. or 4.10 P.M.

Table of Equivalents.—The following table shows for which subjects records of the College Entrance Examination Board are accepted as covering requirements for admission to the Institute:—

M. I. T. Subjects.	*C. E. E. B. Subjects.*
ALGEBRA A.	MATHEMATICS A1 (Algebra to Quadratics).
ALGEBRA B.	MATHEMATICS A2 (Quadratics and beyond).[2]
ENGLISH.	ENGLISH 1 and 2 or A and B.
FRENCH (Elementary).	FRENCH A (Elementary).
GEOMETRY, PLANE.	MATHEMATICS C (Plane Geometry).
GEOMETRY, SOLID.	MATHEMATICS D (Solid Geometry).
GERMAN (Elementary).	GERMAN A (Elementary).
HISTORY.	HISTORY A or D.
PHYSICS.	PHYSICS.
ELECTIVES.	HISTORY A or D; HISTORY B; HISTORY C; LATIN 1, 2 and 3; FRENCH B; FRENCH BC; GERMAN B; GERMAN BC; SPANISH; CHEMISTRY; BOTANY; ZOÖLOGY; BIOLOGY; DRAWING.

[1] Elective.
[2] Candidates are expected to take this divided examination in Algebra. Records below 70 based on a single examination in Mathematics A will be accepted only for Algebra A.

Records below 60 will not be accepted.

Certificates covering fewer than three of the Institute requirements are accepted only for final candidates, but a certificate for two subjects may be accepted in connection with a satisfactory elective.

French B and German B will be accepted for advanced standing.

Trigonometry records of 70 or better will be accepted for advanced standing.

The Institute offers summer courses corresponding to entrance requirements in Algebra, Solid Geometry, French and German.

Certificates.—The Institute accepts no certificates of preparatory schools in place of entrance examinations. The value of the opinion of previous teachers is, however, fully recognized, and great weight will be attached to statements from them. It is accordingly requested that each applicant present from the principal of the school last attended a statement of the duration and extent of his work there. For statements in regard to elective certificates see page 74. For the required certificates for preliminary applicants see page 68.

Conditions.—A candidate failing in only one or two of the examination subjects may be admitted with "conditions." A candidate incurring conditions in June must repeat in September examinations in those subjects in which he has failed. Conditions incurred in September, except in History and Physics, must be made up in January for continuance in dependent work. A condition in History incurred in September is removed by passing an examination in June or September following, or by a satisfactory record in History I (American National Development), of the second term of the first year. As no January examination is offered in Physics a September condition will be removed by passing a satisfactory examination the following June or September.

DIVISION OF ENTRANCE EXAMINATIONS.

Candidates for admission are allowed at their option to divide their entrance examinations between two successive years, or between June and September of the same year. A candidate taking all his examinations at one time is termed

"Complete"; a candidate taking certain examinations with a view to admission a year later, "Preliminary"; a candidate who has already passed preliminary examinations, "Final"; a candidate who is dividing examinations between June and September of the same year, "Partial."

A preliminary candidate may take examinations in June or in September, but is not entitled to repeat in September any examination in which he has failed in June. He must be at least sixteen years of age, and will be allowed the choice of any of the following six subjects, but he will not be entitled to a record for any unless he presents a certificate from his teacher stating that he is qualified in the subjects in which he is examined, and unless he passes at least three (or two together with an Elective. See page 69).

ALGEBRA A.	HISTORY.
PLANE GEOMETRY.	FRENCH (Elementary).
PHYSICS.	GERMAN (Elementary).

Preliminary candidates are advised not to offer English or the second part of Algebra (see page 70). A preliminary candidate will not be allowed to offer English unless he presents from the principal of his school a certificate that he has completed satisfactorily four years of English of high school grade. Algebra B, if passed by a preliminary candidate, will be counted with Algebra A as a single subject. Solid Geometry may be taken by a preliminary applicant, provided he presents, before entrance, evidence that he has continued mathematical study during the intervening year.

A partial candidate may make his own choice of subjects, but no credit will be given for less than three (of which one may be an elective). Algebra A and B count as one subject.

A complete or partial candidate having credit for three or more subjects may be credited with them for admission the following year, subject to presenting the teacher's certificate required of a preliminary candidate. Credit for examinations passed will not remain valid for more than one year unless by special permission.

SUBJECTS FOR EXAMINATION.

To be admitted and classified as a first-year student, the applicant must have attained the age of seventeen years, and must have passed satisfactory examinations in the following subjects[1]:—

ALGEBRA A.
ALGEBRA B.
PLANE GEOMETRY.
SOLID GEOMETRY.
PHYSICS.
FRENCH (Elementary).
GERMAN (Elementary).
ENGLISH.
HISTORY.

Applicants for admission must also present satisfactory evidence of preparation in LATIN, as described on page 76, or in two of the following **Electives** (see page 74):—

FRENCH (Intermediate).
GERMAN (Intermediate).
SPANISH.
ENGLISH (Additional).
HISTORY (Additional).
CHEMISTRY.
MECHANICAL DRAWING.
MECHANICAL DRAWING AND MECHANIC ARTS.
BIOLOGY.

A satisfactory examination record in Intermediate French or Intermediate German, obtained either in the C. E. E. B. examination in June or in the Technology examination in September, is accepted at present for the entire elective requirement.

The detailed requirements in the various subjects are as follows:—

Algebra.—A. The four fundamental operations for rational algebraic expressions; factoring, determination of highest common factor and lowest common multiple by factoring; fractions, including complex fractions; ratio and proportion; linear equations, both numerical and literal, containing one or more unknown quantities; problems depending on linear equations; radicals, including the extraction of the square root of polynomials and numbers; exponents, including the fractional and negative.

[1] An applicant unable to offer one of the subjects French or German, but otherwise well prepared, may be admitted as an unclassified student. For admission with "conditions," and other modifications of the usual rules, see pages 62, 63, 67, 68, and 79–82.

B. Quadratic equations, both numerical and literal; simple cases of equations with one or more unknown quantities, that can be solved by the methods of linear or quadratic equations; problems depending upon quadratic equations; the binomial theorem for positive integral exponents; the formulas for the nth term and the sum of the terms of arithmetic and geometric progressions, with applications. The examination in Algebra B may also include questions of a less elementary character on topics in Algebra A.

It is assumed that pupils will be required throughout the course to solve numerous problems which involve putting questions into equations. Some of these problems should be chosen from mensuration, from physics, and from commercial life. Facility in the analysis and the discussion of an algebraic expression or equation, and the use of graphical methods and illustrations in connection with the solution of equations, is also expected.

Plane Geometry.—The usual theorems and constructions of good text-books, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurement of the circle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of lines and plane surfaces.

Solid Geometry.—The usual theorems and constructions of good text-books, including the relations of planes and lines in space; the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and the spherical triangle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of surfaces and solids.

The above definitions are those reported by the committee of the American Mathematical Society, September, 1903.

Importance will be attached to accuracy in the numerical work of the papers in Algebra and Geometry and to satisfactory drawings in Geometry. Familiarity with the Metric System is required.

The attention of teachers and applicants is particularly called to the necessity of thorough preparation in Mathematics, not merely as to the extent and amount of work done, but as to its quality. Candidates should be thoroughly grounded in fundamental principles, operations, and definitions.

It is expected that the time devoted to preparation in Mathematics will be equivalent to not less than 320 periods in Algebra, and the same number in Plane and Solid Geometry. A considerable portion of the Algebra should be given, if practicable, during the final year of preparation.

French (Elementary).—The requirement for Elementary French is a systematic course of four or five periods a week extending over at least two school years, each year representing not less than 120 full sixty-minute periods or the equivalent. Training in pronunciation and in the understanding of easy spoken French is regarded as an essential part of this requirement and a school certificate guaranteeing this part of the training will be required for each candidate.

The examination in French is given in two parts, which, however, may not be taken separately.

(*a*) Ability to read simple prose at sight and to translate it into clear and idiomatic English.

(*b*) Proficiency in elementary grammar, to be tested by the translation of easy English into French and by questions on the following topics: inflection of nouns and adjectives for gender and number; pronominal adjectives; the forms and positions of pronouns, especially the personals; the partitive construction; the forms and use of numerals; the use of the subjunctive, except unusual cases; the conjugation of the regular and of the more common irregular verbs. Special attention will be given to the verbs.

An opportunity will be offered to suitably prepared applicants to pass Intermediate French in September. See page 75.

German (Elementary).—The requirement for Elementary German is a systematic course of four or five periods a week extending over at least two school years, each year

representing not less than 120 full sixty-minute periods or the equivalent. Training in pronunciation and in the understanding of easy spoken German is regarded as an essential part of this requirement and a school certificate guaranteeing this part of the training will be required for each candidate.

The examination in Elementary German is given in two parts, which, however, may not be taken separately.

(*a*) Ability to read simple prose at sight and to translate it into clear and idiomatic English.

(*b*) Proficiency in elementary Grammar, to be tested by the translation of easy English into German, and by questions on the following topics: the conjugation and synopsis of the regular, and of the more usual irregular verbs; declension of readily classified nouns, of adjectives, articles, pronouns; comparison of adjectives and adverbs; use of the more common prepositions; the simpler uses of the modal auxiliaries; simple cases of indirect discourse, and the rules for the order of words.

An opportunity will be offered to suitably prepared applicants to pass Intermediate German in September. See page 75.

English.—The examination in English will be as far as possible a test of the candidate's ability to express himself in writing in a manner at once clear and accurate, and of his power to distinguish in a broad sense literary values,—the qualities which mark a work as being Literature. The examination consists of two parts, which, however, may not be taken separately.

(*a*) The candidate will be required to write upon subjects familiar to him. His composition should be correct in spelling, punctuation, grammar, idiom, and formation of paragraphs, and should be plain and natural in style. He will be judged by how well he writes rather than by how much he writes.

(*b*) The candidate is required to have some acquaintance with good Literature. The books adopted by the National Conference on Uniform Entrance Requirements are taught in most secondary schools, and the candidate may, if convenient, use these in his preparation. Any course of equivalent amount, if made up of standard works, will be received;

and in any case it is expected that the aim of preparatory study will be to gain a clear perception of what qualities make a work Literature. The examination will be intended as a test rather of the candidate's power of intelligent appreciation than of his knowledge of specific books. Copies of recent entrance examination papers may be had of the Secretary of the Faculty, and will give an accurate idea of what is expected of the candidate.

NOTE.—It is expected that the paper in History and the translations from French and German be written in correct and expressive English; and these papers may at any time be examined as additional evidence in determining the student's proficiency in Composition.

History.—Preparation in either United States History or Ancient History may be offered. In the former subject a thorough acquaintance with the history of the Thirteen Colonies and of the United States to the present time is required, together with an elementary knowledge of the government of the United States. In the latter subject the requirement covers the history of Greece and Rome to the fall of the Roman Empire in the West.

Each of the above subjects is intended to represent one year of historical work, wherein the study is given five times per week, or two years of historical work, wherein the study is given three times per week.

The examination in history will be so framed as to require comparison and the exercise of judgment on the pupil's part, rather than of mere memorizing. The examinations will presuppose the use of good text-books, collateral reading, and practice in written work. Geographical knowledge may also be tested.

Candidates expecting to take the Course in Architecture are advised, should it be equally convenient, to prepare in Ancient History.

Physics.—The candidate will be expected to be familiar with the fundamental principles of Physics. It is especially desirable that he should have a good knowledge of general

mechanics and of the mechanics of solids, liquids, and gases. A knowledge of physical hypotheses is comparatively unimportant. Text-book instruction should be supplemented by lecture-room experiments. A sufficiently extended treatment of the subject will be found in any of the principal text-books now in use in secondary schools.[1] Ability to solve simple problems will be expected. It is furthermore expected that the student will receive training in laboratory work. For the present, however, no student will be rejected because of deficiency in laboratory work, if the school from which he comes is unable to furnish such instruction, a certificate to which effect from the principal of the school will be required.

The laboratory work presented for entrance should consist of at least twenty-five well selected experiments, chosen with the view of illustrating and teaching fundamental laws and principles rather than methods of physical measurement. A satisfactory selection may be made from Experiments 1 to 55 of the College Entrance Examination Board.

The notebook should in every case contain the *original data as recorded by the student in the laboratory*, and each experiment should bear the instructor's indorsement. Great weight is attached at the Institute to the ability of the student properly to record experimental data at the time they are taken, as well as subsequently to discuss and draw logical conclusions from them; and this training should begin in the preparatory school at the very outset of the work in quantitative measurement.

Laboratory notebooks should be presented at the Registrar's office during the week preceding the examination if practicable, and must be certified by the teacher.

ELECTIVE SUBJECTS.

The object of the elective requirements is to secure and to recognize greater breadth of preparatory training. The time allotment for each elective is expected to be equivalent to four or five periods per week for one year.

[1] A printed syllabus of the subject will be sent on application.

These requirements are to be met by the presentation of certificates made out on forms supplied by the Institute, and applicants for elective blanks are requested to specify for which subjects they are desired; but an applicant passing an examination for advanced standing in Intermediate French, in Intermediate German, or in both United States History and Ancient History, need not present a certificate in the corresponding subject. Certificates are also not required of candidates passing certain College Entrance Board Examinations. (See page 66.)

Excuse from the elective requirements, or the acceptance of an equivalent may be allowed in the case of applicants considerably above the usual age, or those coming from foreign countries. Applications for the substitution of work other than that given in the list of electives will also be entertained. Examinations are in general required in the case of applicants desiring excuse from work in the Institute on the ground of electives offered at entrance. The subjects in which excuse may be granted on examination are French (L62) (Intermediate), German (L21) (Intermediate), Drawing,[1] and Mechanic Arts. Applicants offering Chemistry may take a course more advanced than otherwise during their first year, and all applicants who expect to enter the Course in Chemistry or that in Chemical Engineering are advised to present Chemistry as an elective subject if practicable.

Elective French (Intermediate).[2]—Translation from English into French; review of Grammar; reading of ordinary French prose. This is equivalent to the course in French L62. (See page 392.)

Elective German (Intermediate).[2]—Translation from English into German; review of Grammar; reading of ordinary German prose. This is equivalent to the course in German L21. (See page 388.)

Elective Spanish (Elementary).—Elementary Grammar,

[1] See foot-note, page 366.

[2] In addition to the uniform requirements stated on page 71. A certificate in these subjects does not excuse the holder from the intermediate work in the Institute. See pages 66, 69.

including the common irregular verbs; reading, translation from Spanish into English and from English into Spanish. This is equivalent to the course in Spanish L81. (See page 394.)

The reading in French, German, or Spanish may be selected from the works read in the Institute classes, but no requirement of particular text-books is intended.

Applicants passing advanced standing examinations in Intermediate French or Intermediate German given in September may at present count these examinations for the entire elective requirement.

Elective Latin: Satisfactory evidence should be presented that the applicant has acquired the elements of Latin Grammar, that he has had an elementary course in Latin Composition and has read four books of Caesar or the equivalent. A smaller amount of Latin would be of no practical advantage, therefore this is the minimum amount that can be accepted; if satisfactory, this amount will for the present be counted as equivalent to the entire elective requirement.

The study of Latin is recommended to persons who purpose to enter the Institute and who can give the subject adequate attention beyond the regular requirements for admission, since in addition to its disciplinary value Latin gives a better understanding of the various terms used in science, and facilitates the acquisition of the Modern Languages.

Elective English or History.[1]—The work of secondary schools varies so much in these branches that no definite requirement is formulated at present. Any applicant who has carried work in English or History materially beyond the requirements stated on pages 72 and 73 may present for approval as his elective a statement of the amount and kind of work done.

Elective Chemistry.—Applicants must present evidence of familiarity with the rudiments of Chemistry. More importance is attached to aptitude in manipulation and in critical

[1] In addition to the uniform requirements stated on pages 72 and 73.

observation, and to a practical knowledge of the composition, methods of preparation, and reactions of the common chemical substances, than to a knowledge of theoretical conceptions, such as the determination of atomic and molecular weights, molecular structure, valence, etc.

The subject should be attempted only in schools having adequate equipment; and the laboratory work should be carried out with great care and attention to manipulation and note-writing, special emphasis being laid upon exhaustive observation and correct inference.

The applicant should also present for examination his original, uncopied notes, with any annotations which may have been made by the instructor.

For applicants who have completed the requirements of the chemistry elective a course of instruction is provided which is sufficiently advanced to take advantage of the knowledge of chemical science which they already possess, and such applicants are, in general, expected to take this course, while those who satisfy the Chemical Department, by examination or otherwise, as to their proficiency in Inorganic Chemistry may substitute more advanced work for the entire Chemistry of the first year.

Elective Mechanical Drawing.—The applicant should have had at least 160 hours of drawing, and have attained good results in penciling and inking. He should be familiar with the projection of solids, and the finding of sections and developments. Experience in reading projection drawings is regarded as important, and it is also desirable that the applicant shall have had some instruction in sketching from machine details, and in freehand lettering and dimensioning. Plates should be presented, showing the ground covered. Applicants are advised in general not to offer Mechanical Drawing or Descriptive Geometry with a view to omitting these courses at the Institute. (See foot-note, page 367.)

Elective Mechanical Drawing and Mechanic Arts.—These subjects may be offered in combination. The Drawing should

represent at least 60 hours work, along the above lines, or of such kind as is ordinarily given in connection with Mechanic Arts courses.

In Mechanic Arts, the applicants should be thoroughly familiar with the different tools and materials, and know when and how to use them. He should be able to adjust and to sharpen all edge-tools, and capable of executing work from working drawings. The main object of preparatory exercises should be systematic instruction in the correct use of various tools and in the fundamental operations, rather than construction.

Carpentry: The exercises should include systematic instruction in sawing; planing; chiselling, including chamfering, grooving, and plain moulding work; framing, including tenoning, mortising and fitting in braces; use of the ordinary moulding-planes and the making of simple mouldings; the making and use of the mitre-box in fitting mouldings; nailing; dovetailing; gluing; and the proper use of sand-paper.

At least seventy-five hours should be allowed, exclusive of any time that may be used in making working drawings.

Wood-turning: The applicant should have had systematic instruction and experience in the use of the wood-lathe; should understand the adjustment of speeds for the work in hand, and how to use properly the turning tools, such as gouges, turning chisels, nosing tools, right and left side tools, parting tool, calipers, and dividers. The exercises should also include systematic instruction in center and chuck turning, particular attention being paid to the production of smooth work by the cutting action of the tools, and not by the excessive use of sand-paper.

At least forty-five hours should be allowed, exclusive of any time that may be used in making drawings.

Elective Biology.—Applicants may offer either (*a*) an extended course in Botany, such as that recommended by the College Entrance Examination Board, or courses of similar extent in Zoölogy or in Physiology; or (*b*) briefer courses in

any two of the same subjects. In the latter case evidence should be given of thorough elementary knowledge of general principles and of some laboratory and field work.

ADMISSION TO ADVANCED STANDING.

In the case of students passing examinations for advanced standing, in addition to obtaining *a clear record* in entrance requirements, the Faculty endeavors to facilitate the substitution of alternative work. A candidate passing with advanced standing in Modern Languages may arrange to complete any further language requirement of his course during his first year. A candidate passing Trigonometry or other subjects for advanced standing may, with the approval of the Faculty, substitute History II (European National Development), or Mechanic Arts, or take additional work in English Composition. A candidate who has passed off first-year Descriptive Geometry and Mechanical Drawing[1] may take second-year Descriptive Geometry. Graduates of Manual Training Schools may be excused in particular cases from the Mechanic Arts required in some of the Engineering Courses. It is in general preferred that English and Mathematics be not anticipated.

To be admitted as a student in a regular course of the second, third, or fourth year, the applicant must have attained the age of eighteen, nineteen, or twenty years, respectively, and must in general pass satisfactorily the examination for admission to the first-year class, and examinations on all subjects given in the earlier years of the Course which he desires to enter. Applicants presenting satisfactory certificates for work done at other colleges which is substantially equivalent to that required in the first year at the Institute may be excused provisionally from taking the corresponding examinations at the Institute. The examinations for advanced standing are held at the time stated on page 8. (See pages 69 to 75 and pages 83 to 131.)

Graduates of colleges and scientific schools granting degrees are admitted to the Institute without the usual entrance exam-

[1]See foot-note, page 367.

ination, and will be permitted to enter any of the Courses at such a point as their previous range of studies will allow. If prepared to enter upon most of the studies of a certain year, they may often be afforded opportunity to make up any studies of the earlier years in which they are deficient. They will, in general, be credited with all subjects in earlier or later years in which they can show, by examination or otherwise, a standing satisfactory to the Faculty, and may be received provisionally in regular courses, subject to making up deficiencies in work of previous years within a limited time. The attention of such applicants is particularly called to the schedules of Courses on pages 85 to 129, and to the description of Subjects of Instruction, pages 169 to 406. It is highly desirable that students contemplating professional courses after graduation from college should arrange their college electives to cover the earlier subjects of the Courses chosen, in order that the number of deficiencies to be made up may be as small as possible. *In order to enter any of the Engineering or allied Courses in the second year, it is essential that applicants have preparation in Analytic Geometry and the elements of the Calculus, and highly desirable that they be familiar with Mechanical Drawing and Descriptive Geometry. A single year of college work will rarely suffice for admission to the second year.* For admission to third-year engineering work, they must be prepared in Mathematics through the Calculus, in Mechanical Drawing, in Descriptive Geometry, in Physics and in that part of Applied Mechanics given in the second year. Summer courses of appropriate scope are offered in most of these subjects, and applicants intending to enter with advanced standing are advised to correspond with the Secretary of the Faculty in regard to their credits as early as June 1, if in doubt as to what studies, if any, should be pursued during the summer preceding entrance. (See page 132.) *Applicants desiring excuse from any portion of the physical laboratory work must present their original laboratory records.* Those desiring excuse from Mechanical or Freehand Drawing should submit examples of their work besides presenting official records.

Graduates of technical schools not of collegiate grade will

be expected to take entrance and advanced standing examinations, or in case of drawing and laboratory courses to present drawings, original note-books, etc. In certain subjects the passing of an advanced standing examination may carry credit for elementary work.

A special circular in regard to the Admission of Applicants from other Colleges and Opportunities for College Graduates will be mailed on application, and all persons desiring admission with advanced standing should correspond with the Secretary of the Faculty.

ADMISSION OF SPECIAL STUDENTS.

Persons considerably past the usual age of entering students may be admitted to one or more selected subjects in one of the regular Courses except that in Architecture, *i. e.*, to a partial or special course, on giving satisfactory evidence by examination or otherwise that they are qualified to pursue with advantage the subjects chosen.

Applicants desiring admission as special students in Architecture must be college graduates, or twenty-one years of age with not less than two years of experience in an architect's office, or some equivalent and satisfactory preparation. They must give evidence of this preparation through personal conference, letters from former employers, and by the presentation of drawings covering their experience. They must pass the entrance examinations in English and Ancient History, or give other satisfactory evidence of their preparation in these subjects. (See pages 72 and 73 for the ground covered by entrance requirements.) They must take in their first year of residence courses in Descriptive Geometry and Mechanical Drawing unless these subjects have been passed at the September examinations for advanced standing, or excuse from one or both has been obtained on the basis of equivalent work accomplished elsewhere.[1] Entrance to these courses must be approved by the Department of Drawing, and satisfactory records must be obtained in order to continue architec-

[1] See foot-note, page 368.

tural subjects. All special students must also register for second year Freehand Drawing. The first week of this course will be considered a test period to determine the standing of the student. In general special students in Option 1 will be expected to take, in addition to the subjects already mentioned, courses in Design, Shades and Shadows, Perspective, Applied Perspective, Architectural History, History of European Civilization and Art, and Philosophy of Architecture, the arrangement of subjects for each student to be approved by the Department. To become eligible for the Traveling Fellowship in Architecture a special student must obtain satisfactory records for full undergraduate requirements in all the subjects mentioned above, and a satisfactory record in graduate Design. Special students who desire to take work in Architectural Engineering must pass or offer equivalents for the entrance examinations in Mathematics and Physics, and courses in Mathematics, Physics, and Applied Mechanics required in the Option.

By means of the description of Subjects of Instruction, pages 169 to 406, the applicant may ascertain what the various subjects of study are, how, when, and by whom they are given, in what regular Courses they are included, and the preparation required for each; but admission to and continuance in special courses is dependent in all cases upon the approval of the Faculty. In general, no student will be allowed to take any subject until he has shown that he has a satisfactory knowledge of all subjects required as preparation for it.

To Teachers and to Persons of Mature Age Engaged in Technical Pursuits, and wishing to devote some time to scientific study, the Institute desires to offer the amplest opportunities in its lecture-rooms and laboratories. Such persons may in general be admitted without formal examination, on satisfying the Faculty that they are qualified to undertake the work proposed. They will be expected after admission to attend the same exercises and examinations as other students.

Undergraduate Courses of Study.

GENERAL INFORMATION.

On the following pages are given the schedules of the various Undergraduate Courses of Study. Their general character and purposes are described on pages 43 to 49.

The sum of the time assigned to exercises and of that estimated as being normally necessary for the outside preparation for them in all Courses is ordinarily seven hundred and twenty hours for each term of fifteen weeks. In the following Course Schedules, the numbers in the columns at the right represent for each particular subject the total number of hours of exercise and of preparation for a term of fifteen weeks. These hours of exercise and of preparation are also given for each subject in the Alphabetical Subject Index, pages 171 to 180.

Numbers, or letters and numbers, in parentheses refer to the description of Subjects of Instruction (subjects designated by numbers only, pages 182 to 364; subjects designated by letters and numbers, pages 365 to 406), where details are given as to the methods of instruction and scope of each course, as well as to the preparation required.

During the summers between the first and second, and the second and third years all students in regular Courses are required to complete assigned courses of reading of a literary, historical, and general scientific character. (See page 131.)

In the summer following the first year, students pursuing the Course in Mining Engineering (III., Option 2), Chemistry (V.), Chemical Engineering (X.), Electrochemistry (XIV.) or Engineering Administration (XV., Option 3) are required to take Qualitative Analysis 511. In the summer following the second year, students in the Course in Civil Engineer-

ing (I.), Sanitary Engineering (XI.) or Engineering Administration (XV., Option 1) are required to attend the Surveying Camp at Gardner's Lake, near East Machias, Maine. (See page 136.) Students in Mining Engineering (III., Options 1, 3) or Geology (XII.) are required to take a summer course in Surveying (104). Students in Engineering Administration (XV., Option 2) are required to take courses in Surveying (100) and Mechanic Arts (297). (See page 127.)

A special course in English Composition may be required at any time after the first year of any student who shows inability to write clear and correct English. (See subject E15.)

All students bred to speak any language other than English are required, unless they pass the Entrance Examination or unless special arrangement is made to the contrary, to take special courses in English in their first and second years. (See subjects E10 and E20, pages 373, 374.)

In the third year, in addition to the other prescribed subjects, all students in regular Courses, except in Course XV., are required to devote forty-five hours (exercise and preparation) in the first term and seventy-five hours in the second term to elective work in General Studies. (See page 130.)

FIRST YEAR.

FOR DESCRIPTION OF SUBJECTS OF INSTRUCTION SEE PAGES 181 TO 364 FOR NUMBERED SUBJECTS, AND PAGES 365 TO 406 FOR SUBJECTS DESIGNATED BY LETTERS AND NUMBERS.

FIRST TERM.

	Hours Ex. Prep.
Mathematics (M11)	30 – 60
Plane Trigonometry (M10)	30 – 60
Inorganic Chemistry (501); Laboratory, Lectures, and Recitations; Chemical Laboratory	120 – 60
Mechanical Drawing (D11) and Descriptive Geometry (D15)	90 – 0
Freehand Drawing (D31)	30 – 0
German[1] (L21)	45 – 90
Rhetoric and English Composition (E11)	30 – 30
Military Science (20)	45 – 0
Physical Training (25)	25 – 0

SECOND TERM.

COURSES I, II, V, VI, VIII, XI, XIII, XIIIB, XV.	Hours Ex. Prep.
Mathematics (M12)	60 –120
Inorganic Chemistry (502); Laboratory, Lectures, and Recitations	120 – 60
Mechanical Drawing (D12) and Descriptive Geometry (D16)	90 – 0
Freehand Drawing (D32)	15 – 0
German (L21)	45 – 90
English (E11)	30 – 0
History I. (H12)	30 – 30
Military Science (20)	45 – 0
Physical Training (25)	15 – 0

COURSE IV.

Perspective (412)	20 – 40
Mathematics (M12)	60 –120
Mechanical Drawing (D14) and Descriptive Geometry (D18)	135 – 15
Freehand Drawing (D41)	60 – 0
French[1] (L62)	45 – 90
English (E11)	30 – 0
History I. (H12)	30 – 30
Military Science (20)	45 – 0
Physical Training (25)	15 – 0

COURSE VII.

Microscopical Laboratory (700)	30 – 30
Mathematics (M12)	60 –120
Inorganic Chemistry (502); Laboratory, Lectures, and Recitations	120 – 60
Freehand Drawing (D32)	15 – 0
German (L21)	45 – 90
English (E11)	30 – 0
History I. (H12)	30 – 30
Military Science (20)	45 – 0
Physical Training (25)	15 – 0

COURSE IX.
See page 110.

COURSES III, X, XII, XIV.

Mathematics (M12)	60 –120
Inorganic Chemistry (502); Laboratory, Lectures and Recitations	120 – 60
Mechanical Drawing (D12a) and Descriptive Geometry (D16a)	90 – 0
Freehand Drawing (D32)	15 – 0
German (L21)	45 – 90
English (E11)	30 – 0
History I. (H12)	30 – 30
Military Science (20)	45 – 0
Physical Training (25)	15 – 0

Summer Reading, see page 131.
Required Summer Work: Qualitative Analysis (511) for Students in Courses III., Option 2, V, X, XIV, XV, Option 3.

[1] Students expecting to take Course IV. take French (L62). For more advanced elective courses in French and German see Subjects of Instruction, pages 387 to 395.

I.—CIVIL ENGINEERING.

The Course in Civil Engineering is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based. Particular care is taken to enforce the application of the principles taught, and the student is made familiar with the use of engineering instruments and with the usual problems of practice.

Civil Engineering is the broadest in scope of the engineering professions, being the parent stem from which have diverged all the other branches; but, even though these have become recognized as distinct professions, the field of Civil Engineering still remains so large that no one can become expert in its whole extent. It covers Topographical Engineering; the building of railroads, harbors, docks, and other works serving the purposes of commerce and transportation; Municipal Engineering, including the construction of sewers, waterworks, roads, and streets; Structural Engineering, including the construction of bridges, buildings, walls, foundations, and all fixed structures; Hydraulics, the development of water power and other branches. All of these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class-room, the drawing-room, the field, and the testing laboratory.

In the third year the student is offered a choice of two options; one a general option which may lead in the fourth year either to the option in Hydraulic and Sanitary Engineering or to that in Railroad Engineering, and the other, an option in Highway Engineering which continues throughout the fourth year. Students desiring to pursue in greater detail the study of Geodesy and Topography are offered opportunity to do so by taking Course XII. and Advanced Courses.

For further details see pages 186 to 207, 408 to 413, and 431.

I.—CIVIL ENGINEERING.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Surveying and Plotting (100)	30 – 15
Descriptive Geometry (D23)	60 – 45
Mathematics (M21)	45 – 90
Spherical Trigonometry (M20)	10 – 20
Physics	90 – 75
Physical Laboratory (807)	15 – 15
Mechanism (201)	30 – 60
German (L34)	30 – 30
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Surveying and Plotting (100)	30 – 0
Topographical Drawing (195)	30 – 0
Stereotomy (197)	45 – 10
Astronomy (112)	30 – 30
Applied Mechanics (215)	45 – 90
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.
SUMMER COURSE IN SURVEYING, SEE PAGE 136.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Surveying, Advanced (109)	30 – 0
Applied Mechanics (217)	60 – 90
Geology, Dynamical (1231)	45 – 30
Lithology (1211)	15 – 0
Physics (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45
Options.	
Railroad Engineering (121)	30 – 60
Railroad Drawing (123)	60 – 0
1. Elements of Electrical Engineering (618)	30 – 30
2. Electrical Engineering Laboratory (681)	15 – 30
Chemistry of Road Materials (538)	120 – 30
3. Railroad Drawing (123)	45 – 0
Railroad Engineering (121)	20 – 40

SECOND TERM.	Hours Ex. Prep.
Materials (143)	30 – 45
Testing Materials Laboratory (236)	30 – 0
Geology, Stratigraphic (1238)	15 – 15
Geology, Structural and Field (1234)	30 – 15
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75
Options.	
Highway Engineering (130)	15 – 30
Structures (140)	45 –105
Railroad Engineering (121)	30 – 30
1. Railroad Drawing (123)	60 – 0
2. Geodesy (113)	30 – 30
Electrical Engineering Laboratory (682)	30 – 30
Structures (140)	45 – 90
Railroad Drawing (123)	75 – 0
3. Highway Construction (132)	45 – 90
Testing Highway Materials (139)	30 – 15
Railroad Engineering (121)	20 – 20

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Structures (149)	45 – 90
Bridge Design (153)	90 – 0
Foundations (148)	15 – 30
Hydraulics (162)	45 – 90
Heat Engineering (247)	45 – 90
Engineering Laboratory (263)	15 – 15
Options.	
Hydraulic and Sanitary Engineering (175)	45 – 75
1. Thesis	30
Railroad Design (126)	45 – 0
2. Railroad Engineering (125)	30 – 45
Thesis	30
Highway Construction (132)[3]	45 – 60
3. Highway Drainage (133)	15 – 30

SECOND TERM.	Hours Ex. Prep.
Structures (149), (150)	75 –150
Bridge Design (153)	90 – 0
Hydraulic Laboratory (172)	15 – 5
Heat Engineering (247)	45 – 90
Options.	
Hydraulic and Sanitary Engineering (176)	45 – 75
Hydraulic and Sanitary Designing (179)	30 – 0
1. Sanitary Science and Public Health (754)	15 – 0
Thesis	85
Railroad Engineering (125)	45 – 90
2. Railroad Design (126)	30 – 0
Thesis	85
Highway Design (135)	60 – 0
Highway Economics (136)	30 – 30
3. Sanitary Science and Public Health (754)	15 – 0
Thesis	115

[1] For 1915–1916 only. [2] After 1915–1916.
[3] This course will be offered to fourth year students in the academic year 1915–1916 only.

II.—MECHANICAL ENGINEERING.

The course in Mechanical Engineering aims first, to give the student a thorough training in such fundamentals as Physics, Mathematics, and Applied Mechanics; then to familiarize him by means of lectures, laboratory work and drawing room work, with the various problems that a mechanical engineer has to deal with. He is also given a training in the Mechanic Arts sufficient to make him familiar with the use of shop tools, foundry practice, forging and pattern work, such knowledge being essential to the successful designer of machinery.

The work in Mechanism includes the study of linkages, cams, gear teeth, valve gears of steam engines and in the advanced courses, given in the third year, the application of mechanisms to machine tools and to automatic machinery. The course in Heat Engineering covers Thermodynamics, Steam Engines, Boilers, Gas Engines, Gas Producers and Power Station Accessories. Courses are given in Applied Dynamics, Foundations, Factory Construction, Heating and Ventilation, Refrigeration, Industrial Management, and on the Physical Chemical Properties of Engineering Alloys. The student is given sufficient work in Electrical Engineering subjects to enable him to handle the ordinary problems which may confront him. A thorough course in Theoretical Hydraulics is followed by Hydraulic Engineering, a course in which both the estimation of, and the utilization of, hydraulic power is discussed. Instruction in Drawing extends to the end of the third year, the work finishing with the complete design and calculation of a boiler. The course in Machine Design, extending through both terms of the senior year and the course in Power Plant Design, afford the student an opportunity of applying many of the facts learned in preceding years. In the fourth year the student is offered the option of courses in Engine Design, Locomotive Construction, Mill Engineering and Steam Turbine Engineering.

The laboratory work in Steam, Hydraulics and Strength of Materials is planned to follow the class-room work and thereby assist the student in getting a better grasp of these subjects.

For further details see pages 208 to 239 and 408 to 413.

II.—MECHANICAL ENGINEERING.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Mechanism (200)	45 – 90
Mechanical Engineering Drawing (206)	60 – 0
Descriptive Geometry (D21)	45 – 0
Forging (284)	30 – 0
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
German (L35)	15 – 15
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Mechanism and Valve Gears (200)	20 – 40
Mechanical Engineering Drawing (206)	45 – 0
Applied Mechanics (215)	45 – 90
Foundry (287)	45 – 0
Forging (284)	30 – 0
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 25
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Heat Engineering (245)	60 – 90
Applied Mechanics (216)	45 – 90
Machine Drawing (208)	30 – 0
Wood Work and Pattern Making (289)	60 – 0
Mathematics (M31)	45 – 75
Physics (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
Surveying (102)	30 – 0
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Heat Engineering (245)	45 – 90
Applied Mechanics (225)	45 – 90
Mechanism of Machines (204)	30 – 35
Mechanical Engineering Drawing (209)	90 – 0
Boiler Design (266)	45 – 0
Engineering Laboratory (260)	20 – 5
Electrical Engineering (616)	30 – 30
Physical Chemistry of Engineering Alloys (233)	15 – 15
Vise and Bench Work (290)	30 – 0
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Machine Design (267)	60 – 0
Applied Mechanics (229)	45 – 90
Testing Materials Laboratory (235)	25 – 5
Dynamics of Machines (243)	25 – 50
Engineering Laboratory (261) (532)	50 – 25
Theoretical Hydraulics (164)	30 – 60
Electrical Engineering (617)	30 – 30
Electrical Engineering Laboratory (687)	30 – 30
Factory Construction (270)	45 – 0
Foundations (148)	15 – 30
Machine Tool Work (291)	45 – 0

SECOND TERM.	Hours Ex. Prep.
Machine Design (267)	60 – 0
Power Plant Design (272)	60 – 0
General Engineering Lectures (275) or Aeronautical (1371)	15 – 15
Engineering Laboratory (261) (814)	60 – 30
Hydraulic Engineering (168)	45 – 60
Refrigeration (253)	15 – 30
Heating and Ventilation (255)	15 – 30
Industrial Management (274)	15 – 15
Machine Tool Work (291)	60 – 0
Thesis	120

Options.

1. Engine Design (277)	50 – 25
2. Locomotive Engineering (278)	30 – 45
3. Mill Engineering (279)	75 – 0
5.[3] Steam Turbine Engineering (280)	90 – 45

[1] For 1915–1916 only. [2] After 1915–1916
[3] Turbine Option omits Machine Design.

III.—MINING ENGINEERING AND METALLURGY.

The demands made upon the mining and metallurgical engineer call for training in a great variety of lines. The policy of the school, accordingly, is to give him the underlying principles of Mathematics, Physics, Chemistry, Mineralogy, Geology, Mining Engineering, and Metallurgy, as well as some practical knowledge of Mechanical, Civil, and Electrical Engineering. Thus equipped, he can take up specialized work after graduation with the expectation of carrying it on successfully.

Beginning with the second year, three optional lines of study are open to the student.

Option 1, general in character, covers the field of Mining and Metallurgy without laying stress on either subject. It aims to meet the needs of students who desire to obtain at college a broad scientific and technical training, and to defer the choice between Mining and Metallurgy to a later period.

Option 2 is arranged to fulfil the requirements of the Metallurgical Engineer. The study of metals and alloys, of metallurgical processes, and of the principles of Mechanical and Electrical Engineering is made prominent in the course.

Option 3 is intended to train the student who desires to specialize in Mining. In the courses stress is laid upon the study of Mineralogy, Petrography, Economic Geology, Mining, and Ore-Dressing.

Valuable opportunities are offered for observation and field work in the ample laboratories of the Institute (see page 413), and in the Summer Schools of Surveying, (see page 136), of Mining and of Metallurgy (see page 138).

Advanced Courses of one year, which may lead to the degree of Master of Science, have been arranged for students able to devote an additional year to professional study. (See page 148).

III.—MINING ENGINEERING AND METALLURGY.

FOR THE CLASSES OF 1916 AND 1917.

DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

THIRD YEAR.

Option 1, Mining and Metallurgy.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Quantitative Analysis (513)	120 – 15
Mineralogy (1201)	105 – 15
Stratigraphic Geology (1237)	30 – 15
Applied Mechanics (215)	45 – 90
Physics: Heat (802)	15 – 20
Physical Laboratory (808)	15 – 10
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Fire Assaying (321)	75 – 15
Quantitative Analysis (514)	150 – 15
Mineralogy and Petrology (1208)	60 – 15
Elementary Economic Geology (1252)	15 – 15
Field Geology (1262)	15 – 15
Applied Mechanics (218)	45 – 90
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

Option 2, Metallurgy.

FIRST TERM.	Hours Ex. Prep.
Quantitative Analysis (513)	120 – 15
Mineralogy (1201)	90 – 15
Heat Engineering, Thermodynamics (245)	30 – 60
Machine Drawing (208)	60 – 0
Applied Mechanics (215)	45 – 90
Physics: Heat (802)	15 – 20
Physical Laboratory (808)	15 – 10
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Quantitative Analysis (514)	165 – 15
Fire Assaying (321)	75 – 15
Heat Engineering: Boilers (245)	60 –120
Engineering Laboratory (260)	15 – 15
Applied Mechanics (218)	45 – 90
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

Option 3, Mining Geology.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Quantitative Analysis (513)	120 – 15
Stratigraphic Geology (1237)	30 – 15
Mineralogy (1201)	105 – 15
Applied Mechanics (215)	45 – 90
Physics: Heat (802)	15 – 20
Physical Laboratory (808)	15 – 10
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Quantitative Analysis (514)	150 – 15
Fire Assaying (321)	75 – 15
Field Geology (1262)	15 – 15
Mineralogy and Petrology (1208)	60 – 15
Elementary Economic Geology (1252)	15 – 15
Applied Mechanics (218)	45 – 90
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

SUMMER COURSE IN PRACTICAL METALLURGY OR MINING (ELECTIVE IN OPTIONS 1, 2, 3).

III.—MINING ENGINEERING AND METALLURGY.

FOR THE CLASSES OF 1916 AND 1917.

DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

FOURTH YEAR.

Option 1, Mining and Metallurgy.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering: Ore-dressing (303)	45 – 30
Mining and Metallurgical Calculations (305)	15 – 15
Metallurgy (331)	45 – 45
Metallurgical Laboratory (351)	100 – 0
Metallography (334)	15 – 5
Geological Surveying (1265)	60 – 45
Economic Geology (1253)	45 – 45
Laboratory Reports (356)	15 – 0
Testing Materials Laboratory (235)	20 – 10
Heat Measurements (813)	30 – 15
Elements of Electrical Engineering (619)	30 – 30
Electrical Engineering Laboratory (687)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Power in Mining (259)	45 – 45
Mining and Metallurgical Calculations (305)	15 – 15
Metallurgy (331)	45 – 45
Thermo-chemistry and Chemical Equilibrium (567)	30 – 60
Gas Analysis (531)	20 – 10
Laboratory Reports (356)	15 – 0
Theoretical Hydraulics (163)	20 – 40
Sanitary Science and Public Health (754)	15 – 0
Forging (285)	45 – 0
Thesis	180 – 75

Option 2, Metallurgy.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering: Ore-dressing (303)	45 – 30
Mining and Metallurgical Calculations (305)	15 – 15
Metallurgy (331)	45 – 45
Metallurgical Laboratory (351)	100 – 0
Metallography (334)	15 – 5
Laboratory Reports (356)	15 – 0
Theoretical Chemistry I. (565)	45 – 90
Heat Measurements (813)	45 – 30
Testing Materials Laboratory (235)	20 – 10
Elements of Electrical Engineering (619)	30 – 30
Electrical Engineering Laboratory, (687)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Metallurgy (331)	45 – 45
Mining and Metallurgical Calculations (305)	15 – 15
Laboratory Reports (356)	15 – 0
Theoretical Chemistry I. (565)	20 – 35
Gas Analysis (531)	20 – 10
Theoretical Hydraulics (163)	20 – 40
Electric Furnaces (889)	15 – 20
Engineering Laboratory (262)	60 – 30
Sanitary Science and Public Health (754)	15 – 0
Forging (285)	45 – 0
Thesis	180 – 75

Option 3, Mining Geology.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering: Ore-dressing (303)	45 – 30
Geological Surveying (1265)	60 – 45
Economic Geology (1253)	45 – 45
Petrography (1215)	45 – 15
Index Fossils (1273)	45 – 20
Metallurgy (331)	45 – 45
Metallurgical Laboratory (351)	100 – 0
Laboratory Reports (356)	15 – 0
Elements of Electrical Engineering (619)	30 – 30
Electrical Engineering Laboratory (687)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Power in Mining (259)	45 – 45
Geology of North America (1291)	60 – 30
Economic Geology (1254)	30 – 15
Petrography (1215)	45 – 15
Metallurgy (331)	45 – 45
Thermo-chemistry and Chemical Equilibrium (567)	30 – 60
Laboratory Reports (356)	15 – 0
Theoretical Hydraulics (163)	20 – 40
Sanitary Science and Public Health (754)	15 – 0
Thesis	150 – 15

III.—MINING ENGINEERING AND METALLURGY.

FOR THE CLASS OF 1918 AND THEREAFTER.

Option 1, Mining and Metallurgy.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.
SUMMER WORK. SURVEYING (104) MAY BE TAKEN AFTER THE FIRST OR THE SECOND YEAR.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Qualitative Analysis (511)	120 – 15
Mineralogy (1201)	75 – 15
Dynamical Geology (1231)	45 – 30
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Elements of Mining Engineering (301)	15 – 10
Quantitative Analysis (512)	120 – 15
Mineralogy and Petrology (1208)	90 – 15
Stratigraphic Geology (1237)	30 – 15
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.
SUMMER COURSE IN SURVEYING (104) MAY BE TAKEN AFTER THE FIRST OR THE SECOND YEAR.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Fire Assaying (321)	75 – 15
Quantitative Analysis (513)	120 – 15
Structural and Field Geology 1264	45 – 30
Applied Mechanics (215)	45 – 90
History II (H31)	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Mining Engineering (302)	45 – 45
Wet Assaying (323) or Quantitative Analysis (514)	120 – 15
Thermo-chemistry and Chemical Equilibrium (567)	30 – 60
Field Geology (1262)	45 – 15
Applied Mechanics (218)	45 – 90
Elements of Electrical Engineering (616)	30 – 30
Forging (285)	45 – 0
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

SUMMER COURSE IN PRACTICAL METALLURGY OR MINING (ELECTIVE).

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Mining Engineering: Ore Dressing (303)	45 – 45
Metallurgy (331)	60 – 60
Metallurgical Laboratory and Reports (351)	120 – 15
Geological Surveying (1265)	30 – 30
Economic Geology (1256)	45 – 45
Testing Materials Laboratory (235)	20 – 10
Heat Measurements (813)	30 – 15
Elements of Electrical Engineering (617)	30 – 30
Electrical Engineering Laboratory (687)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Power in Mining (259)	45 – 45
Mining and Metallurgical Calculations (305)	30 – 30
Metallurgy (331)	45 – 45
Gas Analysis (531)	20 – 10
Theoretical Hydraulics (163)	20 – 40
Sanitary Science and Public Health (754)	15 – 0
Spanish (L81) or English Composition and Literature (E34)	45 – 75
Thesis and Conference	195 – 60

III.—MINING ENGINEERING AND METALLURGY.

FOR THE CLASS OF 1918 AND THEREAFTER.

Option 2, Metallurgy.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SUMMER WORK. QUALITATIVE ANALYSIS (511).

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Quantitative Analysis (512)	120 – 15	Quantitative Analysis (513)	120 – 15
Mineralogy (1201)	75 – 15	Mineralogy and Petrology (1208)	90 – 15
Dynamic Geology (1231)	45 – 30	Ore Deposits (1251)	30 – 40
Mathematics (M21)	45 – 90	Mathematics (M22)	45 – 90
Physics (801)	90 – 75	Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30	Physical Laboratory (807)	30 – 30
English Literature (E21)	30 – 30	Precision of Measurements (803)	10 – 10
		English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

SUMMER COURSE IN SURVEYING (104) (ELECTIVE).

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Fire Assaying (321)	75 – 15	General Metallurgy (335)	45 – 40
Mining Engineering (306)	30 – 30	Metallurgy: Lead, Gold, Silver (337)	35 – 35
Gas Analysis (531)	20 – 10	Metallurgy: Copper (339)	30 – 30
Mechanism (201)	30 – 60	Non-Ferrous Metallurgical Laboratory (355)	85 – 0
Machine Drawing (208)	60 – 0	Thermochemistry and Chemical Equilibrium (567)	30 – 60
Applied Mechanics (215)	45 – 90	Elements of Electrical Engineering (616)	30 – 30
German (L34)	30 – 30	Applied Mechanics (218)	45 – 90
History II (H31)	30 – 30	Forging (285a)	30 – 0
Political Economy (Ec31)	45 – 45	Business Law (Ec60)	15 – 15
General Studies (see page 130)	45	General Studies (see page 130)	75

SUMMER COURSE IN PRACTICAL METALLURGY OR MINING (ELECTIVE).

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Metallurgy: Iron and Steel (341)	75 – 45	Metallurgy: Zinc and Minor Metals (340)	30 – 30
Metallography (333)	85 – 25	Mining and Metallurgical Calculations (305)	30 – 30
Ore Dressing (307)	40 – 15	Wet Assaying (323)	75 – 0
Heat Measurements (813)	30 – 15	Electrochemistry (890)	30 – 30
Heat Engineering (247)	45 – 90	Theoretical Hydraulics (163)	20 – 40
Elements Electrical Engineering (617)	30 – 30	Heat Engineering (247)	45 – 60
Electrical Engineering Laboratory (687)	45 – 45	Engineering Laboratory (260)	15 – 15
Elementary Technical Electrical Measurements (668)	15 – 15	Foundry (287)	45 – 0
Testing Materials Laboratory (235)	20 – 10	Thesis and Conference	195 – 30
Metal Turning (295)	45 – 0		

III.—MINING ENGINEERING AND METALLURGY.

FOR THE CLASS OF 1918 AND THEREAFTER.

Option 3, Mining.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.
SUMMER WORK. SURVEYING (104) MAY BE TAKEN AFTER THE FIRST OR SECOND YEAR.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Qualitative Analysis (511)	120 – 15
Mineralogy (1201)	75 – 15
Dynamical Geology (1231)	45 – 30
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Elements of Mining Engineering (301)	15 – 10
Quantitative Analysis (512)	120 – 15
Mineralogy and Petrology (1208)	90 – 15
Stratigraphic Geology (1237)	30 – 15
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.
SUMMER COURSE IN SURVEYING (104) MAY BE TAKEN AFTER THE FIRST OR SECOND YEAR.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Fire Assaying (321)	75 – 15
Metallurgy: Principles (336)	60 – 15
Mineralogy and Petrology (1209)	30 – 15
Structural and Field Geology (1264)	45 – 15
Applied Mechanics (215)	45 – 90
Elements of Electrical Engineering (619)	30 – 30
German (L34)	30 – 30
History II (H31)	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (See page 130)	45

SECOND TERM.	Hours Ex. Prep.
Mining: Prospecting, Exploring, Exploitation (315)	30 – 30
Metallurgy: Copper (339)	30 – 30
Quantitative Analysis (513)	120 – 15
Mineralogy and Petrology (1209)	60 – 15
Field Geology (1262)	45 – 15
Applied Mechanics (218)	45 – 90
Electrical Engineering Laboratory (689)	45 – 45
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

SUMMER WORK. MINING CAMP (372) RECOMMENDED.

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Metal Mining: Exploitation (316)	170 –120
Mining: Coal (317)	20 – 20
Mining Laboratory (318)	20 – 20
Metallurgy: Iron and Steel (341)	45 – 45
Geological Surveying (1265)	35 – 15
Economic Geology (1255)	75 – 45
Hydraulics (164)	30 – 60

SECOND TERM.	Hours Ex. Prep.
Mining Engineering: Ore Dressing, Leaching (308)	200 – 45
Mining Plant (313)	45 – 30
Mining Laboratory (318)	90 – 45
Metallurgy: Zinc and Minor Metals (340)	30 – 30
Economic Geology (1255)	45 – 45
Thesis and Conference	115

IV.—ARCHITECTURE.

Architecture is essentially a fine art. It has aptly been called an applied fine art. To become an architect worthy of the name requires years of earnest effort and self-sacrificing study. The school training in architecture serves only to start a man on his career. He is given the proper attitude toward his profession; he is made familiar with the underlying principles of art and science which are to become the foundation of his professional knowledge and development; he is taught the logic and reasonableness of all true architecture; his taste, his power of discrimination between the good and the beautiful and the commonplace and vulgar are developed. He is given facility in the processes which he must use in the expression of his imagination and thought, and is made acquainted with the sciences and their applications by which his creations may be transformed into reality. Such is the ideal toward which the course in Architecture aims.

The curriculum and the methods of instruction employed have been selected not merely to prepare the student for the future practice of architecture but to supply a training which shall be educational in the broadest sense.

Two Options are offered by the Department, one in General Architecture and one in Architectural Engineering. Each includes the general fundamentals essential to the education of all architects. Option I., General Architecture, lays most stress upon Design and Art, with a minimum of Engineering: Option II., Architectural Engineering, lays greatest emphasis upon Structural Design and Engineering, with enough of General Architecture and Art to put the student into full sympathy with the ideals of his profession. The intimate relation which must exist between the work of the two Options, in the practice of architecture, is kept constantly before the student, and he is made to understand that both Options are working with the same end in view,—the noblest architectural achievement.

The first year is to some extent a preparatory one. Courses in Drawing, History, Literature, Language, Science, and Engineering lead in the later years to the various phases of professional work.

The Drawing group embraces Mechanical Drawing, Descriptive Geometry, Shades and Shadows, Perspective, Structural and Freehand Drawing. The courses in freehand occupy a considerable portion of the student's time. Drawing from the cast and from life grows in importance through the four years, and leads in the advanced years to the study of decorative

IV.—ARCHITECTURE.

Option 1, General Course.

First Year, page 85. Description of Subjects of Instruction, pages 181 to 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Elementary Design. Elements of Architecture (471)	105 – 0
European Civilization and Art (H33)	45 – 45
Freehand Drawing (D42)	60 – 0
Shades and Shadows (411)	30 – 15
Applied Perspective (413)	30 – 0
Mathematics (M21)	45 – 90
Physics (801)	75 – 60
English Literature (E21)	30 – 30
History II. (H31)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Design and Theory of Architecture (471)	135 – 0
Architectural History (441)	15 – 15
European Civilization and Art (H33)	30 – 40
Freehand Drawing (D42)	60 – 0
Applied Perspective (414)	20 – 0
History of Ornament (431)	15 – 30
Water Color (453)	30 – 0
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
English Literature (E21)	30 – 30

Summer Reading, see page 131.

THIRD YEAR.

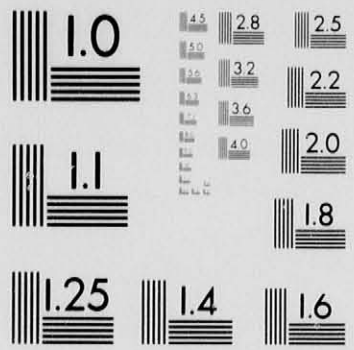
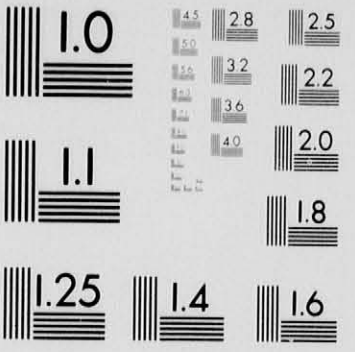
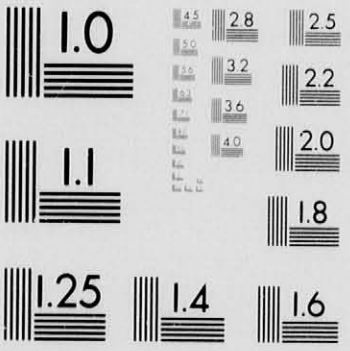
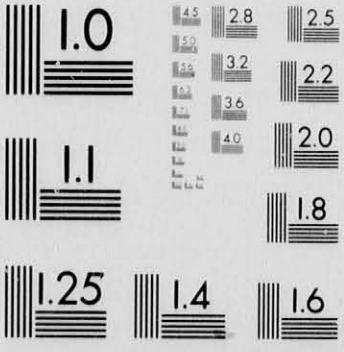
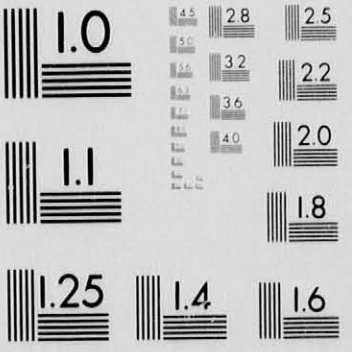
FIRST TERM.	Hours Ex. Prep.
Design (472)	135 – 15
Architectural History (442)	20 – 15
European Civilization and Art (H34)	30 – 40
Freehand Drawing (D43)	60 – 0
Applied Perspective (415)	30 – 0
Water Color (453)	30 – 0
Heating and Ventilation (256)	45 – 45
Applied Mechanics (219)	40 – 80
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Design (472)	200 – 15
Architectural History (442)	20 – 25
European Civilization and Art (H34)	30 – 40
Freehand Drawing (D43)	60 – 0
Applied Perspective (415)	30 – 0
Specifications and Working Drawings (421)	60 – 0
Applied Mechanics (227)	45 – 90
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Design (473)	280 – 45
Constructive Design I., Elementary (481)	120 – 15
European Civilization and Art (H34a)	45 – 60
Life Class (D44)	90 – 0
Philosophy of Architecture (451)	15 – 0
Professional Relations (422)	15 – 15
Color (831)	5 – 5
Acoustics (829)	5 – 5

SECOND TERM.	Hours Ex. Prep.
Design: Thesis (473)	345 – 90
Constructive Design II. (482)	45 – 0
European Civilization and Art (H34a)	45 – 60
Life Class (D44)	90 – 0
Philosophy of Architecture (451)	15 – 0
Professional Relations (422)	15 – 0
Sanitary Science and Public Health (754)	15 – 0


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IV.—ARCHITECTURE (*continued*).

figure design with its varied relations to painting and sculpture as applied to architecture. Supplementing the work of this group are courses in Water Color and Modelling in Clay.

Very early in his course the student begins the study of Architectural Design, and that the Department has the fullest appreciation of the value of this important branch is shown by the fact that the instructors who have it in charge are not only highly trained men but have the experience which comes from the active practice of their profession. Courses in this subject occupy increasing periods of the student's time until in the senior year of Option I. over one-half of the school hours are devoted to its study, while the opening of the drawing-rooms in the evening still further augments the time available for this purpose.

Extended courses in Architectural History and History of European Civilization and Art, give the broad, artistic, historical, and technical training which is necessary for a full appreciation of the essential spirit of any of the great periods of architecture.

The Engineering group begins with the study of Mathematics and Mechanics required as preparation for the courses in Applied Mechanics, Theory of Structures, Testing of Materials, Heating and Ventilation, and Structural Design. This group is most highly developed in the Option in Architectural Engineering, in the later years of which thorough courses in Structural Design replace the corresponding work in Architectural Design in the General Option. The relative amount of time devoted to each subject in the two Options is given in the accompanying detailed subject list.

The Bachelor's degree in Architecture conferred by the Institute admits the holder to candidacy for membership in the American Institute of Architects without the examination ordinarily required.

Opportunities are offered for one or two years of graduate professional work. The value of this graduate training is abundantly shown by the remarkable progress made by the students who have embraced this opportunity for a year's uninterrupted study of subjects essential to thorough preparation for their professional work.

The Department will accept under certain conditions special students in Architecture who must conform to the requirements stated on page 81. Except for these requirements there is no definite course for the special student. He may select, with the approval of the Department, such courses as he desires, and for which he has the necessary preparation.

See page 255 for description of subjects of instruction.

IV.—ARCHITECTURE.

Option 2, Architectural Engineering.[1]

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Elementary Design, Elements of Architecture (471)	105 – 0
European Civilization and Art (H33)	45 – 45
Freehand Drawing (D42)	60 – 0
Shades and Shadows (411)	30 – 15
Surveying (103)	30 – 0
Mathematics (M21)	45 – 90
Physics (801)	75 – 60
English Literature (E21)	30 – 30
History II. (H31)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Design and Theory of Architecture (471)	135 – 0
Architectural History (441)	15 – 15
European Civilization and Art (H33)	30 – 40
Specifications and Working Drawings (421)	60 – 0
Freehand Drawing (D42)	60 – 0
History of Ornament (431)	15 – 5
Sanitary Science and Public Health (754)	15 – 0
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Design (472)	120 – 15
Architectural History (442)	20 – 15
European Civilization and Art (H34)	30 – 40
Structural Drawing (490)	30 – 0
Applied Mechanics (220)	60 –120
Geology of Materials (1257)	15 – 30
Heating and Ventilation (256)	45 – 45
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Structural Design (491)	150 – 0
Architectural History (442)	20 – 25
European Civilization and Art (H34)	30 – 0
Theory of Structures (141)	45 – 90
Applied Mechanics (228)	60 –120
Materials (143)	30 – 45
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Structural Design (492)	220 – 0
Theory of Structures (151)	45 – 90
Applied Mechanics (230)	25 – 50
Testing Materials Laboratory (238)	30 – 15
Testing Materials Laboratory (239)	35 – 15
European Civilization and Art (H33)	45 – 45
Foundations (148)	15 – 30
Electric Wiring and Lighting of Buildings (651)	15 – 15
Professional Relations (422)	15 – 15

SECOND TERM.		Hours Ex. Prep.
Structural Design: Thesis (492)		420 – 0
Theory of Structures (151)		45 – 90
European Civilization and Art (H33)		30 – 40
Sanitary Science and Public Health (754)		15 – 0
Steam and Mechanical Appliances for Buildings (258)	Lect.	15 – 15
	Lab.	8 – 0
Professional Relations (422)		15 – 0

[1] Students in Option II., by taking one additional year, may include in their Course a very large part of the undergraduate work required in Option I. The breadth of fundamental training thus acquired will be found of inestimable value as a basis for professional practice. Students intending to take this combined Course should register on the five-year basis at the beginning of the second year. The degree of Bachelor of Science in Architecture will be awarded at the completion of the Course.

V.—CHEMISTRY.

The course in Chemistry provides fundamental training in the important branches of chemical science, in both class-room and laboratory. It aims to prepare its graduates to take a responsible part in the establishment or development of industries which involve an application of chemical principles, to act as consulting chemists, to deal with problems of public welfare, to engage in research, or to become teachers. The Course includes also a considerable range of instruction in Mathematics, Physics, and German, all of which are essential to an intelligent grasp of modern chemical science and its rapid advances in scientific and technical fields.

The sequence of studies is indicated in the schedules on pages 85 and 101. The growing appreciation of the importance of chemical science, especially in its technical applications, has created a demand in widely different fields for graduates with a chemical training. To meet these conditions three series of tional subjects have been arranged in the last two years of the Course, which afford a consistently planned preparation along certain specific lines, without, however, sacrificing any fundamental subjects.

In Option 1, which may be designated as that of Research Chemistry, a large amount of time is devoted to training the individual student in the investigation of laboratory problems pertaining to the different branches of chemistry. It is intended to prepare graduates to attack the chemical problems constantly arising in the development of the industries, to act as experts, and to fill positions in technical or scientific research laboratories, or as teachers. In Option 2 a large amount of time is devoted to laboratory practice along somewhat varied lines, with reference to general analytical practice, and to the requirements for the control laboratories in chemical or metallurgical industries; while Option 3 provides the biological subjects which bear upon municipal or sanitary chemistry, together with related lines of laboratory practice.

Instruction in Inorganic, Analytical, Organic, Theoretical, and Industrial Chemistry is given to all students in the Course, and includes, in each of these subjects, a considerable amount of laboratory practice arranged to accompany the teaching in the class or lecture-room. In addition to these fundamental lines, somewhat more specialized courses are offered, which include the study of water supplies, foods, oils, gas, sugars and starches, and the methods of proximate technical analysis.

For further information, see pages 150, 265 to 289, and 415.

V.—CHEMISTRY.

First Year, page 85. Description of Subjects of Instruction, pages 181 to 406.
Summer Work. Qualitative Analysis (511.)

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Quantitative Analysis (512)	180 – 15
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
Mathematics (M21)	45 – 90
German (L31)	45 – 60
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Quantitative Analysis (513)	195 – 15
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 25
Precision of Measurements (803)	10 – 10
German (L31)	45 – 60
English Literature (E21)	30 – 30
Options.	
1. Mathematics (M22)	45 – 90
2, 3. Mineralogy (1202)	105 – 30

Summer Reading, see page 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical Chemistry I. (565) Lect.	45 – 75
Theoretical Chemistry I. (565) Lab.	27 – 18
Gas Analysis (531)	20 – 10
Physics (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130).	45
Options.	
1. Quantitative Analysis (514)	120 – 30
1. Experimental Problems in Inorganic Chemistry (590)	165 – 15
2. Quantitative Analysis (514)	135 – 15
2. Experimental Problems in Inorganic Chemistry (590)	90 – 15
2. Dynamical Geology (1231)	45 – 30
3. Quantitative Analysis (514)	195 – 30
3. Sugar Analysis (527)	30 – 15
3. Elements of Biology (702)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Theoretical Chemistry I. (565) Lect.	45 – 75
Theoretical Chemistry I. (565) Lab.	27 – 18
Organic Chemistry I. (551)	60 – 45
Organic Chemical Laboratory (556)	150 – 10
Business Law (Ec60)	15 – 15
General studies (see page 130).	75
Options.	
1. Experimental Problems in Theoretical Chemistry	165 – 20
2. Sugar Analysis (527)	30 – 15
2. Heat Measurements (813)	30 – 20
2. Water and Air Analysis (520)	45 – 0
3. Food Analysis (525)	45 – 0
3. Bacteriology (730)	60 – 35

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical Chemistry II. (566) Lect.	30 – 45
Theoretical Chemistry II. (566) Lab.	18 – 12
Industrial Chemistry I. (575)	45 – 45
Organic Chemistry (551)	45 – 30
Organic Chemical Laboratory (556)	105 – 0
Journal Reports (594)	15 – 10
Options.	
1. Laboratory Option[3]	90 – 15
1. Experimental Problems in Organic Chemistry (592)	180 – 30
1. Industrial Chemistry II. (587)	90 – 15
2. Proximate Analysis (530)	90 – 30
2. Problems in Applied Chemistry (588)	30 – 60
3. Industrial Chemistry II. (587)	90 – 15
3. Food Analysis Adv. (526)	75 – 15
3. Industrial Microbiology (732)	60 – 15
3. Bacteriology of Water and Sewage (731)	30 – 15

SECOND TERM.	Hours Ex. Prep.
Theoretical Chemistry II. (566) Lect.	30 – 45
Theoretical Chemistry II. (566) Lab.	18 – 12
Industrial Chemistry I. (575)	45 – 45
Inorganic Chemistry II. (503)	30 – 30
History of Chemistry (593)	15 – 15
Recent Developments of Chemistry (597)	10 – 0
Thesis Reports (595)	15 – 15
Options.	
1. Thesis	395
2. Metallography (507)	15 – 30
2. Thesis	350
2. Sugar Analysis (527)[1]	30 – 15
2. Microscopy of Drinking Waters (757)	15 – 15
3. Sanitation in Chemical Industries (523)	30 – 30
3. Sanitary Science and Public Health (754)	15 – 0
3. Thesis	240[1]

[1] For 1915–1916 only. [2] After 1915–1916.
[3] Industrial Chemistry II., Proximate Technical Analysis, or Air, Water and Food Analysis.

VI.—ELECTRICAL ENGINEERING.

As the modern development of Electrical Engineering has taken place largely along lines dependent on a sound theoretical knowledge, great importance is attached in Course VI. to the study of Mathematics, Chemistry, Physics and Applied Mechanics in the earlier years and of the Theory of Electricity, beginning in the third year and continuing throughout the remainder of the Course. The electrical engineering lectures of the junior and senior years also take on a distinctly professional character, involving the applications of electricity to the various problems in railroad work, power station-design, power-transmission, lighting, telephony, etc., the work of the Department being supplemented by lectures delivered by engineers not connected with the Institute.

The theoretical work runs parallel with an extended course in the laboratories, which begins with the work in Chemistry and Physics and extends through all of the scientific branches studied. The Electrical Testing laboratories and the laboratories devoted to Electrical Machinery are component parts of the equipment and are in charge of professors of the Department. These laboratories are described on page 418 under the title of The Augustus Lowell Laboratories of Electrical Engineering. They are extensively equipped with apparatus adapted to the needs of undergraduate and advanced study. The laboratory work is carried on with the purpose of developing in the student habits of accurate observation, and of bringing to his consideration not only the methods and tests of fundamental importance, but questions of economy of time and precision of results. The electrical laboratory work is supplemented by a system of conferences in which these factors are especially emphasized.

The high importance of work of the nature of scientific research is strongly emphasized; and research-rooms, with facilities for carrying on special investigations, are available.

For further details see pages 290 to 302 and 418 to 421. For the schedule of an Advanced Course in Electrical Engineering see page 151.

VI.—ELECTRICAL ENGINEERING.

First Year, page 85. Description of Subjects of Instruction, pages 181 to 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
Mechanism (200)	45 – 90
Mechanical Engineering Drawing (206)	60 – 0
Descriptive Geometry (D21)	45 – 0
Metal-turning (294)	30 – 0
Mathematics (M21)	45 – 90
German, Advanced (L33)	30 – 45
English Literature (F21)	15 – 5

SECOND TERM.	Hours Ex. Prep.
Power and its Transformations (600)	5 – 0
Physics (801)	75 – 60
Physical Laboratory (806, 807)	45 – 45
Precision of Measurements (803)	10 – 10
Mechanism (200)	20 – 40
Mechanical Engineering Drawing (206)	20 – 0
Applied Mechanics (215)	45 – 90
Mathematics (M22)	45 – 90
Surveying (102)	30 – 0
Metal-turning (294)	30 – 0
English Literature (E21)	30 – 30

Summer Reading, see page 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Principles of Electrical Engineering (611)	75 – 85
Physics: Heat (802)[1]	15 – 20
Physical Laboratory: Heat (808)[1]	15 – 10
Electrical Engineering Laboratory and Reports (670)	30 – 15
Technical Electric Measurements Laboratory (664)	15 – 15
Heat Engineering: Thermodynamics (245)	45 – 90
Applied Mechanics (218)	45 – 90
Testing Materials Laboratory (237)	20 – 0
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130).	45

SECOND TERM.	Hours Ex. Prep.
Principles of Electrical Engineering (612)	60 – 60
Electrical Engineering Laboratory and Reports (671)	40 – 20
Technical Electrical Measurements (661)	30 – 10
Technical Electrical Measurements Laboratory (664)	30 – 30
Heat Engineering (245)	45 – 90
Engineering Laboratory (260)	20 – 0
Mathematics (M35)	45 – 75
Machine Drawing (208)	60 – 0
Business Law (Ec60)	15 – 15
General Studies (see page 130).	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Alternating Current Machinery (621)	90 – 60
Electrical Engineering Laboratory and Reports (672)	50 – 40
Electric Transmission and Distribution of Power (633)	30 – 45
Technical Electrical Measurements (662) and Laboratory (665)	40 – 40
Theoretical Hydraulics (164)	30 – 60
Engineering Laboratory (261, 532)	45 – 25
Economics of Corporations (Ec55)	30 – 30
Optional Studies (see page 291).	45 – 60

SECOND TERM.	Hours Ex. Prep.
Alternating Current Machinery (622)	35 – 15
Electrical Engineering Laboratory and Reports (673)	55 – 40
Journal Meetings (691)	30 – 0
Engineering Laboratory (261, 814)	45 – 25
Stationary Structures (144)	45 – 75
Hydraulic Engineering (169)	30 – 60
Optional Studies (see page 291)	155 to 185
Thesis	115 to 160

[1] For 1915–1916 only.

[2] After 1915–1916.

VII.—BIOLOGY AND PUBLIC HEALTH.

INCLUDING BACTERIOLOGY AND SANITARY SCIENCE.

This course provides a scientific and professional training for persons desiring to become bacteriologists, or microbiologists, or sanitary inspectors or health officers; or to teach or to investigate within the broad fields of plant and animal life or of hygiene and sanitation.

Useful and inviting careers in the service of states, municipalities, private corporations, firms or individuals, in connection with sanitary surveys, boards of health, public health laboratories, public service corporations, public water supplies, sewerage works, etc., are now open to ambitious and technically trained men and women, and the demand for such persons has of recent years generally exceeded the supply.

There is also a constant demand for persons equipped in Industrial Microbiology, that is, qualified to make, interpret, and report upon, inspections and investigations of milk and milk products, vinegar and lactic acid manufactures, yeast supplies, antiseptics, preservatives, and other aspects of the dairy, fermentation or food-preserving industries.

Taken either in whole or in part the Course affords also an excellent preparation for the work of those higher medical schools which now require for entrance, special preparation in Biology, Chemistry, Physics and other sciences.

The professional subjects are firmly established upon a broad and strong foundation of Chemistry, Physics, General Biology, Botany, Zoölogy, Anatomy, Physiology, Parasitology and Vital Statistics.

Abundant opportunities for research work are supplied in the Departmental Laboratories, in the Sanitary Research Laboratory and Sewage Experiment Station of the Institute, and (by the kindness of Professor Prescott) for Industrial Microbiology in the Boston Bio-Chemical Laboratory.

Graduates of this Department are eligible as candidates for the Certificate in Public Health (C.P.H.), in the School for Health Officers. See page 449.)

For more detailed information see pages 303 to 319, 421.

VII.—BIOLOGY AND PUBLIC HEALTH.

First Year, page 85. Description of Subjects of Instruction, pages 181 to 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
General Biology (701)	60 – 15
Qualitative Analysis (511)	105 – 15
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
German, Adv. (L31)	45 – 60
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Cryptogamic Botany (703)	60 – 40
Invertebrate Zoölogy (704)	30 – 30
Quantitative Analysis (512)	150 – 15
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 15
Precision of Measurements (803)	10 – 10
Surveying (102)	30 – 0
German (L31)	45 – 60
English Literature (E21)	30 – 30

Summer Reading, see page 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
General Bacteriology (730)	90 – 45
Vertebrate Anatomy (710)	75 – 45
Organic Chemistry (550)	30 – 30
Organic Chemical Laboratory (557)	105 – 15
Water and Air Analysis (520)	45 – 0
Food Analysis (525)	45 – 0
Physics: Heat (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Vertebrate Anatomy and Histology (711)	90 – 75
Embryology (712)	75 – 60
Anthropology (714)	15 – 15
General Physiology (720)	90 – 60
Bacteriology of Water and Sewage (731)	45 – 30
Physiological Laboratory (721)	45 – 15
Business Law (Ec60)	15 – 15
General Studies (see page 130).	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Industrial Microbiology (732)	60 – 15
Theoretical Biology (780)	30 – 45
Advanced Bacteriology (734)	45 – 30
Biology of Infectious Diseases (735)	30 – 45
Zymology (733)	45 – 30
Vital Statistics (190)	30 – 30
Journals (770)	30 – 15
Organic Chemical Laboratory (557)	105 – 15
Options.	
1. Plant Physiology (724)	15 – 15
1. Comparative Physiology (722)	45 – 30
1. Public Health Problems (750)	15 – 15
2. Hygiene of Heating and Ventilation (755)	15 – 15
2. Industrial Hygiene and Sanitation (752)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Problems in Chemical and Industrial Biology (740)	15 – 15
Theoretical Biology (780)	30 – 60
Microscopy of Drinking Waters (757)	15 – 15
Sanitary Science and Public Health (754)	15 – 0
Public Health Laboratory Methods (736)	45 – 30
Personal Hygiene (723)	15 – 30
Journals (770)	30 – 30
Theoretical Chemistry II. (566)	48 – 57
Options.	
1. Physiological Laboratory Advanced (781)	60 – 30
1. Thesis Conferences (771)	15 – 15
1. Thesis	180
2. Municipal Sanitation (753)	60 – 30
2. Public Health Problems (750)	15 – 30
2. Thesis Conferences (772)	15 – 15
2. Thesis	105

[1] For 1915–1916 only.

[2] After 1915–1916.

VIII.—PHYSICS.

As distinguished from the professional or technical Courses in Engineering, Architecture, etc., the Institute offers certain Courses of a distinctly scientific nature. The Course in Physics contains a series of studies adapted to the needs of those who wish to become teachers of Physics, or who desire to enter upon a course in physical science either with a view to its further continuance or to prepare themselves for professional positions in which a knowledge of pure and applied physics is especially called for. Its leading features are a thorough and continuous study of the various branches of Physics and a treatment of Mathematics advanced considerably beyond the requirements of any of the technical Courses. Inorganic, Theoretical, Analytical, and Organic Chemistry occupy a position next in prominence to Mathematics, and of hardly less importance.

Physics begins with the second year and, in lectures, readings, recitations, and laboratory exercises, extends to the close of the Course. After the completion of the lectures in General Physics the subject is taken up in detail from both the theoretical and the experimental side. The former instruction consists of a series of continuous courses, in which the subjects of Analytical Mechanics, Electricity, Light and Heat are developed from a distinctly mathematical point of view. These courses form an excellent foundation for future graduate work. A large amount of experimental work is also performed, and an experimental investigation is undertaken during the fourth year in connection with the preparation of the thesis. At all times it is sought to encourage the spirit of original research, and to impart an understanding of the principles upon which scientific investigation should be conducted.

In the Third and Fourth years of the Course a certain amount of specialization along the lines of advanced chemistry or mathematics is provided in Options 1 and 2 respectively. A third option recently introduced is that in Industrial Physics which virtually constitutes a distinct Course. (See pages 108, 109.)

For further details see pages 320 to 338 and 423.

VIII.—PHYSICS.

Options 1 and 2.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
Acoustics (828)	15 – 15
Qualitative Analysis (511)	105 – 15
Mathematics (M21)	45 – 90
Metal Turning (295)	45 – 0
German (L31)	45 – 60
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Physics (801)	75 – 60
Physical Laboratory, (806, 807)	45 – 45
Precision of Measurements (803)	10 – 10
Quantitative Analysis (512)	110 – 15
Mathematics (M22)	45 – 90
Least Squares (M26)	20 – 30
German (L31)	45 – 60
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical Physics I. (841)	45 – 90
Physics: Heat (802)[1]	15 – 20
Physical Laboratory: Heat (808)[1]	15 – 10
Theoretical Chemistry I. (565)	45 – 75
Organic Chemistry (550)	30 – 30
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45
Options.	
1. Mathematics (M35)	45 – 75
1. Quantitative Analysis (513)	90 – 0
2. Mathematics (M36)	60 –120
2. Electrical Laboratory (822)	15 – 15

SECOND TERM.	Hours Ex. Prep.
Theoretical Physics I. (841)	45 – 90
Electrical Laboratory (822)	45 – 45
Heat Measurements (813)	30 – 15
Theoretical Chemistry I. (565)	45 – 75
Descriptive Astronomy (833)	30 – 45
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75
Options.	
1. Physico-Chemical Laboratory (893)	75 – 60
1. or Advanced Physical Laboratory (810)	75 – 60
2. Mathematics (M39)	45 – 90

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical Physics II.: Electrostatics (842)	45 – 90
Theoretical Physics III.: Optics (843)	45 – 90
Optical Laboratory (849)	60 – 30
Physical Colloquium (855)	– 30
Electrochemistry (882)	30 – 45
Elements of Electrical Engineering (619)	30 – 30
Fourier's Series; Laplace's Coefficients (M45)	30 – 60
Options.	
1. Theoretical Chemistry II. (566)	30 – 60
2. Advanced Mathematics (M51 to M65)	30 – 60

SECOND TERM.	Hours Ex. Prep.
Theoretical Physics II.: Electrokinetics (842)	30 – 60
Theoretical Physics IV.: Energetics and Kinetic Theory (844)	45 – 90
Physical Colloquium (855)	15 – 15
Electrical Engineering Laboratory (689)	45 – 45
Fourier's Series; Laplace's Coefficients (M45)	30 – 60
Physical Research: Thesis.	195
Options.	
1. Theoretical Chemistry II. (566)	30 – 60
2. Advanced Mathematics (M51 to M65)	30 – 60

[1] For 1915–1916 only.

[2] After 1915–1916.

VIII.—PHYSICS.

OPTION IN INDUSTRIAL PHYSICS.

This Course is intended to meet the increasing need in various branches of industry for men who have received a training which will particularly fit them to deal with problems whose solution involves a thorough knowledge of physical instruments and processes and of the physical properties of materials. Many industrial corporations are coming to recognize in their business the value of such expert training in Physics, and there can be no reasonable doubt that in the near future this demand will increase as scientific methods come to be more fully applied to the industries.

The present Option differs from those hitherto constituting Course VIII in requiring a less extended study of Pure and Applied Mathematics and a fuller consideration of Applied Physics, both in lecture-room and laboratory. The study of Applied Optics, Heat Measurements and Electrical Measurements is greatly extended. Much time is devoted to Theoretical and Applied Chemistry. A very considerable amount of study in Mechanical and Electrical Engineering subjects is required and Electrochemistry pure and applied, and Metallography are likewise included. There is provided an exceptional equipment of instruments and apparatus of precision, so that a large amount of accurate work can be done in the above lines of study.

The Course is so laid out that one completing it should possess such a knowledge of physical investigation and methods of dealing with physical problems as to enable him to treat intelligently questions of this character as they may arise in connection with processes in the arts.

VIII.—PHYSICS.

Option 3., Industrial Physics.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
Acoustics (828)	15 – 15
Qualitative Analysis (511)	120 – 15
Mathematics (M21)	45 – 90
Metal Turning (294)	30 – 0
German (L32)	45 – 60
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Physics (801)	75 – 60
Physical Laboratory (806, 807)	45 – 45
Precision of Measurements (803)	10 – 10
Photography (861)	15 – 0
Quantitative Analysis (512)	120 – 15
Mathematics (M22)	45 – 90
Mechanism (201)	30 – 60
Metal Turning (294)	30 – 0
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Physics: Heat (802)[1]	15 – 20
Physical Laboratory: Heat (808)[1]	15 – 10
Theoretical Physics I. (Mechanics) (841)	45 – 90
Electricity (824)	30 – 60
Heat Measurements (813)	45 – 15
Theoretical Chemistry I. (565)	45 – 75
Mathematics (M35)	45 – 75
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Theoretical Electricity (825)	45 – 90
Electrical Laboratory (822)	45 – 45
Technical Electrical Measurements Laboratory (664)	30 – 30
Advanced Heat Measurements (815)	30 – 30
Theoretical Chemistry I. (565)	45 – 75
Applied Mechanics (221)	30 – 60
Testing Materials Laboratory (236)	30 – 15
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical and Applied Optics (848)	45 – 90
Optical Laboratory (849)	60 – 30
Photographic Laboratory (851)	60 – 0
Electrical Discharges in Vacua (Laboratory) (852)	45 – 0
Electrochemistry (882)	30 – 45
Organic Chemistry (550)	30 – 30
Elements of Electrical Engineering (619)	30 – 30
Heat Engineering (245)	30 – 60
Physical Colloquium (855)	– 30

SECOND TERM.	Hours Ex. Prep.
Applied Electrochemistry (885)	30 – 60
Electric Furnaces (889)	45 – 15
Electrical Engineering Laboratory (689)	45 – 45
Heat Engineering (245)	30 – 60
Metallography (507)	30 – 30
Physical Colloquium (855)	15 – 15
Thesis	225

[1] For 1915–1916 only.

[2] After 1915–1916.

IX.—GENERAL SCIENCE.

This Course, as indicated by the regulations given in the next paragraph, is largely elective above the first year, and is, accordingly, not designed to prepare students for any special branch of engineering or of science, but rather to provide a broad general training along scientific lines. The Course may well answer the needs of several classes of students. Those who have the time and inclination for extended study will be able to lay a wider and more varied foundation for subsequent intensive work than is possible in the strictly professional courses. The Course is especially adapted to the wants of teachers of science in secondary schools, where ordinarily one is expected to give instruction in more than one branch of science, and where also it is particularly desirable for teachers to be familiar with the elements of several sciences rather than to be specialists in any one. It also gives a good scientific preparation for a business career. Furthermore, this Course makes possible the choice of a considerable amount of such non-professional subjects as English, Modern Languages, History and Economics, on the one hand, and, on the other, Mathematics, Drawing and the Mechanic Arts. Looked at from another point of view, the Course may be regarded as affording an opportunity to secure a general education in which science predominates, but with a generous admixture of other subjects, all of which are pursued according to the methods and standards of a professional school.

The following regulations respecting the Course in General Science have been adopted by the Faculty:

1. Students of this Course shall be required to take all studies of the first term of the first year, and in the second term of the first year shall take all the studies of some one of the prescribed Courses of the Institute.

2. In the second and third years those subjects are to be taken that are required in all Courses.

3. First-year students who intend to become candidates for a degree in this Course shall, at the end of the first term of the first year, submit for the approval of the Faculty their

course of study for the remainder of the four years. Those admitted to the Course later than the middle of the first year shall submit such program of studies upon entering the Course.

4. No subject shall be taken for which the student has not had the required previous preparation; and, furthermore, the choice of subjects may be restricted by tabular view limitations.

The required subjects of the second and third years are as follows:

Second year, first term: Mathematics, Physics, English Literature.

Second year, second term: Physics, Physical Laboratory, Precision of Measurements, English Literature.

Third year, first term: Physics, Physical Laboratory, History II: European National Development, Political Economy, General Studies.

Third year, second term: Business Law, General Studies.

X.—CHEMICAL ENGINEERING.

The efficiency of any industrial chemical process depends not only upon a knowledge of the chemical reactions forming the basis of the process, but also upon a knowledge of the mechanical principles on which depend the design, construction and maintenance of plant for carrying on these reactions. To prepare students capable of filling the demand for men competent to create and operate manufacturing industries based upon chemical principles is the purpose of the Course in Chemical Engineering.

The professional work of the course falls naturally into three groups; first, courses which provide a thorough knowledge of the fundamental principles of chemistry. Second, those courses which furnish a sound knowledge of mechanical engineering subjects, both in theory and in practice. Third, courses which deal with chemical engineering as a separate entity, and which develop a breadth of knowledge not required by students in either the Course in Chemistry or the Course in Mechanical Engineering.

The Course therefore includes a training in Inorganic, Analytical, Organic, and Industrial Chemistry, which is the same as that given to students in the Course in Chemistry, except in the case of some of the laboratory courses. The training in Mechanism, Mechanical Engineering Drawing, Heat Engineering, Applied Mechanics, and other important mechanical engineering subjects is given in the Department of Mechanical Engineering, and is developed with special reference to the particular needs of this Course. This is true also of the work of the Course which is given in the Electric Engineering Department. The instruction in Chemical Engineering I and II, Industrial Chemistry II, and the six graduate courses in Chemical Engineering, is of a distinctly professional nature, the aim of which is described on pages 282–286.

A graduate year of the Course is provided in which opportunity for the development and correlation of these fundamental subjects in the field of Chemical Engineering is presented. For more detailed information see pages 154, 208 to 239, and 265 to 289.

X.—CHEMICAL ENGINEERING.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.
SUMMER WORK. QUALITATIVE ANALYSIS (511).

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Quantitative Analysis (512)	135 – 15
Mechanism (200)	30 – 45
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
German Adv. (L33)	30 – 45
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Quantitative Analysis (513)	145 – 15
Mechanism (200)	30 – 60
M. E. Drawing (206)	60 – 0
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Theoretical Chemistry I. (565) Lect.	45 – 75
Theoretical Chemistry I. (565) Lab.	27 – 18
Heat Engineering (245)	60 – 90
Machine Drawing (208)	60
Applied Mechanics (215)	60 – 90
Physics (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Chemical Engineering I. (576)	30 – 30
Theoretical Chemistry I. (565) Lect.	45 – 75
Theoretical Chemistry I. (565) Lab.	27 – 18
Organic Chemistry I. (551)	60 – 45
Organic Chemical Laboratory (556)	90 – 0
Heat Engineering (245)	30 – 45
Applied Mechanics (218)	45 – 75
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Industrial Chemistry I. (575)	30 – 30
Chemical Engineering II. (577)	30 – 30
Organic Chemistry I. (551)	45 – 30
Organic Chem. Lab. (556)	90 – 0
Theoretical Chemistry II. (566)	30 – 45
Hydraulics (163)	15 – 30
Testing Materials Lab. (235)	20 – 10
Engineering Laboratory (261)	60 – 30
Elements of Electrical Engineering (618)	30 – 30
Electrical Engineering Lab. (689)	45 – 45
Foundry (288), Vise and Bench Work (290b)	45 – 0

SECOND TERM.	Hours Ex. Prep.
Industrial Chemistry I. (575)	45 – 45
Industrial Chemistry II. (587)	135 – 30
Chemical Engineering II. (577)	30 – 60
Inorganic Chemistry II. (503)	30 – 30
Thesis Rep. and Memoirs (596)	30 – 15
Machine Tool Work (292)	45 – 0
Thesis	225

[1] For 1915–1916 only.

[2] After 1915–1916.

XI.—SANITARY ENGINEERING.

The Course in Sanitary Engineering is essentially one in Civil Engineering. It is designed, however, for students who wish to pay particular attention to those engineering branches which are concerned with problems of the public health, and who, therefore, desire to gain a better knowledge of the subjects of Chemistry, Biology and Public Health, and of their relations to engineering problems, than can be obtained in the Course in Civil Engineering.

The line of study offered differs from the regular Course in Civil Engineering, page 86, in the following particulars.

There is a reduction in the time devoted to railroads and bridges, and an entire omission of Stereotomy, Dynamo Electric Machinery, Highway Engineering, Astronomy and Geodesy, and Foundations.

The time thus gained is devoted principally to courses in Chemistry, Biology and Public Health. In these it is designed to give the students such training as shall fit them to interpret properly the results of researches in Sanitary Chemistry and Sanitary Biology, and to coöperate with chemists and biologists in professional work. Practice is given in the Chemical and Biological Laboratories, and the student is instructed in the methods of Water Analysis, and is taught to observe and identify the various animal and vegetable organisms present in natural waters and sewage. The Course devotes particular attention to the sanitary side of questions of water supply and drainage; and discusses, among other things, the principles of filtration and the methods of purifying water and sewage, the relation between drinking waters and disease, the methods of disposing of sewage, and other questions relating to public health. The instruction in Sanitary Engineering now given in the Course in Civil Engineering, which is there optional, is required in the Course in Sanitary Engineering.

For the Schedule of Advanced Courses in Sanitary Engineering see page 151.

XI.—SANITARY ENGINEERING.

First Year, page 85. Description of Subjects of Instruction, pages 181 to 406.

SECOND YEAR.

FIRST TERM.	Hours Ex.	Prep.	SECOND TERM.	Hours Ex.	Prep.
Surveying and Plotting (100)	30	15	Surveying and Plotting (100)	30	0
Descriptive Geometry (D21)	45	0	Topographical Drawing (195)	30	0
Qualitative Analysis (511)	150	15	Quantitative Analysis (512)	90	15
Mathematics (M21)	45	90	Applied Mechanics (215)	45	90
Physics (801)	90	75	Mathematics (M22)	45	90
Physical Laboratory (807)	15	15	Physics (801)	75	60
German (L34)	30	45	Physical Laboratory (807)	30	30
English Literature (E21)	30	30	Precision of Measurements (803)	10	10
			English Literature (E21)	30	30

Summer Reading, see page 131.
Summer Course in Surveying, see page 136.

THIRD YEAR.

FIRST TERM.	Hours Ex.	Prep.	SECOND TERM.	Hours Ex.	Prep.
Railroad Engineering (121)	20	40	Railroad Engineering (121)	20	20
Railroad Drawing (123)	45	0	Railroad Drawing (123)	75	0
Advanced Surveying (109)	30	0	Theory of Structures (140)	45	90
Applied Mechanics (217)	60	90	Testing Materials Laboratory (236)	30	0
Organic Chemistry (550)	30	30	Materials (143)	30	45
Organic Chemical Laboratory (558)	45	15	General Bacteriology (730)	60	0
Elements of Biology (702)	30	0	Industrial Water Analysis (521)	30	0
Dynamical Geology (1231)	45	30	Mechanism (201)	30	60
Lithology (1211)	15	0	Structural and Field Geology (1234)	30	15
Physics: Heat (802)[1]	15	20	Stratigraphic Geology (1238)	15	15
Physical Laboratory (808)[1]	15	10	Business Law (Ec60)	15	15
History II (H31)[2]	30	30	General Studies (see page 130)	75	
Political Economy (Ec31)	45	45			
General Studies (see page 130)	45				

FOURTH YEAR.

FIRST TERM.	Hours Ex.	Prep.	SECOND TERM.	Hours Ex.	Prep.
Theory of Structures; Bridges and Similar Structures (149)	45	90	Theory of Structures; Bridges and Similar Structures (149)	45	90
Structural Design (154)	60	0	Sanitary Engineering (178)	90	90
Theoretical Hydraulics (162)	45	90	Hydraulic and Sanitary Designing (179)	85	0
Sanitary Engineering (177)	45	75	Hydraulic Laboratory (172)	15	5
Bacteriology of Water and Sewage (731)	30	15	Sanitary Science and Public Health (754)	15	0
Water Supply and Wastes Disposal (522)	45	30	Microscopy of Drinking Waters (757)	15	15
Heat Engineering (247)	45	75	Heat Engineering (247)	45	90
Engineering Laboratory (263)	15	15	Thesis	120	

[1] For 1915–1916 only.

[2] After 1915–1916.

XII.—GEOLOGY.

Having in view the broad character of the science of geology, and the somewhat divergent lines of training desirable for students specializing in one or more of the different lines of geologic work, no rigid schedule of studies is laid down, but schedules will be prepared under the guidance of the Geological Department to meet the needs of individual cases.

This plan is especially adapted to meeting the needs of college graduates who desire to specialize in geology and who have had the usual college courses in science including more or less geology, but not the more highly specialized courses like those in the Institute's curriculum. Such graduates may expect to take the degree of Bachelor of Science in one or two years, or the degree of Master of Science in two or three years, according to the extent and character of their previous training.

The following regulations respecting the Course in Geology have been adopted by the faculty:

1. Students in this Course shall be required to take all the studies of the first year as in Course III.

2. In the second year the course of study shall follow closely that laid out for options 1 and 3, of Course III., but students are advised to confer with the Geological Department regarding the substitution of German (L31), General Biology (702), and Zoölogy (704) for other subjects in that schedule.

3. Surveying shall be taken as in Course III., Options 1 and 3.

4. In the third year the students shall take the subjects required of all third year students and in addition shall take a course in French. The remainder of their third-year schedule shall be arranged in consultation with the Geological Department. The schedule as arranged should be submitted to the faculty for approval before the close of the second year.

5. Not later than April 1st of the 3rd year, students in this Course shall submit to the faculty for approval a course of study for the fourth year arranged after consultation with

the members of the Department of Geology. The subjects chosen shall be in the main geologic in character but may give preference to one or more special lines of geologic science, such as mineralogy, petrology, stratigraphic geology and paleontology, economic geology, or physiography.

6. The third-year subjects required of all students referred to under section 4 above, are: first term; Physics (802), Physical Laboratory (808), Political Economy (Ec31) and General Studies: second term; Business Law (Ec60) and General Study.

During the summer between the third and fourth years, summer work in geology is advised. This work may advantageously lead to a thesis in the fourth year.

XIII.—NAVAL ARCHITECTURE AND MARINE ENGINEERING.

The Course in Naval Architecture and Marine Engineering provides instruction in the theory and methods of designing and building ships, together with a study of the properties requisite for safety and steadiness at sea. It aims to furnish a well-rounded training for those who expect to be ship-builders, ship-designers, ship-managers, or marine engine builders, or who desire to enter allied industries. Like all the Courses at the Institute, it gives, in addition to a professional and technical training, a good scientific and liberal education.

In addition to the literary, mathematical, and scientific studies requisite for a general training and for preparation for the special work of the Course, instruction is given in Mechanism, Thermodynamics, Applied Mechanics, Hydraulics, Heat Engineering, Steam Turbines, and Marine Engineering. It is believed that a proper coördination of the design of a steamship and its propelling machinery can be attained only by a naval constructor who is familiar with both branches of his profession.

Lectures are given on theoretical Naval Architecture and Marine Engineering; treating of displacement and stability, launching, theory of waves, rolling of ships, strength of ships, propulsion of ships, steering and manoeuvering, and adjustment of compasses; and also of power, proportion and strength of marine engines, and the application of steam turbines to marine propulsion.

After preliminary instruction in ship-drawing, each student carries through the design of a ship, and its machinery for a given service in a systematic manner as in good practice, giving attention both to the logical development of the design and to the requirements for registration, for insurance and governmental inspection. Drawings and all customary computations are made of the structure and arrangements of hull, engines and propellers. The student makes a model, lays out plating and draws up specifications. To explain and unify the work of design, lectures are given on the materials and methods of construction of ships of wood and of steel, and on ventilation and drainage. (See also pages 352 to 364 and 432.)

For description and schedule of a Graduate Course in Aeronautical Engineering see pages 154 and 155.

XIII.—NAVAL ARCHITECTURE AND MARINE ENGINEERING.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.
Mechanism (200)	45 – 75
Mechanical Engineering Drawing (206)	75 – 0
Descriptive Geometry (D21)	45 – 0
Forging (284)	30 – 0
Mathematics (M21)	45 – 90
Physics (801)	90 – 75
Physical Laboratory (807)	30 – 30
Applied Chemistry (585)	15 – 15
English Literature (E21)	30 – 30

SECOND TERM.	Hours Ex. Prep.
Ship Construction (1331)	20 – 20
Ship Drawing (1341)	30 – 0
Mechanism (200)	20 – 40
Mechanical Engineering Drawing (206) and Surveying Instruments (101)	30 – 0
Applied Mechanics (215)	45 – 85
Forging (284)	30 – 0
Mathematics (M22)	45 – 90
Physics (801)	75 – 60
Physical Laboratory (807)	30 – 20
Precision of Measurements (803)	10 – 10
English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 60
Ship Drawing and Design (1342)	75 – 0
Heat Engineering: Thermodynamics (245)	30 – 60
Applied Mechanics (216)	45 – 90
Mathematics (M31)	45 – 90
Physics: Heat (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
Political Economy (Ec31)	45 – 45
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 55
Ship Construction (1332)	20 – 20
Ship Drawing and Design (1342)	90 – 0
Heat Engineering (245)	60 –120
Engineering Laboratory (260)	20 – 5
Applied Mechanics (226)	30 – 60
Physica Chemistry of Engineering Alloys (233)	15 – 15
Foundry (287)	45 – 0
Vise and Bench Work (290)	30 – 0
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1302)	30 – 60
Ship Design (1343)	80
Model Making (1381)	25 – 0
Ventilation and Drainage (1333)	30 – 30
Applied Mechanics (229)	45 – 90
Testing Materials Laboratory (235)	20 – 10
Hydraulics (163)	15 – 30
Engineering Laboratory (261, 532)	60 – 30
Elements of Electrical Engineering (619)	30 – 30
Electrical Engineering Laboratory (687)	30 – 30
Machine-tool Work (291)	45 – 0

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1302)	15 – 30
Ship Design (1343)	120 – 0
Marine Engineering (1351)	30 – 60
Marine Engine Design (1352)	90 – 0
Marine Steam Turbines (1365)	30 – 60
Engineering Laboratory (261, 814)	60 – 30
Sanitary Science and Public Health (754)	15 – 0
Machine-tool Work (291)	60 – 0
Thesis	120

[1] For 1915–1916 only.

[2] After 1915–1916.

XIII. A.—NAVAL ARCHITECTURE (*continued*).

COURSE FOR NAVAL CONSTRUCTORS.

The Massachusetts Institute of Technology has been selected by the United States Department of the Navy to give professional instruction to officers designated for the Corps of Naval Constructors. For the satisfactory completion of this Course the degree of Master of Science is given.

In arranging this Course the objects sought are the addition to the training already obtained at the Naval Academy of those subjects which are peculiar to Naval Architecture, and such an extension and rounding out of that training as will best enable a Naval Constructor to meet the varied and exacting demands of his official position. The Course includes all the theoretical Naval Architecture of the regular four-year Course, together with lectures on advanced or special subjects relating to Naval Architecture. Other subjects selected from the regular course are Marine Engineering, Heat Engineering, Marine Steam Turbines, and Applied Mechanics. Throughout the three years instruction is given in War-ship Design by means of lectures and drawing. The Course is broadened and strengthened by courses on Sanitation, Metallurgy, and Theory of Structures. A thorough course is given in Electrical Engineering, with adequate training in physical and electrical engineering laboratories. Lectures and laboratory work are given on paints, oils, and other organic materials used on ships.

The first and second years of the following schedule of the Course for Naval Constructors correspond respectively to the third and fourth years of Course XIII.; the third year corresponds to graduate work in other Departments, and leads to the degree of Master of Science.

XIII. A.—NAVAL ARCHITECTURE.

COURSE FOR NAVAL CONSTRUCTORS.

DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

JUNIOR YEAR.[1]

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 60
Theory of Warship Design (1311)	30 – 30
Warship Design, preliminary work (1321)	105
Heat Engineering (246)	30 – 60
Applied Mechanics (216)	45 – 90
Mathematics (M36)	60 –120
Analytical Chemistry (534)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 60
Theory of Warship Design (1311)	30 – 30
Warship Design (1321)	120
Heat Engineering (246)	10 – 20
Internal Combustion Engines (251)	20 – 20
Applied Mechanics (226a)	45 – 90
Mathematics (M38)	30 – 60
Precision of Measurements (803)	10 – 10
Chemical Laboratory (534)	90 – 0
Metallurgy (332)	45 – 45

SENIOR YEAR.

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1302)	30 – 60
Theory of Warship Design (1312)	30 – 30
Warship Design (1322)	90 – 0
Aeronautics (1372)	45 – 45
Model Making (1395)	30 – 0
Applied Mechanics (229)	30 – 30
Testing Materials Laboratory (235)	20 – 10
Principles of Electrical Engineering (611)	75 – 85
Standardizing Laboratory (667)	30 – 30
Political Economy (Ec31)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1302)	15 – 30
Theory of Warship Design (1312)	30 – 30
Warship Design (1322)	90 – 0
Marine Steam Turbines (1365)	30 – 60
Sanitation of Ships (756)	15 – 15
Aeronautics (1372)	45 – 45
Engineering Laboratory (261, 814)	60 – 30
Principles of Electrical Engineering (612)	45 – 45
Electrical Engineering Laboratory (684)	45 – 45

GRADUATE YEAR.

FIRST TERM.	Hours Ex. Prep.
Theory of Warship Design (1313)	30 – 30
Warship Design (1323)	90 – 0
Marine Engineering (1355)	30 – 30
Marine Engine Design (1361)	90 – 45
Engineering Laboratory (261)	60 – 30
Alternating Current Machinery (623)	45 – 45
Electrical Engineering Laboratory (685)	45 – 45
Economics of Corporations (Ec41)	30 – 30
Public Speaking (E39)	30 – 15

SECOND TERM.	Hours Ex. Prep.
Theory of Warship Design (1313)	30 – 30
Warship Design (1323)	90 – 0
Aeronautics, Advanced (1372)	30 – 60
Mechanical Applications of Electrical Power (635)	30 – 60
Theory of Structures (145)	105 – 90
Industrial Management (274)	15 – 15
Business Law (Ec60)	15 – 15
Memoirs (1305)	15 – 35
Thesis	120

[1] The three years of this Course correspond respectively to the third, fourth, and graduate years of Course XIII.

XIII. B.—NAVAL ARCHITECTURE (*continued*).

COURSE IN NAVAL CONSTRUCTION.

The Massachusetts Institute of Technology now offers a full five year Course in Naval Construction open to all students. The Course is parallel to that provided for United States Naval Constructors, differing mainly in that it articulates with the first two years of the regular four-year Course in Naval Architecture and Marine Engineering. Instruction is given by the same professors and instructors and the Course is of the grade of Course XIII.A.

The Course gives a good scientific and liberal education with adequate instruction in Mathematics, Chemistry, Physics, Applied Mechanics, Heat Engineering, and laboratory practice.

The more strictly professional work consists of Naval Architecture, Naval Construction and Marine Engineering (including steam turbines and internal combustion engines). Each student makes a design for a warship and its machinery; he makes supplementary calculations, such as those for launching, and makes and lays out a plating model and takes instruction in mold-loft work.

Courses are given in Electrical Engineering, the Theory of Structures and Aeronautical Engineering. This last subject is included both for its present importance and its relation to Naval Architecture.

The Department has in its possession an extensive collection of drawings, designs and other material so arranged as to facilitate instruction in the theory and practice of Naval Construction in the best manner.

The first two years of the Course are the same as those for Course XIII. and the last three years correspond to the three years on page 121 for Course XIII.A.

XIII. B.—NAVAL ARCHITECTURE.

COURSE IN NAVAL CONSTRUCTION.

FIRST YEAR, PAGE 85. CHINESE AND JAPANESE STUDENTS SUBSTITUTE ENGLISH (E10) FOR GERMAN (L21).

SECOND YEAR, PAGE 119. SAME AS FOR COURSE XIII.

DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 60
Theory of Warship Design (1311)	30 – 30
Warship Design (1321)	90 – 0
Heat Engineering (245)	30 – 60
Applied Mechanics (216)	45 – 90
Mathematics (M31)	45 – 90
Physics: Heat (802)[1]	15 – 20
Physical Laboratory (808)[1]	15 – 10
History II. (H31)[2]	30 – 30
General Studies (see page 130)	45

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1301)	30 – 55
Theory of Warship Design (1311)	30 – 30
Warship Design (1321)	120 – 0
Heat Engineering (245)	60 –120
Engineering Laboratory (260)	20 – 5
Applied Mechanics (226)	30 – 60
Foundry (287)	45 – 0
Business Law (Ec60)	15 – 15
General Studies (see page 130)	75

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Naval Architecture (1302)	30 – 60
Theory of Warship Design (1312)	30 – 30
Warship Design (1322)	90 – 0
Model Making (1395)	30 – 0
Ventilation and Drainage (1333)	30 – 30
Hydraulics (163)	15 – 30
Testing Materials Laboratory (235)	20 – 10
Engineering Laboratory (261, 532)	60 – 30
Applied Mechanics (229)	45 – 90
Political Economy (Ec31)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Naval Architecture (1302)	15 – 30
Theory of Warship Design (1312)	30 – 30
Warship Design (1322)	120 – 0
Steam Turbines (1365)	30 – 60
Aeronautics (1372)	30 – 60
Internal Combustion Engines (251)	20 – 20
Engineering Laboratory (261, 814)	60 – 30
Electrical Engineering (616)	30 – 30
Metallurgy (332)	45 – 45
Vise and Bench Work (290)	30 – 0

FIFTH YEAR.

FIRST TERM.	Hours Ex. Prep.
Theory of Warship Design (1313)	30 – 30
Warship Design (1323)	90
Marine Engines (1355)	30 – 60
Marine Engine Design (1361)	120 – 0
Marine Boilers	30 – 60
Hydrodynamics (M57)	20 – 40
Elements of Electrical Engineering (617)	30 – 30
Electrical Engineering Laboratory (687)	45 – 45
Machine Tool Work (291)	45 – 0

SECOND TERM.	Hours Ex Prep.
Theory of Warship Design (1313)	30 – 30
Warship Design (1323)	120
Sanitation of Ships (756)	15 – 15
Theory of Structures (145)	105 – 90
Memoirs (1305)	15 – 45
Industrial Management (274)	10 – 10
Machine Tool Work (291)	60 – 0
Thesis	120

[1] For 1915–1916 only.

[2] After 1915–1916.

XIV.—ELECTROCHEMISTRY.

The Course in Electrochemistry aims primarily to prepare students to enter upon any of the various electro-chemical and electro-metallurgical industries which are being so rapidly developed at the present time. The instruction given in this Course is, however, of so broad a character that students completing it should be well prepared to undertake various lines of purely electrical and chemical work other than Electrochemistry, if they so desire.

Its main features are a very thorough training in electrical and chemical subjects, which extend throughout the whole Course, and the distinctly professional work in Electrochemistry, which runs through the fourth year. The electrical studies are for the most part identical with those taken by students in Electrical Engineering, and include courses in the Theory of Direct and Alternating Currents, an extended laboratory course in Electrical Measurements and Testing, and a Course in Direct and Alternating Current Generators and Motors and Power Transmission, with practice in the Laboratory of Electrical Engineering. The instruction in Chemistry is devoted chiefly to courses in Analytical, Theoretical, Organic, and Industrial Chemistry. In addition to these subjects are included shorter courses in Gas Analysis, Assaying, and Metallurgical Laboratory, and courses in Mechanism and Steam Engineering.

The work in Electrochemistry extends throughout the fourth year. During the first term the theory of the subject is taken up in a course of lectures which are accompanied by extended laboratory practice in Electrochemical Measurements. In the second term the instruction is continued by lectures on Applied Electrochemistry, including electrodeposition, accumulators, electric furnaces, and their products, electrolytic processes, and electro-metallurgy, and by work in the Laboratory of Applied Electrochemistry. The current periodical literature of the subject is reviewed in a weekly colloquium. The thesis required is also on some electrochemical topic.

Beyond the particular alternative studies indicated in the Course Schedule, a certain further liberty of substitution in the fourth year may be allowed by the Faculty in the case of students in Course XIV. who are fitting themselves for some special line of work.

Owing to the present crowded condition of the fourth year Electrochemical Laboratory places cannot be guaranteed to students who have not been registered in the Course at least one year.

XIV.—ELECTROCHEMISTRY.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.
SUMMER WORK. QUALITATIVE ANALYSIS (511).

SECOND YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Physics (801)	90 – 75	Physics (801)	75 – 60
Physical Laboratory (807)	30 – 30	Physical Laboratory (807)	30 – 30
Quantitative Analysis (512)	120 – 15	Precision of Measurements (803)	10 – 10
Mathematics (M21)	45 – 90	Quantitative Analysis (513)	100 – 15
Mechanical Engineering Drawing (207)	30 – 0	Gas Analysis (531)	20 – 10
Metal-turning (294)	30 – 0	Applied Mechanics (215)	45 – 90
German (L32)	45 – 60	Mathematics (M22)	45 – 90
English Literature (E21)	30 – 30	Metal-turning (294)	30 – 0
		English Literature (E21)	30 – 30

SUMMER READING, SEE PAGE 131.

THIRD YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Principles of Electrical Engineering (611)	75 – 85	Principles of Electrical Engineering (612)	60 – 50
Electrical Engineering Laboratory and Reports (671)	30 – 30	Electrical Engineering Laboratory (671)	15 – 15
Technical Electrical Measurements Laboratory (664)	15 – 15	Technical Electrical Measurements Laboratory (664)	15 – 15
Theoretical Chemistry I. (565)	45 – 75	Theoretical Chemistry I. (565)	45 – 70
Organic Chemistry (550)	30 – 30	Organic Chemical Laboratory (557)	75 – 0
Quantitative Analysis (513)	65 – 0	Gas Analysis (531)[1]	20 – 10
Fire Assaying (322)	30 – 0	Heat Measurements (813)	30 – 15
Physics: Heat (802)[1]	15 – 20	Mechanism (201)	30 – 60
Physical Laboratory: Heat (808)[1]	15 – 10	Mathematics (M32)	30 – 60
Political Economy (Ec31)	45 – 45	Business Law (Ec60)	15 – 15
History II. (H31)[2].	30 – 30	General Studies (see page 130)	75
General Studies (see page 130)	45		

FOURTH YEAR.

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep.
Electrochemistry (882)	30 – 45	Applied Electrochemistry (885)	30 – 60
Electrochemical Laboratory (886)	105 – 15	Electrochemical Laboratory (887)	45 – 30
Alternating Current Machinery (623)	60 – 30	Physical Chemistry of Engineering Alloys (233)	15 – 15
Electrical Engineering Laboratory and Reports (672)	70 – 40	Heat Engineering (248)	30 – 60
Electric Transmission and Distribution of Power (633)	30 – 45	Industrial Chemistry I. (575)	45 – 45
Heat Engineering (248)	30 – 60	Colloquium (855)	15 – 15
Industrial Chemistry I. (575)	45 – 45	Thesis.	
Metallurgical Laboratory and Reports (352, 356)	30 – 0	*Options.*	
Colloquium (855)	30	1. Electrical Engineering Laboratory and Reports (673)	35 – 30
		2. Industrial Chemistry II. (587)	45 – 45

[1] For 1915–1916 only.

[2] After 1915–1916.

XV.—ENGINEERING ADMINISTRATION

The Course in Engineering Administration provides a training for men who expect to enter positions concerned with the management or administration of manufacturing, construction, and transportation enterprises which demand a knowledge of scientific and engineering principles. It combines with instruction in general engineering, studies in the methods, economics, and law of business. The course includes (1) the instruction common to all Courses, in literature, language, and history, and in chemistry, physics, and mathematics; (2) a choice of engineering studies classified under three options: Civil Engineering, Mechanical and Electrical Engineering, Chemical Engineering; and (3) a selected group of subjects in business and economics. While the amount of time assigned to engineering subjects is less than that prescribed in the other Courses of the Institute, the fundamental subjects have been retained which will enable graduates to fill many of the positions open to engineers.

Approximately one fourth of the total time of the curriculum is given to business subjects which are primarily chosen so as to train students to analyze commercial and industrial problems. In this group special emphasis is placed upon accounting, business law, the industrial organization of society, and business management.—The course in Accounting is designed to be of service to administrative officers in the analysis of accounts and financial reports, rather than to make bookkeepers, auditors, or accountants in a technical sense. Cost Accounting includes methods of determining costs of material, processes, labor, and machines; distribution of indirect costs and overhead expenses; cost data to secure economy; and inventories. Business Law treats of contracts, agency, negotiable instruments, sales, and patents. The two extended subjects of Industrial Organization and Business Management deal with the financial operations of corporations and the conduct of business from the standpoint of the individual employer. They include a treatment of the organization of the executive force, departmental functions, factory efficiency, standardization of goods, stock keeping, routing of orders, management of labor, efficiency methods, marketing of goods, publicity and advertising, credit department, insurance, and business ethics. Among other subjects included in the group of business studies are Banking, Statistics, Report Writing, Transportation, and Securities and Investments.

Civil Engineering Option. The Civil Engineering Option is intended to meet the needs of students expecting to enter upon administrative positions in organizations engaged in transportation or the construction of works pertaining thereto, or in

XV.—ENGINEERING ADMINISTRATION.

FIRST YEAR, PAGE 85. DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.
Option 3. SUMMER COURSE IN QUALITATIVE ANALYSIS (511).

SECOND YEAR.

	FIRST TERM.	Hours Ex. Prep.
	Mathematics (M21)	45 – 90
	Physics (801)	90 – 75
	Physical Laboratory (807)	30 – 30
	Political Economy (Ec32)	45 – 45
	German[1] (L33)	30 – 45
	English Literature (E21)	30 – 30
	Options.	
1.	Mechanism (201)	30 – 60
	Descriptive Geometry (D21)	45 – 0
2.	Mechanism (201)	30 – 60
	Descriptive Geometry (D21)	45 – 0
3.	Quantitative Analysis (512)	120 – 15

	SECOND TERM.	Hours Ex. Prep.
	Accounting (Ec50)	45 – 45
	Banking (Ec37)	45 – 60
	Physics (801)	75 – 60
	English Literature (E21)	30 – 30
	Options.	
1.	Applied Mechanics (215)	45 – 90
	Surveying (102)	30 – 0
	Mathematics (M22)	45 – 90
	Physical Laboratory (807)	5 – 5
	Precision of Measurements (803)	10 – 10
2.	Applied Mechanics (215)	45 – 90
	Mathematics (M22)	45 – 90
	Physical Laboratory (807)	20 – 20
	Precision of Measurements (803)	10 – 10
3.	Quantitative Analysis (513)	120 – 15
	Mechanism (201)	30 – 60
	Foundry Work (287)	45 – 0
	Physical Laboratory (807)	20 – 20
	Precision of Measurements (803)	10 – 10

SUMMER READING, SEE PAGE 131.
Option 1. SUMMER COURSE IN SURVEYING, SEE PAGE 136.
Option 2. SUMMER COURSES IN SURVEYING (100) AND MECHANIC ARTS (297).

THIRD YEAR.

	FIRST TERM.	Hours Ex. Prep.
	Industrial Organization (Ec56)	30 – 60
	Statistics (Ec65)	60 – 0
	Report Writing (E35)	30 – 30
	Heat Engineering (247)	45 – 90
	Physics: Heat (802)[2]	15 – 20
	Physical Laboratory (808)[2]	15 – 10
	History II. (H31)[3]	30 – 30
	Options.	
1.	Applied Mechanics (217)	60 – 90
	Railroad Engineering (121)	20 – 40
	Elements of Electrical Engineering (618)	30 – 30
	Electrical Engineering Laboratory (681)	15 – 30
2.	Applied Mechanics (216)	45 – 90
	Elements of Electrical Engineering (614)	45 – 75
	Machine Drawing (208)	60 – 0
3.	Theoretical Chemistry I. (565) Lect.	45 – 75
	Theoretical Chemistry I. (565) Lab.	27 – 18
	Organic Chemistry (550)	30 – 30
	Mechanical Engineering Drawing (207)	45 – 0
	Metal Turning (295)	45 – 0

	SECOND TERM.	Hours Ex. Prep.
	Industrial Organization (Ec56)	45 – 45
	Transportation (Ec35)	30 – 45
	Securities and Investments (Ec38)	45 – 45
	Heat Engineering (247)	45 – 60
	English Composition and Literature (E34)	45 – 75
	Options.	
1.	Structures (140)	45 – 90
	Railroad Engineering (121)	20 – 20
	Materials (143)	30 – 35
2.	Applied Mechanics (225)	45 – 90
	Mechanical Engineering Drawing (209)	105 – 0
3.	Theoretical Chemistry I. (565)	72 – 93
	Organic Chemistry Laboratory (557)	75 – 0

[1] Students taking Civil Engineering Option may substitute Spanish for German.
[2] For 1915–1916 only. [3] After 1915–1916.

the development and distribution of hydraulic power. The course differs from the regular Civil Engineering Course by the substitution of business subjects for some of the more descriptive optional subjects of the fourth year and for the following subjects of earlier years: Astronomy, Geodesy, Geology, Highway Engineering, Railroad Drawing, Stereotomy, and Topographical Drawing. That the graduates of this option will be well trained in the principles upon which the practice of Civil Engineering depends is ensured by the maintenance in the course of the fundamental professional subjects of Surveying, Railroad Engineering, Hydraulics, Hydraulic Engineering, Structures and Structural Design, and of the allied professional subjects of Heat Engineering and Electrical Engineering.

Mechanical and Electrical Engineering Option. The Option in Mechanical and Electrical Engineering is planned to give a training in a sufficient number of the fundamental engineering subjects to make its graduates competent to deal with engineering affairs other than the direct design and construction of plants. It includes many of the important subjects given in the regular course in Mechanical Engineering, omitting, however, such subjects as Mechanism of Machines, Boiler Design, Physical Chemical Properties of Engineering Alloys, Factory Construction, Power Plant Design, Refrigeration, and Heating and Ventilation. The amount of time devoted to Mechanic Arts has also been reduced. The option differs from the Course in Electrical Engineering in that less attention is given to design and to the more theoretical parts of electrical engineering, the aim being to give the students a general knowledge, which, together with the laboratory practice, should make them capable of employment in the operating or in directing the operating of electrical plants.

Chemical Engineering Option. The Chemical Engineering Option affords instruction in the more important branches of Chemistry and in the fundamental principles of Mechanical Engineering. The time devoted in this option to organic chemistry is much less, and that devoted to the other branches of chemistry is somewhat less than in the Chemical Engineering Course. The training is, however, adequate to fit capable students to take many of the positions open to graduates of Courses V. and X. The instruction in Mechanical and Electrical Engineering is also less extended than that in the Chemical Engineering Course. The primary purpose of the option is to give the information and training necessary to prepare men to deal with the economic administration, rather than with the scientific development and control of the processes involved in the industries devoted to the manufacture of materials, such as textiles, paper, leather, rubber, fertilizers, iron and steel, foods, and chemicals.

XV.—ENGINEERING ADMINISTRATION (*continued*).

DESCRIPTION OF SUBJECTS OF INSTRUCTION, PAGES 181 TO 406.

FOURTH YEAR.[1]

Option 1.—Civil Engineering.

FIRST TERM.	Hours Ex. Prep.
Cost Accounting (Ec51)	45 – 45
Business Management (Ec58)	30 – 60
Business Law (Ec61)	30 – 60
Taxation (Ec70)	15 – 15
Structures (149)	45 – 90
Railroad Engineering (125)	30 – 60
Theoretical Hydraulics (164)	30 – 60
Testing Materials Laboratory (235)	30 – 0
Foundations (148)	15 – 30

SECOND TERM.	Hours Ex. Prep.
Business Management (Ec58)	60 –110
Business Law (Ec61)	30 – 60
Structures (149)	45 – 90
Structural Design	75 – 0
Hydraulic Engineering (169)	30 – 60
Hydraulic Laboratory (172)	15 – 5
Sanitary Science (754)	15 – 0
Thesis	125

Option 2.—Mechanical and Electrical Engineering.

FIRST TERM.	Hours Ex. Prep.
Cost Accounting (Ec51)	45 – 45
Business Management (Ec58)	30 – 60
Business Law (Ec61)	30 – 60
Taxation (Ec70)	15 – 15
Machine Design (267)	90 – 0
Theoretical Hydraulics (164)	30 – 60
Testing Materials Laboratory (235)	30 – 0
Electric Transmission and Distribution of Power (633)	30 – 60
Electrical Engineering Laboratory (681)	45 – 45

SECOND TERM.	Hours Ex. Prep.
Business Management (Ec58)	60 –110
Business Law (Ec61)	30 – 60
Machine Design (267)	60 – 0
Hydraulic Engineering (169)	30 – 60
Engineering Laboratory (261)	60 – 30
Central Stations (637)	30 – 60
Thesis	130

Option 3.—Chemical Engineering.

FIRST TERM.	Hours Ex. Prep.
Cost Accounting (Ec51)	45 – 45
Business Management (Ec58)	30 – 60
Business Law (Ec61)	30 – 60
Taxation (Ec70)	15 – 15
Industrial Chemistry (586)	45 – 90
Applied Mechanics (215)	60 –105
Engineering Laboratory (261)	60 – 30

SECOND TERM.	Hours Ex. Prep.
Business Management (Ec58)	60 –110
Business Law (Ec61)	30 – 60
Industrial Chemistry II. (587)	105 – 15
Elements of Electrical Engineering (614)	30 – 30
Electrical Engineering Laboratory (689)	45 – 45
Thesis	190

[1] Instruction will not be given in fourth year subjects of this Course until the year 1916–1917.

OPTIONS IN GENERAL STUDIES.

All students in regular courses in the third year, except in Course XV, are required to devote forty-five hours during the first term and seventy-five hours during the second term to elective work in general studies. The division of this time between exercise and preparation varies for the different subjects. The choice of subjects is to be made from the following list of options:—

FIRST TERM.	Hours Ex. Prep.	SECOND TERM.	Hours Ex. Prep
ECONOMICS.			
Economic History (Ec33)	15 – 30	Railroad Economics (Ec34)	45 – 30
		Banking and Finance (Ec36)	45 – 30
		Labor Problems (Ec45)	45 – 30
ENGLISH.			
Public Speaking (E39)	30 – 15	English Literature of the Nineteenth Century (E32)	45 – 30
Shakespeare's Plays (E31)	30 – 15	Advanced English Composition (E35)	30 – 45
The English Bible (E33)	30 – 15	Argumentation and Debate (E37)	45 – 30
MODERN LANGUAGES.			
German (L41)	15 – 30	German (L41)	30 – 45
German (L42)	15 – 30	German (L42)	30 – 45
German (L43)	30 – 15	German (L44)	30 – 0
French (L71)	15 – 30	German (L45)	30 – 45
French (L72)	15 – 30	German (L46)	30 – 45
French (L73)	30 – 15	German (L47)	15 – 30
		French (L71)	15 – 30
		French (L72)	15 – 30
		French (L74)	30 – 0
HISTORY.			
Current Public Problems (H37)	15 – 30	Municipal Government (H38)	30 – 45
International Law (H39)	15 – 30	History of Science (790)	30 – 45
History of Science (790)	15 – 30	General Geology (1233)	45 – 30

Students are allowed to exercise entire freedom of choice among these subjects, except that General Geology is not counted as an option in Courses I, III, Option 1 and 3, V, Option 2, VII, XI, XII.

Students will be expected to choose their general study option for the following term in May and in December. Subject to the approval of the heads of their Departments, fourth-year students also will be admitted to these options in general studies without requirement as to examination.

SUMMER READING.

All students who are candidates for the Bachelor's degree of the Institute are required by the Faculty to complete prescribed courses of reading of a non-professional character during the summers following the first and the second school-years. A statement of the works read during the summer is required at the beginning of the next school-year. The first-year reading is advantageous as preparation for the English Literature Course of the second year.

The purposes of these courses are to increase the acquaintance of the student with Literature, History, and General Science, to develop in him a taste for such reading, and to impress him with the importance of general culture, not only as a source of individual enjoyment, but as a practical aid to professional men in their social and business relations.

A circular on Summer Reading is issued each year, containing a list of the required reading, and a supplementary list in which additional books are recommended to the attention of students. The books in both lists are selected for their value from the point of view of general training, and the attempt is made to include only readable and attractive works.

Summer Courses

The Institute offers courses of instruction during the months of June, July, August, and September, supplementing the work of the regular school year. The requirements for admission, and in general the work performed and the final examinations are expected to correspond to those of the regular school year, and similar records and reports will be given. In case such a final record is based on an examination, no student taking the examination for the purpose of making up a condition will be entitled to admission also to the September examination in the same subject.

Summer Courses are undertaken primarily for the benefit of two classes of students: first, for those who wish to prolong their stay in summer, in order to distribute their work over a large portion of the year, or to gain more time for advanced work in their regular courses—time especially valuable in the fourth year, when original investigations and the examination of professional problems form an important part of their occupations; and second, for those who, through illness or for other causes, have deficiencies to make up. The continuity of effort and freedom from interruption made possible by summer work are of particular value in many of the laboratory courses.

The Summer Courses are open also to persons not students in the Institute, if they possess the necessary qualifications. They are of particular advantage to persons planning to enter the Institute, whether with or without advanced standing. Applicants for admission to the first year may take French or German. College graduates or others desiring to enter the second or third year will find it greatly to their advantage to make up deficiencies in Mathematics, Drawing, etc., in this way, and they are advised to communicate as early as possible with the Secretary of the Faculty with reference to plans of study.

SCHEDULE OF SUMMER COURSES.

Offered in 1915.

Mathematics.

(*a*) Mathematics (Solid Geometry).
(*b*) Mathematics (Entrance Algebra).
(*c*) Mathematics (M12).
(*d*) Mathematics (M21).
(*e*) Mathematics (M22).
(*f*) Mathematics (M31) and (M35).

Mechanics.

(*a*) Applied Mechanics (215).

Drawing.

(*a*) Mechanical Drawing and Descriptive Geometry.

Mechanic Arts.

(*a*) Woodwork and Pattern Making (289).
(*b*) Forging (284).
(*c*) Vise and Bench Work (290).
(*d*) Machine Tool Work (291).
(*e*) Metal Turning (294).

English.

(*a*) English (E11, first term).
(*b*) English (E11, second term).
(*c*) English (E21, first term).
(*d*) English (E21, second term).

Modern Languages.

(*a*) German (Elementary) (L11).
(*b*) German (Intermediate) (L21).
(*c*) German (Advanced).
(*d*) French (Elementary) (L61).
(*e*) French (Intermediate) (L62).

Chemistry.

(*a*) Qualitative Analysis (511) (Required Summer Course).
(*b*) Inorganic Chemistry (501, 502).
(*c*) Qualitative Analysis (511).
(*d*) Quantitative Analysis (512).
(*e*) Quantitative Analysis (513).
(*f*) Organic Chemistry (556, 557).
(*g*) Industrial Chemistry II. (587).
(*h*) Chemical Engineering Laboratory.

Physics.

(*a*) Mechanics, Optics, and Electricity (801).
(*b*) Precision of Measurements (803).
(*c*) Physical Laboratory, (Mechanics, Light, and Heat) (807, 808).
(*d*) Physical Laboratory, (Electricity) (806, 807).

Civil Engineering.

(*a*) Surveying (100).
(*b*) Structures (140).
(*c*) Theoretical Hydraulics (162).
(*d*) Reinforced Concrete (158).
(*e*) Summer Surveying Camp (Required Summer Course).

Mechanical Engineering.

(*a*) Mechanism (200, 201).
(*b*) Mechanical Engineering Drawing (206, 207, 208, 209).

Architecture.

(*a*) Shades and Shadows (411).
(*b*) Design I. (471).
(*c*) Design II. (472)

Electrical Engineering.

(*a*) Principles of Electrical Engineering (612).
(*b*) Electrical Engineering Laboratory.

Biology and Public Health.

(*a*) General Bacteriology.
(*b*) Microscopy and General Biology.
(*c*) Municipal Sanitation.
(*d*) Principles of Sanitation.
(*e*) Microscopy of Drinking Water and Limnology.

Persons desiring instruction in subjects included in the foregoing schedule may make application to the Secretary of the Faculty. Courses likely to be of special value to persons desiring admission with advanced standing will not begin, as a rule, until July, and in other cases arrangements for delayed admission will be made if practicable.

Requirements for Admission.—The requirements for admission to the various courses are the same as those stated for the corresponding courses in the Subjects of Instruction, pages 169 to 406, except that Chemistry (b) is open only to students who have had lecture room instruction of college grade. Applicants not already connected with the Institute

should correspond with the Secretary of the Faculty in regard to their qualifications.

Applications for admission to any of the courses should be made to the Registrar, at a date as early as possible before the beginning of the course. In general, courses will not be given unless at least six applications have been received before June 10.

Registration and Fees.—Each student will be required to register in advance at the Registrar's office for every course he desires to attend. Admission will be contingent upon approval of attendance cards.

A fee of $25 for each course (with certain exceptions noted in the special circular) will be collected by the Bursar at the time fixed for beginning the course. For one-half or any smaller portion of a course the fee will be three-fifths that of the full course, and for any fraction of a course greater than one-half the full fee will be charged. For the courses in the Chemical or Mining Laboratories a deposit of $20 will be required, to cover the cost of gas, water, and chemicals, as well as a charge for apparatus damaged or destroyed; and in the Mechanical Laboratories additional charges will be made for materials, power, and service. Attendance at the Summer Surveying Camp is required of all students in Courses I, XI, and XV, Option 1. For information concerning tuition see page 137.

A special circular (issued in April) giving full details in regard to dates and subjects will be sent on application. A circular describing the Summer Surveying Camp may also be obtained on application.

Professional Summer Schools.

To bring the students into closer relations with the practical side of their professions, professional summer schools are held in the Departments of Civil Engineering, Mining Engineering and Metallurgy, Chemistry, and Geology. The students, accompanied by instructors, give their time to field-work or visit and report on mines or industrial establishments.

Summer School of Civil Engineering.—With the exception of a brief course in the manipulation and use of the chain, compass, transit and level, the entire field-work in surveying and railroad engineering is given at the Technology Summer Camp on the shore of Gardner's Lake near the village of East Machias, Maine. This locality is well adapted for the carrying out of all the operations involved in the various problems of plane surveying; for performing the field-work necessary for the making of large and small scale topographic maps; and for the making of railroad location surveys. Gardner's Lake is specially favorable for carrying on the field-work necessary to hydrographic surveying. The Machias and East Machias Rivers are available for stream gaging, by means of floats and by the various types of meters. Some of the smaller streams afford opportunity for weir measurements.

The camp property comprises about eight hundred and fifty acres of rolling land in the form of a strip varying in width from one-fourth to one mile with a shore line of five miles on the lake. The principal structure consists of a central administration building, connected by covered pas-

sageways with two other buildings. The central building contains class rooms, offices, a few sleeping rooms, and a general reading and assembly room. On either side of the central building are one story wings, one of which contains a drafting room furnishing accommodations for seventy-two students, and the other a dining room with seating space for one hundred and sixty-eight, kitchen, lavatory and other necessary service rooms. The sleeping accommodations consist of a group of tents with raised wooden floors, each furnished with two cots and other necessary equipment for camp life. Sanitary accommodations of the most approved type, and a wholesome water supply are provided. A physician is in constant attendance throughout the camp session.

The camp is primarily intended for students of Courses I, XI, and XV, Option 1, who are required to attend during the months of August and September following their sophomore year. A limited number of students from other courses having the requisite preparation may be admitted by petition.

No additional charge for tuition will be made to Institute students. Others, not connected with the Institute, may be admitted with the approval of the Faculty upon payment of a tuition fee of $50 which will be remitted in case of later registration as Institute students and payment of full tuition for two years. The cost of camp operation and maintenance is shared equally by those in attendance.

Summer School in Chemistry.—The course in Qualitative Analysis (511) as given in Courses III, Option 2, V, X, XIV, and XV, Option 3, is now transferred to the summer, and attendance is required of all students in these Courses. The summer work begins immediately after the close of the first year, and lasts for six weeks. Both class-room and laboratory instruction is given, and under conditions which permit of a greater concentration of thought and energy, and a greater freedom from interruption than is possible

during the two regular terms. The time thus gained has been utilized to strengthen the Courses concerned.

No extra charge for tuition is made in the case of Institute students intending to enter the second year of Courses III, Option 2, V, X, XIV or XV, Option 3, and the course is open only to such students. The usual deposit with the Bursar to cover chemical breakage is required.

Summer Schools of Mining and Metallurgy.—In order to bring the students of mining and metallurgy into closer touch with practice, there are organized traveling Summer Schools for the study of geological fields, mines, mills and smelting works, and a Summer Camp of Mining. Opportunities are also offered to students for practical work in mines during the summer holidays.

The mining and metallurgical Summer Schools take place in alternate years; it is customary to include some metallurgical study in the school devoted to mining and vice versa. For the Summer School of Mines a section of the country is selected where the students with their instructors may make a systematic study of mining, geology, and surveying in one or more representative mines. At the Summer School of Metallurgy, the party visits a locality where various smelting and refining operations are conducted, and makes a systematic study of the different operations, writing up the notes from day to day.

In recent years the Summer School has visited the mines, mills and smelters of the Lake Superior copper district, the iron mines of the Mesabi range, the Sudbury copper-nickel district, the silver mines and milling plants of Cobalt, the Porcupine gold camp, the coal and iron regions of Pennsylvania, and many other localities where important mining and metallurgical operations are carried on.

The Summer Camp is located at the Elizabeth Mine, near the village of South Stafford, Vermont. Under the charge of an instructor, students spend six weeks at the mine to become familiar with underground conditions; the course of instruction includes underground surveying, hand- and machine-drilling, blasting, timbering, track laying, and the like.

Summer instruction will not be given to less than six students.

Practical work for the summer can usually be obtained for students desiring to gain experience by working regular shifts at the prevailing rate of wages.

Summer School of Industrial Chemistry.—In alternate years since 1902 a traveling Summer School of Industrial Chemistry has been held in June at the close of the school year.[1] In this, opportunity is afforded to advanced students in the Courses in Chemical Engineering, Chemistry, and Electrochemistry to visit typical chemical and metallurgical plants, under the guidance of instructors, to study and report upon the various features of the industrial processes involved. These trips occupy one or two weeks and include frequent conferences between instructors and members of the school, at which notes are written up and details of the processes discussed. A tuition fee to re-imburse the Institute for the expense involved, is charged for the course, and the membership of the party is limited to such number as may be deemed advisable by the Head of the Department of Chemistry and Chemical Engineering. The right is also reserved to abandon any such proposed trip, should there fail to be a sufficient number of applicants to warrant the undertaking, or in case any other circumstances should make the trip appear inadvisable.

In 1915 the party visited manufacturing plants in Brooklyn and New York City, N. Y.; Babbitt, Bayonne, Edgewater, Millville, Newark and Trenton, N. J.; Conshohocken, Ivy Rock, Northampton and Philadelphia, Penn. In all some fourteen plants were inspected during this trip of nine days.

Summer Schools of Geology, Paleontology, and Mineralogy.—With the view of emphasizing the practical character of the instruction in Geology, provision is made for field-work during the summer vacation in districts remote from Boston. Advanced students may sometimes secure field

[1] This trip was omitted in 1914.

experience in connection with the professional work of the instructors. At present such work is being carried on in the Rocky Mountains of British Columbia, at the Hawaiian Volcano Observatory, and among the fossil-bearing strata of New York State.

Graduate Study and Research.

GENERAL STATEMENT.

The Institute offers opportunities for graduate study and research leading to the degrees of Master of Science, Doctor of Philosophy, or Doctor of Engineering. These degrees are awarded solely for resident work, under the conditions specified in the following pages. Advanced study or investigation may also be pursued by students having the necessary preparation, without reference to candidacy for a degree. This may, for example, be advantageous for those who desire either to devote their time almost wholly to a definite line of investigation or to specialize in some limited field of science or technology.

In addition to the facilities for investigation offered in connection with all the departments of the Institute, there have been established laboratories devoted to research in Physical Chemistry, in Applied Chemistry, in Electrical Engineering, and in Sanitary Science, Public Health and Sewage Experimentation, which offer unusual opportunities to those wishing to pursue such work. The organization and equipment of these laboratories and the character of the work pursued are described on pages 164 to 168, 407, 421, and 423.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

The degree of Master of Science is awarded upon the satisfactory completion of a resident course of study in science or engineering extending over not less than one year. The candidate for this degree must, except in cases of unusual attainments, have taken his first degree in some scientific school, college, or university of good standing; and his preparation must be substantially equivalent to that of a graduate of the Institute, except as specially provided below in the case of college graduates taking two or three years at the Institute.

Only those applicants will be accepted as candidates whose attainments, as shown by their previous record of scholarship or by other information, are of such a character as to indicate that their proposed course of advanced study and research can be creditably pursued.

The applicant must file with the Secretary of the Faculty, on a form provided for this purpose, preferably before May 1st,[1] a statement of his proposed course of study. A specific course in Aeronautical Engineering is offered which in general should be taken entire. If not a graduate of the Institute, he will be expected to include also on a special blank a full statement of his previous work, showing how far it corresponds with the requirements for the Bachelor's degree of the Institute. Candidates are expected to enter upon their work at the beginning of the school year.

College students intending to enter the Institute for fourth-year or advanced work will find it advantageous to make their selection of college electives correspond as nearly as possible to the first three or four years of undergraduate work at the Institute. If in doubt in regard to any courses of study, they should correspond with the Secretary of the Faculty or with the Professor in charge of the Department. A special circular on "Opportunities for College Graduates," will be mailed on application to the Secretary.

COURSES FOR THE DEGREE OF MASTER OF SCIENCE.

1. For Graduates in Scientific Courses.

The course of study leading to the degree of Master of Science consists mainly of advanced study and research in the branch of science or engineering in which the student has already completed an undergraduate course substantially equivalent to one of those given at the Institute.[2] The candidate must pursue his course of study continuously, under the direction and oversight of the Faculty, for not less than one

[1] In case financial aid is asked for, application for it and for candidacy for the higher degree should be presented by March 1st.

[2] For preparation for the Graduate Course in Aeronautical Engineering, see page 154.

full school year after filing his application, exhibiting during that time ability to conduct original investigations. He must pass creditable examinations at such times and on such subjects as may be designated, and finally must present an acceptable thesis.

This advanced course serves to supplement the undergraduate work in the same field by more thorough instruction in underlying principles and their mathematical development, by a more specialized study of important branches of the profession, and especially by training in the investigation of scientific and technical problems. The great recent development of pure and applied science has made it very difficult for the student to acquire an adequate professional education from an undergraduate course of four years, especially since much of this time needs to be given to preparatory and general educational studies. If his circumstances permit, it is therefore highly desirable for the student to devote at least one additional year to graduate work. The character of such work and the conditions under which it is carried on are so different from those in the undergraduate courses that the fifth year is almost sure to give, not merely more additional professional knowledge, but a new and valuable kind of training. The closer individual contact with the instructors, the general use of original articles and scientific monographs rather than text-books, and especially the large amount of time devoted to research, develop originality and independent power, and inculcate the principles and spirit of the investigator, which are necessary to success not less in technological than in scientific pursuits.

2. For College Graduates.

The number of college graduates who come to the Institute each year to prepare themselves for the engineering profession continues to increase. Many of these students so elect their college program that they are able to enter as students in the third year of the Institute course. To encourage such students to pursue advanced work and thereby

to get the utmost value from their professional course, the Faculty has voted to give to such students, when they have completed (in general with not less than one year's residence) substantially all requirements in any course up to the beginning of the fourth year, the option of becoming a candidate for the Master of Science degree without previously taking the Bachelor of Science degree, on the basis of two years of additional work, or of becoming candidates for the Bachelor's degree on the basis of one year's additional work in case it is felt that a longer period cannot be devoted to study. Under this arrangement a student by properly electing his course of study in college may in three years after taking his Bachelor's degree take the Master's degree at the Institute in any desired branch of engineering.

The requirements for this two years' course include the subjects in the fourth year of the regular course and subjects chosen from the list of studies offered as electives for advanced courses, together with the preparation of a thesis. The choice and distribution of studies constituting the schedules of both years should be made in consultation with the Professor in charge of the Department (it being understood that the work of the first year would consist mainly of the work of the regular fourth year) and the schedules should be submitted to the Faculty for its approval.

ELECTIVE SUBJECTS FOR ADVANCED COURSES.

Since the choice of the most advantageous subjects for an advanced course depends much upon individual conditions, the Faculty has not prescribed definite schedules for the higher degrees except in Aeronautical Engineering. But in order to indicate the opportunities for advanced work offered by the Institute, and in order to aid candidates for such degrees in laying out their courses of study, there have been brought together upon the following pages the names of such elective subjects as are considered to be especially appropriate for this purpose. A detailed description of these subjects will be found in the later section of this Cata-

logue entitled "Description of Subjects of Instruction," to which the numbers in parentheses attached to the separate topics refer. These subjects have been grouped under headings corresponding to the various undergraduate Courses of the Institute, so as to indicate the lines of advanced work most suitable for a graduate of any of these Courses or for a graduate from another institution who has had an equivalent preparation. It should be understood, however, that the choice of subjects is not necessarily restricted to those offered in any one Department; but it is in general essential that the applicant for admission to any elective subject shall have had the preparation indicated as being required for it in the description given under Subjects of Instruction. The necessary preparation may in many cases be obtained by taking subjects offered in the Summer School or by pursuing such courses of special reading during the previous summer as may be recommended by the Professor in charge.

The Subjects in each Course are classified as follows:[1]—

A. Principal Subjects, consisting of professional studies more advanced in character and scope than the corresponding work for the degree of Bachelor of Science. The principal part of the candidate's work must be selected from subjects in this group.

B. Subordinate Subjects, consisting of studies selected from the fourth-year schedules of other Undergraduate Courses or Options in the same Course, and in exceptional instances certain third-year subjects which form with the advanced work a logical general program. The time devoted to subjects in this group must be less than that required for the principal work.

The candidate's research and his other principal subjects are to be selected with due reference to each other in consultation with the Professor in charge of the Department, and the proposed course of study must be submitted to the Faculty for approval.

[1] This classification does not apply to the Course in Aeronautical Engineering.

CIVIL ENGINEERING.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex. – Prep.
Thesis	
Structures of Metal, Wood and Masonry (156)	150 – 120
Railroad Engineering (127)	30 – 60
Railroad Design (128)	45 – 0
Waterpower Design (182)	90 – 0
Water Power Engineering (173)	45 – 90
Engineering of Water and Sewage Purification (181)	120
Sanitary Design (183)	90 – 0
Advanced Highway Engineering Research (134)	30 – 135
Advanced Structural Design (156a)	90 – 0
Valuation of Public Service and other Corporations (129)	45 – 90

Second Term.

Thesis	
Structures of Metal, Wood and Masonry (156)	90 – 60
Railroad Engineering (127)	30 – 60
Railroad Design (182)	45 – 0
Waterpower Design (182)	90 – 0
Water Power Engineering (173)	45 – 90
Sanitary Design (183)	90 – 0
Advanced Highway Engineering Research (134)	30 – 135
Advanced Structural Design (156a)	90 – 0
Reinforced Concrete Research (159)	
Specifications and Contracts (199)	30 – 60

B. SUBORDINATE SUBJECTS.

Railroad Engineering (125), Railroad and Highway Designing (126), Hydraulic and Sanitary Engineering (175), Hydraulic and Sanitary Engineering (176), Sanitary Engineering (177), Sanitary Engineering (178), Hydraulic and Sanitary Designing (179), Reinforced Concrete Design (158), Vital Statistics (190).

Sanitary Science and Public Health (754), Municipal Sanitation (753), Public Health Problems (750), Theory and Practice of Water and Sewage Purification (760).

Chemistry of Road Materials (538), Highway Construction (132), Highway Drainage (133), Highway Design (135), Highway Economics (136), Highway Specifications (137), Testing Highway Materials (139).

Mathematics (M36), Mathematics (M39), Least Squares (M26).

European Civilization and Art (H33), Economics of Corporations (Ec55).

MECHANICAL ENGINEERING.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex. Prep.
Research	
Advanced Heat Engineering* (250)	100 – 200
Advanced Machine Design* (270)	100 – 200
Advanced Theory of Elasticity* (231)	100 – 200
Analytical Mechanics (M65)	30 – 60

Second Term.

Research	
Advanced Heat Engineering* (250)	100 – 200
Advanced Machine Design* (268)	100 – 200
Advanced Theory of Elasticity* (231)	100 – 200
Analytical Mechanics (M65)	30 – 60

B. SUBORDINATE SUBJECTS.

Engine Design (277), Locomotive Construction (278), Mill Engineering (279), Heating and Ventilating (255), Hygiene of Ventilation and Heating (755), Power Plant Design (272), Refrigeration (253), Industrial Management (274).

Alternating Current Machinery (621, 622),[1] Electrical Engineering Laboratory,[3] Technical Electrical Measurements (661, 662),[2] Standardizing Laboratory.[3]

Mathematics (M36), Mathematics (M38), Fourier's Series (M45).

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[1] Students who have not had the equivalent of the third-year electrical work in Course VI., but have had an amount of Electrical Engineering corresponding to that required in Course II., should confer with Professor Jackson as to preparation to be made during the summer for this course.

[2] References to be studied prior to admission to this course will be furnished by Professor Laws to those who have not had course 661 in the third year or its equivalent.

[3] Special Course offered to two or more applicants.

* May be given in either first or second terms.

MINING ENGINEERING AND METALLURGY.

A. PRINCIPAL SUBJECTS.[1]

First Term.

	Hours Ex.	Prep.
Research		
Advanced Mining Engineering (311)	45 –	90
Problems in Dressing and Milling of Ores (309)	120 –	
Advanced Ore Dressing (312)	45 –	90
Leaching Gold and Silver Ores (338)	120 –	60
Metallurgy and Physics of Metals (360)	120 to	480
Mechanical Treatment of Metals, Lectures and Laboratory (361)	30 –	30
Economics of Metallurgical Plants (362)	15 –	15
Development of Metallurgical Processes (363)	30 –	30
Mineral Lands, Acquisition, Tenure (314)	90 –	

Second Term.

Research		
Advanced Mining Engineering (311)	200 –	
Advanced Ore Dressing (312)	200 –	
Mining Projects and Design (319)	150 –	
Mine Examination and Reports (320)	200 –	
Metallurgical Plant Design (349)	100 –	
Metallurgy and Physics of Metals (360)	120 to	480
Metallurgy of Copper, Advanced (364)	30 –	30
Machine Design (269)	60 –	
Heat Measurements (816)	45 –	

B. SUBORDINATE SUBJECTS.

These subjects can be chosen from studies given in Course III as well as in other Courses, especially Courses II, XII and XV (see page 145).

[1] Geological studies which can form part of the Principal Subjects for students in Options 1 and 3, are given on page 340.

ARCHITECTURE.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex.	Prep.
Advanced Architectural Design (474)	370	
Advanced Constructive Design (483)	120	
Advanced Life Class and Decorative Design (D45)	90	
European Civilization and Art: Special Topics (H35)	45	
Architecture, Theory and Practice (454)	15	

Second Term.

Advanced Architectural Design (474)	465	
Advanced Life Class and Decorative Design (D45)	90	
Advanced Architectural Problems (452)		
History and Archæology (444)	30	
Architecture, Theory and Practice (454)	15	

B. SUBORDINATE SUBJECTS.

With the approval of the Head of the Department certain fourth-year subjects given in other Courses, and optional subjects in Course IV., and in exceptional instances third-year subjects which form with the advanced work a logical general program, may be elected.

CHEMISTRY.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex.	Prep.
Chemical Research		
Research Reports	15	
Inorganic Chemistry III. (504)	15 –	60
Special Topics in Inorganic Chemistry (505)	15 –	
Qualitative Analysis of Rare Metals (515)	165 –	
Organic Qualitative Analysis (516)	135 –	
Organic Chemistry II. (552)	15 –	60
Theoretical Chemistry II. (566)	30 –	60
Biochemistry (524)	30 –	45
Industrial Applications of Chemical Principles (584)	15 –	15
Optical Crystallography and Applications (1223)	45 –	30
Polarized Light and its Applications (864) or Radiation (868) (given in alternate years)*	15 –	30
Mathematics (M56)	30 –	60

Second Term.

	Hours Ex.	Prep.
Chemical Research		
Research Reports	15	
Inorganic Chemistry III. (504)	15 –	60
Qualitative Analysis of Rare Metals (515)	165 –	
Organic Chemistry II. (552)	15 –	60
Theoretical Chemistry II. (566)	30 –	60
Polarized Light and its Applications (864 or Radiation (868) (given in alternate years)*	15 –	30
Geology of Coal and Petroleum (1260)	30 –	30
Mathematics (M56)	30 –	60

B. SUBORDINATE SUBJECTS.

Industrial Chemistry II. (587), Proximate Technical Analysis (530), Advanced Food Analysis (526), Water and Air Analysis (520), Sugar Analysis (527).

Theoretical Physics IV. (844), Theoretical Physics III. (843), Descriptive Astronomy (833), Electrical Measurements (813), Electrochemistry, lect. and lab. (882), (886), Applied Electrochemistry, lect. and lab. (883), (887).

Bacteriology of Water and Sewage (731), Industrial Biology (732), Sanitary Science and Public Health (754), Zymology (733), Problems in Chemical and Industrial Biology (740), Vital Statistics (190), Municipal Laboratory Methods (736).

Metallurgy (332).

Mathematics (M36), Mathematics (M39), Least Squares (M26).

European Civilization and Art (H33).

*May be given in either first or second terms.

ELECTRICAL ENGINEERING.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours.
Research	
Alternating Currents (Advanced) (627)	135
Electrical Engineering Laboratory (675)	75 to 150
Design of Stations and Distribution of Systems (639)	75 to 150
Electric Railways (Advanced) (643)	135
Electrical Testing (Advanced) (669)	75 to 150
Electrical Engineering Seminar (692)	75
Water Power Design (182)	90
Organization and Administration of Public Service Companies (695)	135 to 180
Advanced Mathematics	90 to 180

Second Term.

Research	
Alternating Currents (Advanced) (627)	135
Alternating Current Machinery (Advanced) (625)	75
Electrical Engineering Laboratory (675)	75 to 150
Dynamo Design (Advanced) (647)	75 to 150
Design of Stations and Distribution of Systems (639)	75 to 150
Electric Railways (Advanced) (643)	135
Electrical Engineering Seminar (692)	75
Water Power Design (182)	90
Organization and Administration of Public Service Companies (695)	135 to 180
Advanced Mathematics	90 to 120

B. SUBORDINATE SUBJECTS.

Structures (149),[1] Railroad Engineering (125),[2] Valuation of Public Service and other Corporations (190).

Machine Design (267),[3] Mill Engineering (279).[3]

Electrostatics and Electrokinetics (842), Electrochemistry, lectures and laboratory [4] (882), (886), Applied Electrochemistry, lect. and lab. (883), (887).

Fourier's Series (M45), Least Squares (M26), Advanced Mathematics.

European Civilization and Art (H33).

[1] The student must have taken third-year Structures or the course given in Course VI., fourth year.

[2] Students who have not pursued courses equivalent to Railroad Engineering (121) should arrange a course of summer preparation designated by the Professor of Railroad Engineering.

[3] References to be studied prior to admission to these courses will be furnished by Professor Park to applicants who have not had courses equivalent to those given in Course II. in Mechanical Engineering Drawing, Steam Engineering, Applied Mechanics and Dynamics of Machines. For Mill Engineering, Cotton Machinery is also required.

[4] Students who have not studied Theoretical Chemistry should arrange a course of summer reading with Professor Goodwin.

BIOLOGY AND PUBLIC HEALTH.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex. Prep.
Research	30 – 60
Dairy Bacteriology (738)	60 – 90
Bacteriology of Fermentation Industries (739)	30 – 60
Epidemiology (751)	15 – 45
Theory and Practice of Water and Sewage Purification (760)	30 – 60
Biochemistry (524)	30 – 45

Second Term.

Research	30 – 60
Theory and Practice of Water and Sewage Purification (760)	30 – 60
Sanitation of Houses and Public Buildings (758)	15 – 15
Public Health Administration (763)	15 – 15
Sanitary Law (762)	15 – 15

B. SUBORDINATE SUBJECTS.

Public Health Problems (750), Industrial Hygiene and Sanitation (752), Biology of Infectious Diseases (735), Public Health Laboratory Methods (736), Municipal Sanitation (753).

Vital Statistics (190).

Hydraulic Measurements (170), Sanitary and Hydraulic Engineering (175).[1]

Water Analysis and Water Supplies (522).

[1] Courses in Applied Mechanics and Theoretical Hydraulics must be taken prior to admission.

PHYSICS.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex.	Prep.
Physical Research		
Radiation (868) [1]	15 –	60
Theory of Radiation (869) [2]	15 –	60
Microscope Theory and Photomicrography* (867)	60 –	30
Wave Theory and Polarization [1] (870)	15 –	60
Polarized Light and its Applications [2] (864)	15 –	†
Optical Crystallography and Applications (1223)	45 –	30
Theoretical Chemistry II. (566)	30 –	60
Mathematics (M56), (M69)	30 –	60
Electrical Discharges in Vacua (852)	45 –	0

Second Term.

Physical Research		
Microscope Theory and Photomicrography* (867)	60 –	30
Electrical Discharge in Gases; Radioactivity [1] (862)	15 –	†
Hertz Waves; Radio-Telegraphy [2] (863)	15 –	†
Theory of Radiation [2] (869)	15 –	60
Radioactive Measurements (872)	30 –	15
Constitution of Matter in the Light of Recent Discovery [2] (871)	15 –	60
Theoretical Chemistry II. (566)	30 –	60
Mathematics (M56), (M69)	30 –	60

B. SUBORDINATE SUBJECTS.

Electrochemical Laboratory (886), Applied Electrochemistry, lect. and lab. (883), (887).

Electrical Engineering (678), Electrical Engineering Laboratory.[3]

History of Chemistry (591), Organic Chemistry Laboratory (557).

Mathematics (M36), Analytical Mechanics (M65).

European Civilization and Art (M33).

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[1] Not given in 1915–1916.
[2] Given in 1915–1916. These courses are given in alternate years.
[3] Special course given to two or more students.
*Offered in either the first or second term.
† Assigned reading and an examination will be required.

CHEMICAL ENGINEERING.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours. Ex.	Prep.
Research		
Research Reports		
Chemical Engineering of Special Industries (579)	30 –	60
Chemical Engineering Laboratory (583)*	30 –	
Industrial Applications of Chemical Principles (584)	15 –	15
Applications of Thermodynamics (581)	30 –	60
Plant Design (582)	60 –	30
Refrigeration (254)*	30 –	60
Qualitative Analysis of Rare Metals (515)*	165 –	
Inorganic Chemistry III. (504)	15 –	60
Special Topics in Inorganic Chemistry (505)	15 –	
Organic Qualitative Analysis (516)	135 –	
Organic Chemistry II. (552)	15 –	60
Optical Crystallography and Applications (1223)	45 –	30

Second Term.

Research		
Research Reports		
Chemical Engineering Laboratory (583)*	30 –	
Materials of Construction (580)	30 –	30
Plant Design (582)	60 –	60
Refrigeration (254)*	30 –	60
Advanced Inorganic Chemistry (504)	15 –	60
Qualitative Analysis of Rare Metals (515)*	165 –	
Advanced Organic Chemistry (552)	15 –	60
Theoretical Chemistry II. (566)	30 –	60

B. SUBORDINATE SUBJECTS.

Air and Water Analysis (part) (520), Proximate Technical Analysis (530).

History of Chemistry (591).

Electrochemistry, lectures and laboratory (882), (886), Applied Electrochemistry, lectures and laboratory (883), (887), Heat Measurements (813).

Machine Design (267),[1] Mill Engineering (279),[1] Industrial Management (274).

Electrical Engineering (635), Electrical Engineering Laboratory,[2] Technical Electrical Measurements (668).

Mathematics (M36), Mathematics (M38).

Economics of Corporations (Ec55), European Civilization and Art (H33).

[1] References to be studied prior to entrance to these courses will be furnished by Professor Park to applicants who have not had courses equivalent to those given in Course II. in Mechanical Engineering, Drawing, Steam Engineering, Applied Mechanics, and Dynamics of Machines. For Mill Engineering, Cotton Machinery is also required.

[2] Special Course given to two or more students having adequate preparation.

* May be given in either the first or second terms.

SANITARY ENGINEERING.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex.	Prep.
Thesis		
Reinforced Concrete Design (158)	45 –	90
Structures of Metal, Wood and Masonry (156)	150 –	120
Sanitary Design (183)	90 –	0
Engineering of Water and Sewage Purification (181)	120 –	
Theory and Practice of Water and Sewage Purification (760)	30 –	60

Second Term.

Thesis		
Structures of Metal, Wood and Masonry (156)	90 –	60
Sanitary Design (183)	90 –	0
Vital Statistics (190)	30 –	30
Reinforced Concrete Research (159)		
Hydraulic and Sanitary Design (182)	90 –	0
Theory and Practice of Water and Sewage Purification (760)	30 –	60
Sanitation of Houses and Public Buildings (758)	15 –	15
Road Bitumens and Binders (537)	45 –	0
Specifications and Contracts (199)	30 –	60

B. SUBORDINATE SUBJECTS.

First Term. Foundations (148), Engineering Laboratory (263), Epidemiology (751), Hygiene of Ventilation and Heating (755), Industrial Hygiene and Sanitation (752), Biology of Infectious Diseases (735), Mathematics (M36), Economics of Corporations (Ec55).

First and Second Terms. Railroad Engineering (125), Railroad and Highway Designing (126), Bridge Design (153), Public Health Problems (750), Journals (770), European Civilization and Art (H33).

Second Term. Advanced Structures (150), Personal Hygiene[1] (723), Mathematics (M39), Least Squares (M26), Heating and Ventilation (255).

[1] Previous preparation in General Physiology (720) required for admission.

GEOLOGY.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex.	Prep.
Research		
Advanced Petrography (225)	90 –	45
Advanced Economic Geology (1259)	90 –	
Advanced Field Geology (1267)	90 –	
Geology of Europe (1294)	30 –	60
Introductory Paleontology (1271)	60 –	60
Index Fossils (1273)	45 –	20

Second Term.

Research		
Chemical Mineralogy and Petrology (1226)	45 –	90
Advanced Petrography (1225)	90 –	45
Advanced Economic Geology	90 –	
Geology of North America (1291)	60 –	30
Geology of Coal and Petroleum (1260)	30 –	30
Advanced Field Geology (1267)	90 –	
Introductory Paleontology (1271)	60 –	60
Organic Evolution (1275)	30 –	45

B. SUBORDINATE SUBJECTS.

First Term. Metallography (334), Advanced Surveying (109), Heat Measurements (813), Descriptive Astronomy (833).

First and Second Terms. Mining Engineering (302), Ore Dressing (303), Theoretical Chemistry I. (565).

Second Term. General Metallurgy (341), General Metallurgy (342), Fire Assaying (321).

ELECTROCHEMISTRY.

A. PRINCIPAL SUBJECTS.

First Term.

	Hours Ex. Prep.
Research	
Electrochemical Seminar (896)	15 – 60
Alternating Currents (Advanced) (627)	135
Electrical Engineering Laboratory (675)	75 to 150
Applied Thermodynamics (581)	30 – 60
Chemical Engineering Laboratory (583)*	30 – 0
Radiation (868)[1]	15 – 60
Electrical Discharge in Vacua (852)	45 – 0
Industrial Application of Chemical Principles (584)	15 – 15
Advanced Inorganic Chemistry (504)	15 – 60
Theoretical Chemistry II. (566)	30 – 60

Second Term.

Research	
Applied Electrochemistry Seminar (897)	15 – 60
Plant Design (582)	60 – 30
Alternating Currents (Advanced) (627)	135
Electrical Engineering Laboratory (675)	75 to 150
Chemical Engineering Laboratory (583)*	30 – 0
Radio Active Measurements (872)	30 – 15
Constitution of Matter in the Light of Recent Discovery (871)[2]	15 – 60
Advanced Inorganic Chemistry (504)	15 – 60
Theoretical Chemistry II. (566)	30 – 60
Materials of Construction (580)	30 – 30

B. SUBORDINATE SUBJECTS.

Industrial Chemistry II. (587), Problems in Applied Chemistry (588), History of Chemistry (591).

Metallurgy (331), Metallography (334), Mining Engineering, lectures and laboratory (303), 351).

Alternating Current Machinery (621, 622), Power Transmission (633).

Theoretical Hydraulics (164)[2] and Hydraulic Laboratory (172), Engineering Laboratory (260) or (261) (selected work).

Economics of Corporations (Ec55), European Civilization and Art (H33).

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[1] Not given in 1915–1916.
[2] Offered in 1915–1916.
* May be given in either the first or second terms.

AERONAUTICAL ENGINEERING.

The Graduate Course in Aeronautical Engineering is open to graduates of the Institute in Mechanical Engineering, Electrical Engineering or Naval Architecture and to graduates from other technical schools and colleges who have preparation essentially equivalent to that required for the Bachelor's Degree in one of these Courses. In general, graduates from non-technical colleges, even though prepared in Mathematics and Theoretical Mechanics, will find it necessary to take at least one year of work in general engineering before applying for the Course.

Prospective applicants for the Course should be well grounded in Applied Mechanics and Mathematics, including Differential Equations, and they are advised to make special preparation when necessary.

The Course in general consists of theoretical dynamics of rigid bodies and fluids, of the general theory of aeroplanes and airships, and of the design of both types of aircraft.

An aerodynamic laboratory with a four foot wind tunnel gives opportunity for research in connection with the preparation of a design and the graduation thesis. Facilities are available for study and experiments with aeronautical engines and propellers.

Any of the Aeronautical Engineering Courses are open to persons who may not be candidates for a degree, provided they are qualified to undertake the work required.

AERONAUTICAL ENGINEERING.

First Term.

	Hours Ex.	Prep.
Dynamics of Rigid Bodies (M66)	45 –	90
Fluid Dynamics, Theoretical (M59)	30 –	60
Fluid Dynamics, Experimental (1374)	30 –	30
Theory of Aeroplane Design (1375)	45 –	90
Aeroplane Design (1376)	90 –	
Aerial Propellers (1379)	10 –	40
Aero Engines (251a)	30 –	30
Aerodynamic Laboratory (1380)	60 –	30

Second Term.

Dynamics of Rigid Bodies (M66)	45 –	90
Fluid Dynamics, Theoretical (M59)	30 –	60
Aeroplane Design (1376)	90 –	
Theory of Airship Design (1377)	45 –	90
Airship Design (1378)	90 –	
Meteorology (1381)	20 –	20
Thesis	150	

MATHEMATICS.

Special provision will be made for graduates of scientific schools or colleges who may desire to prepare themselves for the teaching of Mathematics, or to pursue advanced mathematical work in connection with other sciences. The list of subjects available for election includes Curve Tracing, Advanced Calculus, Fourier's Series, Hydrodynamics, Thermodynamics, Analytical Mechanics, Mathematics of Wireless Telegraphy, the Potential Function, Elements of the Theory of Functions of a Complex Variable, Partial Differential Equations, Statistical Methods in Theoretical Physics, and a course on the Teaching of Elementary Mathematics. Brief descriptions of these courses may be found on pages 396 to 400, and the Professor in charge of the Department may be consulted in regard to arrangements of work or possible additions to the list. College graduates may find it practicable in two years to combine with the requirements for the Master's degree in Mathematics a valuable amount of undergraduate work in some one of the professional departments.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF ENGINEERING OR DOCTOR OF PHILOSOPHY.

The advanced study and research leading to the Doctor's degrees are specially valuable to those who wish to engage in original investigation or in teaching in higher institutions. Moreover the increasing demand for men having not only engineering training, but the attitude of mind impelling them to attack new problems renders such advanced work valuable for men who are preparing themselves as thoroughly as possible for an engineering career.

The degree of Doctor of Engineering or Doctor of Philosophy certifies to the creditable completion of a programme of advanced studies, and to the performance of an investigation of high grade. The degree of Doctor of Engineering is given when the advanced study consists principally of engineering subjects, and the investigation deals with scientific problems having a technological bearing; that of Doctor of Philosophy is given when the work has been mainly study and research in science. These degrees will be conferred only upon candidates who have not only breadth of scientific attainment, but have also shown the power of dealing with new problems in an independent and efficient manner. As a rule the study and research must be pursued under the direction of the Faculty for three years. Candidates of exceptional ability or those who have had exceptional preparation may be able to complete the requirements in less time. The required time of residence may be somewhat reduced in the case of candidates who satisfy the Faculty that they have successfully accomplished at another institution advanced work of a grade equal to that required at the Institute. It will often be advisable for a candidate to qualify himself for the Master's degree as a part of his preparation for the Doctor's degree.

The candidate for the degree of Doctor of Engineering,

or Doctor of Philosophy must have taken his first degree in some scientific school, college or university of good standing; and his preparation must be substantially equivalent to that of a graduate of the Institute. Only those applicants will be accepted as candidates whose attainments and capacity are believed to be such as to indicate that the requirements for these degrees can be creditably met. The candidate must file with the Secretary of the Faculty on a form provided for this purpose a statement of his proposed plan of study and of his investigation. The work for the degree is expected to consist mainly of scientific research and of the preparation of a thesis describing it. This must be supplemented, however, by systematic studies of an advanced character in some branch of science or engineering, which will be termed the *major* subject of the candidate. Thus, Chemistry, Physics, Geology, Biology, or Civil, Mechanical, Electrical, Chemical, Mining or Sanitary Engineering may be chosen as the major subject. In addition as *minor* subject or subjects, studies such as will give a fundamental knowledge must be pursued in one other or in two other of these branches of science or engineering or in Mathematics. Candidates for the degree of Doctor of Engineering will be required to prepare themselves in two minor subjects outside the branch of engineering chosen as major subject, e.g. with Electrical Engineering as a major, minors may be chosen in other branches of engineering such as Structural Engineering, Hydraulics or Machine Design, or Mathematics, Physics and Electrochemistry.

Candidates for the degree of Doctor of Philosophy will be required to prepare themselves in but one minor, it being understood, however, that the *major* subject in this case shall include the main branches of the science, e.g. a major in chemistry shall include inorganic, organic and theoretical chemistry. Proficiency in the major and minor subjects, which includes the power to use them effectively, will be tested by examinations, which may be written or oral or both, at the discretion of the Department concerned. It is desirable that the work in minor subjects be completed at least one year before the candidate intends to come up for

his degree in order that the latter part of his period of study may be devoted without interruption to the prosecution of his thesis, and to advanced study in his major subject in preparation for his final examination.

Each candidate for a Doctor's degree is required at some time within a half year of final examinations for the degree to present in person before representatives of the Faculty a carefully prepared account of his research work, including a discussion of its bearing on the development of the branch of science to which it relates, and of its relations to previous work in the same field, a summary of the results and conclusions reached by himself, and suggestions as to desirable extensions of the same general line of investigation. Before receiving his diploma each candidate for the degree of Doctor of Philosophy, or Doctor of Engineering, must deposit with the Secretary of the Faculty, in addition to his typewritten thesis, 200 printed copies of an abstract of his thesis in form and substance suitable for publication in a journal devoted to the science to which the thesis pertains. This abstract will be printed with the coöperation of the candidate under the direction of the Committee on Publications at the expense of the Institute.

In planning his course of study, the candidate should consult the section of the Catalogue or Programme entitled "Elective Subjects for Advanced Courses" on page 144, and the section entitled "Opportunities for Research" on pages 164 to 168. More specific information in regard to all requirements will be furnished on application to the Secretary of the Faculty Committee on Advanced Degrees.

Each candidate for the Doctor's degree will at the time of his acceptance be placed in charge of a Faculty committee which will exercise general oversight of his work.

Opportunities for Research.

IN DEPARTMENTAL LABORATORIES.

Opportunities for research are afforded in all the departmental laboratories devoted to the more advanced branches of instruction, as well as in the separately organized Research Laboratories described below.

In Structural Engineering researches may be pursued in the higher theory of structures, such as the investigations of arches, domes, movable bridges, suspension bridges, reinforced concrete structures, and other similar subjects, accompanied by original work in structural design. Students may also carry on investigations upon engineering materials in the testing laboratories.

In Hydraulic Engineering researches may be made upon problems relating to the flow of water and the use of hydraulic motors; also upon the design of water power plants and other hydraulic works.

In Mechanical Engineering researches may be conducted upon subjects connected with the strength of materials, the theory of elasticity, and with thermodynamics, as well as in other lines. As examples of subjects in these first two lines may be mentioned: Investigations upon reinforced concrete, of the stresses in flat and in curved plates, of the stresses in pieces subjected to transverse or to compound stresses, of springs and spring steel, of the effects of repeated and of alternate stresses, and of the change of density under stress; also along thermodynamic lines upon the flow of steam in nozzles and pipes and reaction of the jet; steam losses in turbines and engines; flow of air and other gases; the properties of superheated steam, ammonia, sulphurous anhydride, etc.

In Mining Engineering and Metallurgy researches are carried on mainly along the four lines represented by mining geology, problems in ore-dressing, processes for the

extraction of metals from their ores, and the thermal treatment of metals and alloys and their microscopic examination.

In Electrical Engineering opportunities for research are offered in such subjects as transmission-line problems, the effect of wave form on the performance of the various types of alternating current motors, electrical measuring instruments, condenser losses, the various properties, magnetic and other, of the materials used in electrical construction; the effect of high voltage currents on insulation; the energy transformations in rotary converters, and the numerous obscure phenomena related to the flow of electric currents.

In Electrochemistry students may take up investigations on either the scientific or applied side, the work being done either in the Laboratory of Electrochemical Measurements upon problems involving refined measurements of conductance, decomposition-voltage, polarization and allied quantities; or in the Laboratory of Applied Electrochemistry upon investigations requiring the use of heavy alternating or direct currents, electric furnaces, pyrometers, etc.

In the Laboratory of Heat Measurements provision is made for researches relating to accurate thermometry, high temperature measurements, the calorific power of fuels, heat insulating, and fire-retarding materials.

In the Optical Laboratory modern instruments are provided for studies in photometry, spectroscopy, interference, and polarization, and for researches in photography and micro-photography.

In Chemistry facilities for research are afforded in each of its important branches. Investigations in Physical Chemistry and in Applied Chemistry are carried on mainly in the special research laboratories devoted to those subjects (see page 166). In Organic Chemistry investigations of scientific interest as well as those involving applications to the arts may be pursued. An assistant professor of organic chemical research has been appointed who gives nearly his entire time to the direction of such researches. In Inorganic and Analytical Chemistry and in the Chemistry of Foods there is also especial opportunity for the study of original problems.

In Geology special opportunity for research in the Geological Department is provided in the following subjects now occupying the attention of teachers in the Department as matters of investigation: dynamical geology with special reference to volcanoes; geology of the igneous rocks; chemical mineralogy and petrography; stratigraphy and paleontology.

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

This laboratory, which was established in 1903, is devoted exclusively to research work and advanced instruction in Physical Chemistry. It consists of a group of small laboratories, accommodating in all eighteen research workers. It is equipped with every convenience for physico-chemical investigations. A fuller description may be found on page 407.

The researches are carried on in large part by a staff of Research Assistants and Associates working under the direction of those professors of the Institute who are connected with the subjects of Theoretical or Physical Chemistry. The Laboratory offers also to students who are properly prepared unusual opportunities for a thorough training in Physical Chemistry. Besides pursuing research work, all candidates for higher degrees attend advanced lecture courses and seminars, given by members of the Research Laboratory staff, in which different phases of Physical Chemistry are taken up for study and discussion, or in which reports are given upon current literature and upon the investigations in progress in the laboratory. During every year since its establishment, from ten to sixteen men have been engaged upon physico-chemical researches in the laboratory.

RESEARCH LABORATORY OF APPLIED CHEMISTRY.

In order that opportunity may be provided for the study of some of the general problems of a chemical nature constantly confronting the manufacturing public, that there may be offered to the individual manufacturer facilities for the inves-

tigation of his special problems, and that the Institute may be brought more intimately into connection with the industries of the country, there has been established a Research Laboratory of Applied Chemistry, a description of which may be found on page 407.

Members of the Research Laboratory Staff offer a number of advanced lecture courses and weekly seminars upon topics of general interest in this field. The laboratory work is carried on for the most part by a corps of Research Associates and Assistants, but opportunity is offered for properly prepared students to pursue advanced study and investigation of a character leading to the degrees of Master of Science and Doctor of Engineering.

RESEARCH LABORATORY OF ELECTRICAL ENGINEERING.

In connection with the Department of Electrical Engineering, there has been established a Research Laboratory for the study of problems, both of a technical and economic nature, which bear directly on electrical engineering practice. Two classes of investigations are undertaken in this laboratory: (1) those which lie on the border line between pure Physics and Electrical Engineering, the direct bearing of which on engineering practice depends more or less upon future advancement of the art, and (2) those which are of immediate commercial interest.

The work in this laboratory is carried on for the most part by a corps of research associates and assistants under the immediate supervision of the more experienced members of the Department. Opportunity is also offered for properly qualified students to carry out investigations in this laboratory as theses for the advanced degrees of Master of Science and Doctor of Engineering. Undergraduate students are given the opportunity of acting as special observers from time to time. The Vail Collection of Electrical Engineering Books is available in connection with the work of the Laboratory.

SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

By the generosity of an anonymous donor the Institute has since 1903 maintained a Sanitary Research Laboratory and Sewage Experiment Station for the investigation of problems relating particularly to the purification of the sewage of large cities, for the demonstration of sanitary methods and appliances, and for the advancement of popular education in public health subjects. For a description of the laboratory and experiment station see page 423.

Investigations are carried on by a regular staff of biologists and chemists. Students or others who, having had the necessary preparation in Chemistry, Bacteriology, or Sanitary Engineering, desire to attack problems relating to sanitary science or the public health, or who desire to become familiar with the methods and processes employed in sanitary research and public health science, especially as related to the purification of sewage and water, will be received at any time.

HAWAIIAN VOLCANO OBSERVATORY.

By a gift from the estate of Edward and Caroline Rogers Whitney in 1909, special research in seismology and other branches of geophysics was provided for. On January 1, 1912, the Hawaiian Volcano Research Association co-operated with the Institute to establish an observatory and laboratory at the volcano Kilauea. Work was begun at once and a suitable building has been constructed with laboratories, a seismograph cellar, water supply and facilities for physico-chemical investigation of volcanic process.

Investigations are carried on by a resident staff, and properly qualified investigators will be received at the Observatory for special studies. For further information see page 429.

Subjects of Instruction.

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories, and the drawing-rooms. A high value is set upon the educational effect of these exercises, and they form the foundation of each of the thirteen Courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books; and, in such cases, notes on the lectures and laboratory work have been printed, either privately or by the Institute, and are furnished to the students at cost. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time. Near the close of the months of January and May general examinations are held.

In the following pages will be found a more or less detailed statement of the scope as well as the method of instruction of every subject offered in the various Departments of the Institute. The subjects are classified according to the Departments in which they are given, related studies being arranged in sequence. Owing to the intimate relations existing between the work of the various Departments of the Institute, it not infrequently appears in the following classification of subjects that the same instructor gives courses in several divisions other than his own.

The subjects are numbered, or lettered and numbered, for convenience of reference in consulting the various Course Schedules, pages 85 to 129, and the Alphabetical Subject Index, pages 171 to 180. Subjects designated by numbers alone will be found on pages 181 to 364; subjects designated by letters and numbers on pages 365 to 406. As the total number of hours per term devoted to a subject often varies in different Courses, these hours are not in every case given in connection with the following descriptions. Thus Quanti-

tative Analysis (subject 512) is taken 120 hours in Course III., Option 2, 180 hours in Course V., 135 hours in Course X., etc. In the above mentioned Course Schedules, however, the number of hours of exercise and of preparation in each subject is given, and in the Subject Index, pages 171 to 180, both the hours of exercise and the hours of preparation are also indicated.

The requisites for preparation include not merely the subjects specified by number, but also those required as preparation for them. Thus, for instance, the requirements for 215 (Applied Mechanics) are M22 and 801; that for M22 is M21; that for M21 is M12; that for M12 is M11 and M10; those for M11 and M10 are 1, 2 and 5 (Algebra, Plane Geometry and Solid Geometry required for admission, page 181); the requirement for 801 is M12. So that to take up 215, Applied Mechanics, the applicant must be prepared to pass, or must have passed, examinations in M10, M11, M12, M21, M22, 801 and in 1, 2 and 5. The reason for this is that in order to properly carry on the work in subject 215, the student must have had suitable training in all of the subjects indicated.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special Course may select for the earlier part of that Course such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire. He may also ascertain what preparatory training is requisite for admission to any special work at the Institute.

Applications for exception for sufficient causes from the required preparation as stated in connection with each subject described below will always be considered by the Faculty.

The topics included in the list which follows are subject to change at any time by action of the Faculty; and the list of studies for which any student applies is always subject to the approval of the Faculty.

ALPHABETICAL SUBJECT INDEX.

FIRST TERM.

Numbers, or letters and numbers, in parentheses immediately following the subjects refer to the Subjects of Instruction, pages 173 to 406. Numbered subjects, pages 181 to 364. Lettered and numbered subjects, pages 365 to 406.

Numbers following those in parentheses indicate the year in which the subject is given. g, Graduate. e, Elective.

For many fourth-year subjects division of time between exercises and preparation is varied at the discretion of the instructor.

The hours of exercise and preparation indicated are for a term of fifteen weeks.

Subject.	Hours Ex.	Prep.
Acoustics (828) 2	15–	15
Acoustics (829) 4	5–	5
Aerial Propellers (1379) g	10–	20
Aerodynamic Laboratory (1380) g	60–	30
Aeronautics (1372) 4	45–	45
Aero Engines (251a) g	30–	30
Aeroplane Design, Theory of (1375) g	45–	90
Aeroplane Design (1376) g	90–	0
Air and Water Anal. (520) 3	45–	0
Alternating Currents, Advanced (627) g		
Alternating Current Mach. (621) 4, Lectures	15–	0
Alternating Current Mach. (621) 4, Recitations	45–	60
Alternating Current Mach. (621) 4, Problems	30–	0
Alternating Current Mach. (623) 4, g Lectures	30–	0
Alternating Current Mach. (623) 4, g Recitations	15–	30
Alternating Current Mach. (623) 4, g Problems	15–	0
Analytical Mechanics (M65) e	30–	60
Applied Chemistry (585) 2, 4	15–	15
Applied Mechanics (215) 3 III	45–	90
Applied Mechanics (215) 3 X	60–	90
Applied Mechanics (215) 4 XV[2]	60–	105
Applied Mechanics (216) 3 II, XIII XIIIA, XIIIB, XV[2]	45–	90
Applied Mechanics (217) 3 I, XI, XVI	60–	90
Applied Mechanics (218) 3 VI	45–	90
Applied Mechanics (219) 3 IV[1]	40–	80
Applied Mechanics (220) 3 IV[2]	60–	120
Applied Mechanics (229) 4 II, XIII, XIIIB	45–	90
Applied Mechanics (229) 4 XIIIA	30–	30
Applied Mechanics (230) 3 IV[2]	25–	50
Applications of Chemical Thermodynamics (581) g	30–	60
Architectural History (442) 3	20–	15
Architectural History: Research (443) g		
Architecture, Theory and Practice (454) g	15–	0
Assaying, Fire (322) 3 V	30–	5
Assaying, Fire (322) 3 XIV	30–	0
Bacteriology (730) 3	90–	45
Bacteriology, Advanced (734) 4	45–	30
Bacteriology of Fermentation Industries (739) g	30–	60
Bacteriology of Water and Sewage (731) 4	30–	15
Biochemistry (524) g	30–	45
Biology, General (701) 2	60–	15
Biology, Elements of (702) 3	30–	30
Biology, Elements of (702) 3 XI	30–	0
Biology, Elements of (702) 3 XII	15–	15
Biology of Infectious Diseases (735) 4	30–	45
Biology, Theoretical (780) 4	30–	45
Bridge Design (153) 4	90–	0
Business Law (Ec 61) 4	30–	60
Business Management (Ec 58) 4	30–	60
Calculating Machines (860) e	7–	
Carpentry (289a) and Wood Turning (289b) 2	60–	0
Central Stations (637) 4, e	30–	45
Chemical Engineering II (577)	30–	30
Chemical Engineering Laboratory (583)	30–	
Chemical Engineering of Special Industries (579) g	30–	60
Chemistry, Inorganic I (501) 1 Laboratory 60 Lectures 30 Recitations 30	–	60
Chemistry, Anal. & Tech. (534) 3	45–	45
Chemistry of Road Materials (538) 3	120–	30
Coal Mining (317) 4	20–	20
Color (831) 4	5–	5
Comparative Physiology (722) 4	45–	30
Constructive Design I (481) 4	120–	15
Constructive Design, III (483) g	120–	0
Cost Accounting (Ec 51) 2	45–	45
Crystallography, Optical, and Applications of (1223) g	45–	30
Crystallography, Physical and Chemical (1221) g	45–	
Current Public Problems (H37) 3, e	15–	30
Dairy Bacteriology (738) g	60–	90
Descriptive Geometry (D15) 1	45–	0
Descriptive Geometry (D21) 2	45–	0
Descriptive Geometry (D23) 2	60–	45
Descriptive Geom. College Class	75–	60
Descriptive Geom. I	85–	80
Design I (471) 2	105–	0
Design II (472) 3 IV[1]	135–	15
Design II (472) 3 IV[2]	120–	15
Design III (473) 4	280–	45
Design (Architectural, Advanced) (474) g	370–	0
Design of Stations and Distribution Systems (639) g		
Differential Equations, Applications (M61–M63) e	30–	90
Differential Equations, Partial (M69) e	30–	60
Discrete Systems (M61) e	30–	60
Dynamical Geology (1231) 2, 3	45–	30
Dynamics of Machines (243) 4	25–	50

FIRST TERM.

Subject.	Hours Ex.	Prep.
Dynamics of Rigid Bodies (M66) g	45–	90
Dynamo Design (645) 4, e	30–	45
Economic Geology (1253) 4	45–	45
XII	60–	30
Economic Geology (1055) 4	75–	45
Economic Geology (1256) 4	45–	45
Economic Geology, Advanced (1259) g	90–	0
Economic History (Ec 33) 3, e	15–	
Economics of Corporations (Ec 55) 4	30–	30
Electric Furnaces (888) 4, g	35–	15
Electric Transmission and Distribution of Power (633) 4	30–	45
Electric Railways, Advanced (643) g		
Electric Wiring and Lighting of Buildings (651) 4	15–	15
Electrical Discharges in Vacua (852) 4	45–	0
Electrical Engineering, Elements of (614) 3	45–	75
Electrical Engineering, Elements of (617) 4, 5	30–	30
Electrical Engineering, Elements of (618, 619) 3, 4	30–	30
II	30–	30
Electrical Engineering Laboratory (687) 4 III[1], [2]	30–	30
III[3]	45–	45
XIII	30–	30
Electrical Engineering Laboratory (689) 4	45–	45
Electrical Engineering Laboratory and Reports (670) 3 Laboratory	15–	15
Reports	15–	0
XIV	30–	30
Elect. Eng. Lab. (672) 4 Laboratory	30–	40
Reports	20–	0
XI	70–	40
Elect. Eng. Lab. (685) g	45–	45
Electrical Engineering Laboratory (681) 3	15–	30
Electrical Engineering Laboratory (675) g		
Electrical Engineering, Principles of (611) 3	75–	85
Electrical Engineering Seminar (692) g		
Electrical Laboratory (822) 3	15–	15
Electrical Measurements (821) 3, 4	30–	30
Electrical Testing, Advanced (669) g		
Electricity (824) 3	30–	30
Electrochemical Lab. (886) 4	105–	15
Electrochemical Seminar (896) g	15–	60
Electrochemistry (882) 4	30–	45
Electrochemistry, Elements of (881) e	30–	30
Engineering of Water and Sewage Purification (181) g	120–	
II	50–	25
Engineering Laboratory (261, 532) 4, g XIII, XIIIA	60–	30
VI	45–	25
X, XV[3]	60–	30
Engineering Laboratory (263) 4	15–	15
English (E10) 1	30–	30
English (E11) 1	30–	30
English (E20) 2	30–	30
English Bible (E33) 3, e	30–	15
English Literature (E21) 2	30–	30
VI	15–	05
Epidemiology (751) g	30–	30
European Civilization and Art I (H33) 2, 4	45–	45
European Civilization and Art II (H34) 3	30–	40
(H34a) 4	45–	60
European Civilization and Art (H35) g	45–	60

Subject.	Hours Ex.	Prep.
Factory Construction (270)	45–	0
Field Geology, Advanced (1267) g	90–	
Fire Assaying (321)	75–	15
V	30–	5
Fire Assaying (322) XIV	30–	0
Fluid Dynamics (1374) g	30–	60
Fluid Dynamics, Theoretical (M59) g	30–	60
Food Analysis (525) 3	45–	0
Food Analysis, Adv. (526) 4	75–	15
Forging (284) 2	30–	0
Forging (284a)	60–	0
Foundations (148) 4	15–	30
Foundry Work (288) 4	35–	0
Fourier's Series (M[illegible]) 4	30–	60
Freehand Drawing (D31) 1	30–	0
Freehand Drawing (D42) 2	60–	0
Freehand Drawing (D43) 3	60–	0
French (Elementary) (L61) e	45–	90
French (Intermediate) (L62) 1	45–	90
French (L71) 3, e	15–	30
French (L72) 3, e	15–	30
French (L73) 3, e	30–	15
Gas Analysis (531)	20–	10
Gas and fuel Analysis (532) 4	8–	
III[1], [2] 4	60–	45
Geological Surveying XII[1] 3	55–	0
(1265) 3, 4 XII[2] 3	30–	15
XII[3] 4	60–	30
Geology, Dynamical (1231) 2, 3	45–	30
Geology, Economic (1253) 4	45–	45
XII	60–	30
Geology, Economic (1255) 4	75–	45
Geology, Economic, Advanced (1259) g	90–	0
Geology, General (1232) 2 III[1], [3]	45–	30
XII	45–	30
Geology of Europe (1294) g	30–	60
Geology of Materials of Construction (1257) 3, e	15–	30
Geology, Stratigraphic (1237) 3	30–	15
Geology, Structural and Field III[1]	45–	30
1264 III[3]	45–	15
German (Elementary) (L11) e	45–	90
German (Intermediate) (L21) 1	45–	90
German (L31) 2	45–	60
German (L32) 2	45–	60
German (L33) 2	30–	45
German (L34) 2, 3	30–	30
XI	30–	45
German (L35) 2	15–	15
German (L41) 3, e	15–	30
German (L42) 3, e	15–	30
German (L43) 3, e	30–	15
Glass Blowing (898) 4	12–	0
Heat Eng. (245) 3, 4		
III[3], VI, XIII	30–	60
II, X	60–	90
Heat Engineering (246) 3 XIIIA	30–	60
Heat Engineering (247) 3, 4	45–	90
XI	45–	75
Heat Engineering (248) 4	30–	60
III[1]	30–	15
Heat Measurements (813) 4 III[2]	45–	30
V[1]	30–	30
Heating and Ventilation (256) 3 IV	45–	45
Heating and Ventilation Design (257) 3	30–	0
Highway Construction (132) 4	45–	60
Highway Drainage (133) 4	15–	30
Highway Engineering Research, Advanced (134) g	45–	135

FIRST TERM.

Subject.	Hours Ex.	Prep.
Highway Specifications (137) 4	45–	60
History II (H31) 2, 3	30–	30
History of Science (790) 3, e	15–	30
Hydraulic and Sanitary Engineering (175) 4	45–	75
Hydraulics (162) 4 I, XI	45–	90
Hydraulics, Theoretical (163) 4 III[1, 2] X, XIII, XIIIB	20–	40
	15–	30
Hydraulics, Theoretical (164) 4	30–	60
Hydrodynamics (M57)	20–	40
Hygiene of Ventilation (755) 4	15–	15
Illumination and Photometry (655) 4 e	15–	60
Index Fossils (1273) 4	60–	30
III[3]	45–	20
Industrial Applications of Chemical Principles (584) g	15–	15
Industrial Microbiology (732) 4	60–	15
Industrial Chemistry II (587) 4	90–	15
Industrial Chemistry I (575)4	30–	30
Industrial Chemistry (586) 4	45–	90
Industrial Hygiene and Sanitation (752) 4	30–	30
Industrial Organization (Ec 56) 3	30–	60
Inorganic Chemistry, Exp. Problems in (590) 3 { V[1] / V[2]	165–	15
	90–	15
Inorganic Chemistry III (504) g	15–	60
Inorganic Chemistry, Special Topics in (505)	15–	
Internal Combustion Engines (252) e	15–	
International Law (H39) 3, e	15–	30
Italian (L91) e	30–	45
Journal Reports (594) 4	15–	10
Journals (770) 4	30–	15
Laboratory Reports (356) 4	15–	0
Leaching Gold and Silver Ores (338) g	120–	60
Life Class (D44) 4	90–	0
Life Class and Decorative Design (D45) g	90–	0
Lithology (1211) 3	15–	0
Machine Design (267) 4	90–	0
Machine Design (270) g		
Machine Drawing (208) 3 { II / III[3] / X	30–	0
	60–	0
	60–	0
Machine Tool Work (291) II, XIII, XIIIB	45–	0
Machine Tool Work (291a) e	60–	
Machine Tool Work (292) 4 XIII	45–	0
Marine Engine Design (1361) g	90–	45
Marine Engines (1351) g XIIIA	30–	30
Marine Engineering (1355)	30–	30
Mathematical Laboratory (M54) e	30–	
Mathematics (M11) 1	30–	60
Mathematics (M21) 2	45–	90
Mathematics (M31) 3	45–	90
Mathematics (M32) 3	30–	60
Mathematics (M35) 3	45–	75
Mathematics (M36) 3	60–	120
Mathematics, Advanced (M51–M65).	30–	60
Mechanical Applications of Electric Power (635) g, e	30–	40
Mechanical Draw. (D11) 1	45–	0
Mech. Eng. Draw. (206) 2	60–	0
XIII	75–	0
Mechanical Eng. Drawing (207) 2, 3	30–	0
XV[3]	45–	0
Mechanical Treatment of Metals (361) g	30–	30
Mechanism (200) 2 II, VI	45–	90
X	30–	45
XIII, XIIIB	45–	75
Mechanism (201) 2, 3	30–	60
Metal Mining (316) 4	170–	120
Metallography (333) 4	85–	25
Metallography (334) 4	15–	5
Metallurgical Calculations (347) g		
Metallurgical Laboratory (351) 4	100–	0
Metallurgical Laboratory and Reports (352, 356) 4	30–	0
Metallurgical Plants, Economics of (362) g	15–	15
Metallurgical Processes, Development of (363) g	30–	30
Metallurgy (331) 4	45–	45
Metallurgy and Physics of Metals (360) g	120 to	480
Metallurgy of Iron and Steel (341) 4	45–	45
Metallurgy, Principles of (336) 3	60–	15
Metal Turning (294) 2	30–	0
Metal Turning (295) 2, 3, 4	45–	0
X	30–	0
Military Science (20, 21) 1 { A / B	45–	0
	30–	15
Mineral Lands: Acquisition, Tenure (314) g	90–	0
Mineralogy (1201) 2	75–	15
Mineralogy (1201) 3 { III[1, 2] / III[3]	105–	15
	90–	15
Mineralogy and Petrology (1209) 3	30–	15
Mining and Metallurgical Calculations (305) 4	15–	15
Mining Engineering (302) 3	45–	45
Mining Engineering (303) 4	45–	30
Mining Engineering (306) 3	30–	30
Mining Engineering, Advanced (311) g	45–	90
Mining Laboratory (318) 4	20–	20
Model Making (1395) 4	25–	0
Naval Architecture (1301) 3	30–	60
XIIIA	15–	20
Naval Architecture (1302) 4	30–	60
Oil Testing (536) 4, e	25–	5
Optical Laboratory (849) 4	60–	30
Ore Dressing (307) 4	40–	15
Ore-dressing (312) g	45–	90
Organic Chem. (550) 2, 3	30–	30
Organic Chemistry I (551) 4	45–	30
Organic Chemistry II (552) g	30–	60
Organic Chemical Laboratory (558)	45–	15
Org. Chem. Lab. (557) 3, 4 VII	105–	15
Organic Chem. Lab. (556)	105–	0
X	80–	0
Organic Chemistry, Exp. Problems in (592) 4	80–	30
Organic Laboratory, Adv. (560) e		
Organic Qualitative Analysis (516) g	135–	0
Organization and Administration of Public Service Companies (695) g		
Paleontology (1277) g		
Paleontology, Introductory (1271) 3, g	60–	
Pattern Work (289c) e	30–	0
Perspective (412) 1	20–	40
Perspective, Applied (413) 2	30–	0
Perspective, Applied (415) 2	30–	0
Petrography (1215) 4	60–	15
III[3]	45–	15
Petrography (1225) g		
Philosophy of Architecture (451) 4	15–	0
Photographic Laboratory (851) 4	60–	0
Physical Colloquium (855) 4	–	30

FIRST TERM.

Subject.		Hours Ex.	Hours Prep.
Physical Laboratory (807) 2		30–	30
	I, XI	15–	15
Physical Laboratory (808) 3		15–	10
Physical Measurements, General (866)	g	60–	15
Physical Training (25) 1		20–	0
Physico-Chemical Research Reports and Reviews	g		
Physics (801) 2 { Lectures 45 / Recitations, IV 30 }		90–	75
Physics (802) (Heat) 3		15–	20
Plant Design (582)	g	60–	30
Plant Physiology (724) 4		15–	15
Plotting. See Surveying (100)			
Polarized Light (864)	e	15–	
Political Economy (Ec 31) 3		45–	45
Political Economy (Ec32) 2		45–	45
Potential Function, Theory of (M52)	e	30–	60
Problems in Applied Chemistry (588) 4		30–	60
Problems in the Dressing and Milling of Ores (309)	g	120–	0
Professional Relations (422) 4		15–	15
Proximate Technical Analysis (530) 4		90–	30
Public Health Problems (750) 4		15–	15
Public Speaking (E39) 3,	e	30–	15
Qualitative Analysis (511) 2 { III[1,3] / VII / VIII[2,3] / VIII[3] / XI / XII }		120– / 105– / 105– / 120– / 150– / 105–	15 / 15 / 15 / 15 / 15 / 15
Qualitative Analysis of Rare Metals (515)	g	120–	15
Quantitative Analysis (512) 2, { III[2] / V / X / XIV / XV[3] }		120– / 180– / 135– / 120– / 120–	15 / 15 / 15 / 15 / 15
Quantitative Analysis (513) 3 { III / VIII[1] / X }		120– / 90– / 135–	15 / – / 15
Quantitative Analysis (514) 3 { XIV / V[1] / V[2] / V[3] }		65– / 120– / 135– / 195–	0 / 30 / 15 / 30
Radiation (868)	g	15–	60
Radiation, Theory of (869)	g	15–	60
Railroad Design (126) 4		45–	0
Railroad Design (128)	g	45–	0
R. R. Drawing (123) 3 { I[1,2] / I[3], XI }		60– / 45–	0 / 0
Railroad Engineering (121) 3 { I[1,2] / I[3], XI }		30– / 20–	60 / 40
Railroad Engineering (125) 4		30–	45
Railroad Engineering (127)	g	30–	60
Refrigeration (254)	g	30–	60
Reinforced Concrete Design (158)	g	45–	90
Reinforced Concrete Theory (157) 4		30–	60
Report Writing (E 35) 3		30–	30
Research Conferences (598)	g		
Sanitary Design (183)	g	90–	0
Sanitary Engineering (177) 4		45–	75
Sanitation of Water Supplies (757)	g		
Shades and Shadows (411) 2		30–	15
Shakespeare's Plays (E31) 3,	e	30–	30
Ship Design (1343) 4		80–	
Ship Drawing and Design (1342) 3		75–	0
Spanish (L81)	e	30–	45
Standardizing Lab. (667) 4		30–	30
Statistical Methods in Theoretical Physics (M67)	g	15–	
Statistics (Ec 65) 3		60–	0
Storage Batteries and their Application (653) 4		15–	15
Stratigraphic Geology (1237) 3		30–	15
Structural Design (492) 4		240–	10
Structural Design (154) 4		60–	0
Structural Design, Advanced (156a)	e	90–	0
Structural Drawing (490) 3		30–	0
Structures (149) 4		45–	90
Structures (151) 4, IV[2]		45–	90
Structures of Metal, Wood and Masonry (156)	e	90–	60
Sugar Analysis (527) 3		30–	15
Surveying (103) 2		30–	0
Surveying and Plotting (100) 2		30–	15
Surveying, Adv. (109) 3, 4,	XII	30–	0
Surveying Instruments (102) 3		30–	0
Taxation (Ec 70) 3		15–	15
Teaching of Elementary Mathematics (M71)	e	15–	30
Technical Electrical Measurements (662) 4		10–	10
Technical Electrical Measurements, Elementary (668) 4		15–	15
Technical Electrical Measurements Laboratory (664) 3		15–	15
Technical Electrical Measurements, Laboratory (665) 4		30–	30
Testing Materials, Laboratory (235) 4 { II, XV[2] / III[1,3], X, XIII, XIIIA }		25– / 20–	5 / 10
Testing Materials Laboratory (237) 3		20–	0
Testing Materials Laboratory (238) 4		30–	15
Testing Materials Laboratory IV[2] (239) 4		35–	15
Theoretical and Applied Optics (848) 4		45–	90
Theoretical Biology (780) 4		30–	45
Theoretical Chemistry I (565) 3, 4	III[2]	45–	90
	V, X, XV[3]	72–	93
	VIII, XIV	45–	75
Theoretical Chemistry II (566) 4,	V	48–	57
	X	30–	45
	VIII[1]	30–	60
Theoretical Physics I (841) 3		45–	90
Theoretical Physics II (842) 4		45–	90
Theoretical Physics III (843) 4		45–	90
Theory of Elasticity (231)	g		
Theory of Functions (M56)	e	30–	60
Theory of Warship Design (1311) 3		30–	30
Theory of Warship Design (1312) 4		30–	30
Theory of Warship Design (1313)	g	30–	30
Thermodynamics (M53)	e	30–	60
Topographical Drawing (195) 2		30–	
Trigonometry, Plane (M10) 1		30–	60
Trigonometry, Spherical (M20) 2, 3		10–	20
Valuation of Public Service and other Corporations (129)	e	45–	90
Ventilation and Drainage (1333) 4		30–	30
Vertebrate Anatomy (710) 3		75–	45
Vise and Bench Work (290b) 4		10–	0
Vital Statistics (190) 4		30–	30
Warship Design (1321) 3		105–	
Warship Design (1322) 4		90–	
Warship Design (1323)	g	90–	
Water and Air Analysis (520) 3		45–	0
Water and Sewage, Purification of (760)	g	30–	60

FIRST TERM.

Subject.	Hours Ex.	Prep.
Water Color (453) 3	30–	0
Water Power Design (182) g . . .	90–	0
Water Supply and Wastes Disposal (522) 4	45–	30
Water Power Engineering (173) g .	45–	90
Wave Theory and Polarization (870) g	15–	60
Wood Turning (289b). See Carpentry.		
Woodwork and Pattern Making (289) 3	60–	0
Zoölogy and Parasitology (713) 4 .	30–	30
Zymology (733) 4	45–	30

ALPHABETICAL SUBJECT INDEX.

SECOND TERM.

Numbers, or letters and numbers, in parentheses immediately following the subjects refer to the Subjects of Instruction, pages 169 to 406. Numbered subjects, pages 181 to 364. Lettered and numbered subjects, pages 365–406.

Numbers following those in parentheses indicate the year in which the subject is given. g, Graduate. e, Elective.

For many fourth-year subjects division of time between exercises and preparation is varied at the discretion of the instructor.

The hours of exercise and preparation indicated are for a term of fifteen weeks.

Subject.	Hours Ex.	Hours Prep.
Accounting (Ec 50) 2	45	45
Aeronautics (1371) e	15	15
Aeronautics (1372) 4 XIIIA	45	45
Aeronautics (1372) 4 XIIIB	30	60
Aeronautics (1373) g	30	60
Aeroplane Design (1376) g	90	0
Airship Design, Theory of (1377) g	45	90
Airship Design (1378) g	90	0
Alternating Currents, Advanced (627) g		
Alt. Cur. Machinery (622) 4, g Lectures	5	0
Alt. Cur. Machinery (622) 4, g Recitations	15	15
Alt. Cur. Machinery (622) 4, g Problems	15	0
Alternating Current Machinery (Advanced) (625) g		
Analytical Mechanics (M65) e	30	60
Anthropology (714) 3	15	15
Applied Electrochemistry (885) 4	30	60
Applied Electrochemistry (897) g	15	60
Applied Mechanics (215) 2 I, II, VI, XI, XIV, XV[1,2]	45	90
Applied Mechanics (215) 2 XIII, XIIIB	45	85
Applied Mechanics (218) 3 III	45	90
Applied Mechanics (218) 3 X	45	75
Applied Mechanics (221) 3, VIII[3]	30	60
Applied Mechanics (225) 3, II, XV[2]	45	90
Applied Mechanics (226) 3, XIII XIIIB	30	60
Applied Mechanics (226a) 3, XIIIA	45	90
Applied Mechanics (227) 3, IV[1]	45	90
Applied Mechanics (228) 3, IV[2]	60	120
Architectural History (441) 2	15	15
Architectural History (442) 3	25	20
Architectural History: Special Research (443) g		
Architectural Problems, Advanced (452) g		
Architecture, Theory and Practice (454) g	15	0
Argumentation and Debate (E38) e, 3	45	30
Assaying, Fire (321) 3 III	75	15
Assaying, Wet (323) 3, 4 III[1]	120	15
Assaying, Wet (323) 3, 4 III[2]	75	0
Astronomy (112) 2	30	30
Astronomy, Desc 833	30	45
Bacteriology (730) 3 V	60	30
Bacteriology (730) 3 XI	60	0
Bacteriology of Water and Sewage (731) 3	45	30
Banking (Ec 37) 3	45	60
Banking and Finance (Ec 36) 3, e	45	30
Boiler Design (266) 3	45	0
Botany, Cryptogamic (793) 2	60	40
Bridge Design (153) 4	90	0
Business Law (Ec 60) 3	15	15
Business Law (Ec 61) 4	30	60
Business Management (Ec 58) 4	60	110
Business Relations (422) 4	15	0
Central Stations (637) 4, e	45	30
Chemical Engineering I (576) 3	30	30
Chemical Engineering II (577) 4	30	60
Chemical Engineering Laboratory (583)	30	0
Chemical Mineralogy and Petrology (1226)	45	90
Chemistry, Inorganic (502) Laboratory 60, Lectures 30, Recitations 30	120	60
Chemistry, Analytical and Technical (534) 3	90	0
Chemistry, Inorganic (503) 2	30	30
Chemistry of Road Materials (537) g	45	
Chipping and Filing (2904) e	45	0
Civil Engineering Drawing (107). See Surveying and Plotting 100, 107		
Constitution of Matter (871) g	15	60
Constructive Design (482) 4	45	0
Continuous Media (M62) e	30	65
Crystallography, Elementary (1220) e	15	
Curve Tracing (M51) e	30	60
Descriptive Geom. (D16) 1	45	0
Descriptive Geometry (D16a) 1	70	0
Descriptive Geom. (D18) 1	90	15
Design I (Architectural) (471) 2	135	0
Design II (Architectural) (472) 3	210	15
Design III (Architectural) (473) 4	345	90
Design (Architectural, Advanced) (474) g		
Designs of Stations and Distribution Systems (639) g		
Differential Equations, Applications (M61–M63) e	30	60
Distillation of Fuels (533) g		
Dynamics of Rigid Bodies (M66) g	45	90
Dynamo Design (647) g		
Economic Geology, Elementary (1252) 3	15	15
Economic Geology (1254) 4	30	15
Economic Geology (1254) 4 XII	60	15
Economic Geology (1259) g	90	0
Electric Furnaces (889) 4 III[2]	15	20
Electric Furnaces (889) 4 VIII[3]	45	15
Electric Railways (642) 4, e	30	45
Electric Railways, Advanced (643) g.		
Electrical Discharge in Gases (862) e	15	0

SECOND TERM.

Subject.	Hours Ex.	Prep.
Electrical Engineering, Principles of (612) 3 { VI / XIIIA / XIV	60–	60
	45–	45
	60–	50
Electrical Engineering, Elements of (614) 4	30–	30
Electrical Engineering, Elements of (616) 3, 4	30–	30
Electrical Engin. Laboratory (689) 3, 4	45–	45
Electrical Engineering Laboratory (671) 3 { VI / XIV — Laboratory / Reports	25–	20
	15–	0
	15–	15
Electrical Engineering Laboratory (673) 4 { Laboratory / Reports	30–	40
	25–	0
Electrical Engin. Lab. (684) 4	45–	45
Electrical Engin. Lab. (682) 3	30–	30
Electrical Engin. Lab. (675) g		
Electrical Engineering Seminar (692) g	75–	0
Electrical Lab. (822) 3	45–	45
Electrical Measurements (821) 3, 4	30–	30
Electro-Chemical Laboratory (887) 4	45–	30
Electrochemistry (890) 4	30–	30
Embryology (712) 3	75–	60
Engine Design (277) 4 II	50–	25
Engineering Lab. (260) 3, 4	20–	5
III^2	15–	15
VI	20–	0
Engineering Laboratory (261, 814) 4	60–	30
VI	45–	25
XV^2	90–	0
Engineering Laboratory (262) 4	60–	30
Engineering Lectures, General (275) 4	15–	15
English (E10) 1	15–	15
English (E11) 1	30–	0
English (E20) 2	30–	30
English Composition, Advanced (E36) 3, e	30–	45
English Composition and Literature (E34) 3	45–	75
English Literature (E21) 2	30–	30
English Literature of the Nineteenth Century (E32) 3, e	45–	30
European Civilization and Art I (H33) 2, 4	30–	40
European Civilization and Art II (H34) 3 { IV^1 / IV^2	30–	40
	30–	0
(H34a) 4	45–	60
Field Geology (1262) 3	15–	15
Field Geology Adv. (1267) 4	90–	
Fire Assaying (321) 3	75–	15
Fluid Dynamics, Theoretical (M59) g	30–	60
Food Analysis (525) 3, 4	45–	0
Forging (284) 2,	30–	0
Forging (284a) e	45–	0
Forging (285) 3, 4	45–	0
Forging (285a) 3	30–	0
Foundry Work (287) 2, 3, 4	45–	0
Fourier's Series (M45) 4	30–	60
Free Energy and Chemical Equilibrium g	15–	60
Freehand Drawing (D32) 1	15–	0
Freehand Drawing (D41) 1	60–	0
Freehand Drawing (D42) 2	60–	0
Freehand Drawing (D43) 3	60–	0
French (Elementary) (L61) e	45–	90
French (Intermediate) (L62) 1	45–	90
French (L71) 3, e	15–	30
French (L72) 3, e	15–	30
French (L74) 3, e	30–	0
Gas Analysis (531) 2, 3, 4	20–	10
Geodesy (113) 3	30–	30
Geological Surveying (1265) { XII^1 3 / XII^2 3	90–	0
	120–	15
Geology, Economic (1252) 3	15–	15

Subject.	Hours Ex.	Prep.
Geology, Economic (1254) 4	30–	15
Geology, Economic (1255) 4	45–	45
Geology, Economic (1259) g	90–	0
Geology, General (1233) 3	45–	30
Geology of Coal and Petroleum (1260) g	30–	30
Geology of N. A. (1291) 4	60–	30
Geology, Stratigraphic (1238) 3	15–	15
Geology, Stratigraphic (1237) 2	30–	15
Geology, Structural and Field (1234) 3	30–	15
Geometry, Advanced (M58) e	30–	60
German (Elementary) (L11) e	45–	90
German (Intermediate) (L21) 1	45–	90
German (L31) 2	45–	60
German (L41) 3, e	30–	45
German (L42) 3, e	30–	45
German (L44) 3, e	30–	0
German (L45) 3, e	30–	45
German (L46) 3, e	30–	45
German (L47) 3, e	15–	30
Heat Engineering (245) 3, 4 { II / III^2, VI, XIII / X / XIV	45–	90
	60–	120
	30–	45
	30–	60
Heat Engineering (246) 3	10–	20
Heat Engineering (247) 3, 4	45–	90
III_2, XV	45–	60
Heat Engineering (248) 4	30–	60
Heat Engineering (250) g		
Heat Measurements (813) 3	30–	15
XII	30–	30
Heat Measurements (814) 4	8–	0
Heat Measurements, Advanced (815) 3	30–	30
Heat Measurements (816) g	45–	
Heating and Ventilation (255) 4	15–	30
Hertz Waves; Radio Telegraphy (863) e	15–	0
Highway Construction (132) 3	45–	90
4	45–	60
Highway Design (135) 4	60–	0
Highway Economics (136) 4	30–	30
Highway Engineering (130) 3	15–	30
Highway Engineering Research, Advanced (134) g	45–	135
Highway Specifications (137) 3	30–	60
History I. (H12) 1	30–	30
History and Archaeology (444) g	–	30
History of Chemistry (593) 4	15–	30
History of Ornament (431) 2	15–	30
IV^2	15–	5
History of Science (790) 3, e	30–	45
Hydraulic and Sanitary Design (179) 4 { I / XI	30–	0
	85–	0
Hydraulic and Sanitary Engineering (176) 4	45–	75
Hydraulic Engineering (169) 4	30–	60
Hydraulic Engineering (168) 4	45–	60
Hydraulic Lab. (172) 4 I, XI	15–	5
Hydraulics (163) 4	20–	40
Hydrodynamics (M57) 4	20–	40
Industrial Chemistry I (575) 4	45–	45
Indust. Chemistry II (587) 4	105–	15
X	135–	30
XIV	45–	45
Industrial Management (274) 4	15–	15
Industrial Organization (Ec56) 3	45–	45
Industrial Water Analysis (521) 3	30–	0
Inorganic Chemistry (503) 4	30–	30
X	30–	25
Inorganic Chemistry III (504) g	15–	60
Internal Combustion Engines (251) 4	20–	20
Italian (L91) e	30–	45
Journal Meetings (694) 4	30–	0
Journals (770) 4	30–	30

SECOND TERM.

Subject.	Hours	Ex.	Prep.
Labor Problems (Ec 45) 3			
Laboratory Reports (356) 4		15–	0
Least Squares, Method of (M26) 2, 3, 4		20–	30
Life Class (D44) 4		90–	0
Life Class and Decorative Design (D45) g		90–	0
Locomotive Engineering (278) 4		30–	45
Machine Design (267) 4		60–	0
Machine Design (270) g			
Machine Drawing (208) 3 VI		60–	0
Machine-tool Work (291) 4 II, XIII, XIIIB		60–	0
Machine-tool Work (219a) e		90–	0
Machine-tool Work (292) 4		45–	0
Marine Engine Drawing (1352) 4		90–	
Marine Engineering (1351) 4		30–	60
Marine Steam Turbines (1365) 4		30–	60
Materials (143) 3		30–	45
	IV²	30–	45
Materials of Construction (580) g		30–	30
Mathematical Laboratory (M54) e		30–	
Mathematics (M12) 1		60–	120
Mathematics (M22) 2		45–	90
Mathematics (M35) 3		45–	75
Mathematics, Advanced (M51–M65)		30–	60
Mathematics of Wireless Telegraphy (M63) e		30–	60
Mechanic Arts (297) 2		75–	0
Mech. Applica. of Elect. Power (635) 4 e		30–	45
	XIIIA	30–	60
Mechanical Draw. (D12) 1		45–	0
Mechanical Drawing (D12a) 1		20–	0
Mechanical Draw. (D14) 1		45–	0
Mech. Eng. Draw. (206) 2	II	45–	0
	VI	20–	0
	X	60–	0
	XIII	30–	0
Mech. Eng. Draw. (209) 3	II	90–	0
	XV²	105–	0
Mechanism (200) 2	II, VI, XIII, XIIIB	20–	40
	X	30–	60
Mechanism (201) 2, 3		30–	60
Mechanism of Machines (204) 3 II		30–	35
Memoirs (1305) g		15–	35
Metal Turning (294) 2		30–	0
Metallography (507) 4		15–	30
Metallurgical Plant Design (349) g		100–	0
Metallurgical Laboratory (355) 3		85–	0
Metallurgy (331) 4		45–	45
Metallurgy and Physics of Metals (360) g		120 to	480
Metallurgy, Copper (339) 3		30–	30
Metallurgy, General (335) 3		45–	40
Metallurgy, General (341) g			
Metallurgy, General (342) g			
Metallurgy, Lead, Gold, Silver (337) 3		35–	35
Metallurgy of Copper, Advanced (364) g		30–	30
Metallurgy of Engineering Materials (332) 3		45–	45
Metallurgy, Zinc and Minor Metals (340) 4		30–	30
Meteorology (1381) g		20–	20
Microscopical Laboratory (700) 1		30–	30
Microscopy of Drinking Waters (757) 4		15–	15
Military Science 1	(20) A	45–	0
	(21) B	30–	15
Mill Engineering and Drawing (279) 4		75–	0
Mine Examination and Reports (320) g		200–	0
Mineralogy (1201) 2 XII		60–	15
Mineralogy (1202) 2		105–	30
Mineralogy and Petrology (1208) 2		90–	15
	3	60–	15
Mineralogy and Petrology (1209) 3		60–	15
Mining and Metallurgical Calculations (305) 4		15–	15
Mining Engineering (302) 3		45–	45
Mining Engineering (308) 4		200–	45
Mining Engineering, Advanced (311) g		200–	0
Mining Engineering, Elements of (301)	2	15–	10
Mining Laboratory (318) 4		90–	45
Mining Plant (313) 4		45–	30
Mining Projects and Design (319) g		150–	0
Mining: Prospecting, Exploring, Exploitation (315) 3		30–	30
Municipal Government (H38) 3, e		30–	45
Municipal Sanitation (753) 4 VII³		60–	30
Naval Architecture (1301) 3		30–	55
	XIIIA	30–	60
Naval Architecture (1302) 4		15–	30
Ore Deposits (1251) 2		30–	40
Ore-dressing, Advanced (312) g		200–	0
Organic Chemical Laboratory (557) 3		75–	0
Org. Chem. Lab. (556)		150–	10
	X	90–	0
Organic Chemistry I (551) 3		60–	45
Organic Chemistry II (552) g		30–	60
Organic Evolution (1275) e		30–	45
Organic Laboratory, Adv. (560) e			
Organization and Administration of Public Service Companies (695) g			
Paleontology (1277) g			
Paleontology, Introductory (1271) 3, g		60–	30
Personal Hygiene (723) 4		15–	30
Perspective (412) 1		20–	40
Perspective, Applied (414) 2		20–	0
Perspective, Applied (415) 3		30–	0
Petrography (1215) 4		45–	15
Petrography (1225) g			
Philosophy of Architecture (451) 4		15–	0
Photography (861) 2 e		15–	0
Physical Chemistry of Engineering Alloys (233) 3 II		15–	15
Physical Colloquium (855) 4		15–	15
Physical Laboratory (807) 2	I, III, VI, VIII, X, XI, XIII, XIV	30–	30
	II, V	30–	25
	VII	30–	15
	XV¹	5–	5
	XV²,³	20–	20
Physical Laboratory Recitations (806)	2	15–	15
Physical Laboratory (Advanced) (810)	3	75–	60
Physical Training (25) 1		20–	0
Physico-chemical Lab. (893) 3		75–	60.
Physico-chemical Research Reports and Reviews g			
Physics (801) 2	Lectures 45, Recitations 30	75–	60
Physiological Lab. (721) 3		45–	15
Physiological Lab., Advanced (781)		45–	30
Physiology, General (720)		90–	60
Plant Design (582) g		60–	60
Plotting (107). See Surveying (100).			
Polarized Light (864) e		30–	
Power and its Transformations (600) 2		5–	0
Power in Mining (259) 4		45–	45
Power Plant Design (272) 4		60–	0

SECOND TERM.

Subject.	Hours Ex.	Prep.
Precision of Measurements (803) 2	10-	10
Principles and Applications of Electrolysis (865) e	6-	0
Principles of Scientific Investigation 4	45-	
Problems in Applied Chemistry (588) 4	30-	60
Problems in Chemical and Industrial Biology (740) 4	15-	15
Professional Relations (422) 4	15-	0
Proximate Technical Analysis (530) 4	90-	30
Public Health Administration (763) g	15-	0
Public Health Laboratory Problems (741) g	90-	15
Public Health Laboratory Methods (736) 4	45-	30
Public Health Laboratory Practice (737) g		
Public Health Problems (750) 4	15-	30
Quantitative Analysis (512) 2 — III[1,3]	120-	15
Quantitative Analysis (512) 2 — VII	150-	15
Quantitative Analysis (512) 2 — VIII[1,3]	110-	15
Quantitative Analysis (512) 2 — VIII[2]	120-	15
Quantitative Analysis (512) 2 — XI	90-	15
Quantitative Analysis (512) 2 — XII	135-	15
Quantitative Analysis (513) 2, 3 — III[2]	120-	15
Quantitative Analysis (513) 2, 3 — V[2]	195-	15
Quantitative Analysis (513) 2, 3 — X	145-	15
Quantitative Analysis (513) 2, 3 — XIV	100-	15
Quantitative Analysis (513) 2, 3 — XV[2]	120-	15
Quantitative Analysis (514) 3 — III[1,3]	150-	15
Quantitative Analysis (514) 3 — III[2]	165-	15
Radiation, Theory of (869) g	15-	60
Radioactive Measurements (872)	30-	15
Railroad Design (126) 4	30-	0
Railroad Design (128) g	45-	0
Railroad Drawing (123) 3 — I[1,2]	60-	0
Railroad Drawing (123) 3 — I[3], XI	75-	0
Railroad Economics (Ec 34) 3, e	45-	30
Railroad Engineering (121) 3 — I[1,2]	30-	30
Railroad Engineering (121) 3 — I[3], XI	20-	20
Railroad Engineering (125) 4	45-	90
Railroad Engineering (127) g	30-	60
Recent Developments in Chemistry (597) 4	10-	0
Refrigeration (253)	15-	30
Refrigeration (254) g	30-	60
Reinforced Concrete Research (159) g		
Research Conferences (598) g		
Sanitary Science and Public Health (754) 2, 4	15-	0
Sanitary Design (183) g	90-	0
Sanitary Engineering (178) 4	90-	90
Sanitary Law (762) g	15-	0
Sanitation in Chemical Industries (523) 4	30-	30
Sanitation of Houses and Public Buildings (758) g	15-	15
Sanitation of Ships (756) 4	15-	15
Scientific Investigation, Principles of 4	-	45
Securities and Investments (Ec 38) 3	45-	45
Ship Construction (1331) 2	20-	20
Ship Construction (1332) 3	20-	20
Ship Design (1343) 4	120-	0
Ship Drawing (1341)	30-	0
Ship Drawing and Design (1342) 3	90-	0
Spanish (L81) 3, e	30-	45
III[1]	45-	75
Specifications and Contracts (199) g	30-	60
Specifications and Working Drawings (421) 2, 3	60-	0
Statistical Methods in Theoretical Physics (M67) g	15-	

Subject.	Hours Ex.	Prep.
Stationary Structures (144) 4	45-	75
Steam and Mechanical Appliances for Buildings (258) 4 — Lect.	15-	15
Steam and Mechanical Appliances for Buildings (258) 4 — Lab.	8-	0
Steam Turbine Engineering (280) 4	90-	45
Stereotomy (197) 2	45-	10
Structural Design (155) 4	75-	0
Structural Design (491) 3	150-	0
Structural Design (492) 4	430-	20
Structural Design, Advanced (156a)	90-	0
Structures of Metal, Wood, and Masonry (156) e	90-	60
Structures, Stationary (144) 4	45-	75
Structures, Theory of (140) 3, I[1,2], I[3], XI	45-105	
Structures, Theory of (141) 3 IV	45-	90
Structures, Theory of (145) g	105-	90
Structures, Theory of (149) 4	45-	90
Structures, Theory of (Adv.) (150) 4	30-	60
Structures, Theory of (151) 4 IV	45-	90
Sugar Analysis (527) 3, 4	30-	15
Surveying and Plotting (100) 2, 3	30-	0
Surveying Instruments (102)	30-	0
Surveying Instruments (101) 2 XIII		
Teaching of Elementary Mathematics (M71) e	15-	30
Technical Electrical Measurements (661) 3	30-	10
Technical Electrical Measurements Laboratory (664) 3	30-	30
XIV	15-	15
Telephone Engineering (658) 4, e	30-	45
Testing Highway Materials (139) 3	30-	15
V	45-	30
X	27-	18
Testing Materials, Laboratory (236) 3 I, XI	30-	0
Theoretical Biology (780) 4	30-	60
Theoretical Chemistry I (565) 3, 4 III[2]	20-	35
Theoretical Chemistry I (565) 3, 4 V, X, XV[2]	72-	93
Theoretical Chemistry I (565) 3, 4 VIII	45-	75
Theoretical Chemistry I (565) 3, 4 XIV	45-	70
Theoretical Chemistry II (566) 4, g V, VII	48-	57
Theoretical Chemistry II (566) 4, g VIII	30-	60
Theoretical Electricity (825) 3	45-	0
Theoretical Physics I (841) 3	45-	90
Theoretical Physics II (842) 4	30-	60
Theoretical Physics IV (844) 4	45-	90
Theory and Practice of Water and Sewage Purification (760) g	60-	60
Theory of Elasticity (231) g		
Theory of Functions (M56) g	30-	90
Thermo-Chemistry and Chemical Equilibrium (567) 3, 4	30-	60
Thesis Conferences (771) 4	15-	15
Thesis Conferences (772) 4	15-	15
Thesis Reports (595) 4	15-	15
Thesis Reports and Memoirs (596) 4	30-	15
Topographical Drawing (195) 2, 3	30-	0
Transportation (Ec 35) 4	30-	45
Vertebrate Anatomy and Histology (711) 3	90-	75
Volcanology and Seismology (1296) 4 g	45-	90
Vise and Bench Work (290) 3	30-	0
Warship Design (1321) 3	120-	
Warship Design (1322) 4 — XIIIA	90-	0
Warship Design (1322) 4 — XIIIB	120-	0
Warship Design (1323) g	90-	

SECOND TERM.

Subject.	Hours Ex.	Prep.
Warship Design, Theory of (1311) 3	30–	30
Warship Design, Theory of (1312) 4	30–	30
Warship Design, Theory of (1313) g	30–	30
Water and Air Analysis (520) 3, 4	45–	0
Water and Sewage, Purification of (760) g	30–	60
Water Color (453) 2	30–	0
Water Power Design (182) g	90–	0
Water Power Engineering (173) g	45–	90
Zoölogy, Invertebrate (704) 2, 3	30–	30
	XII 45–	15

REQUIRED SUMMER COURSES.

Summer Surveying Camp.

Subject.			Subject.		
Surveying, Plane (107)	75–	0	Surveying, Hydrographic (160)	45–	15
Surveying, Geodetic and Topographic (108)	75–	0	Railroad Field-Work (190)	50–	20

Chemistry.

Qualitative Analysis (511)	210–	30

Mining.

Surveying (104)	350–		Mining Camp (372) e	300–	

Mechanic Arts.

Mechanic Arts (297)	75–	0

ENTRANCE REQUIREMENTS.

The requirements for admission to the Institute are described in detail on pages 62 to 82.

Applicants for admission as students in the first year must show by examination evidence of suitable preparation in the subjects included in the following list. Applicants for admission as special students in the first year must similarly show evidence of suitable preparation in such subjects of the list as are required for admission to the courses of study that they desire to pursue.

1. ALGEBRA.
See page 69.

2. PLANE GEOMETRY.
See page 70.

3. ENGLISH.
See page 72.

4. HISTORY.
See page 73.

5. SOLID GEOMETRY.
See page 70.

6. FRENCH (Elementary).
See page 71.

7. GERMAN (Elementary).
See page 71.

8. PHYSICS.
See page 73.

DEPARTMENT OF MILITARY SCIENCE AND TACTICS.

EDWIN T. COLE, MAJOR, U. S. ARMY.
Professor of Military Science.

Assistants.

THEODORE D. PARSONS.
JAMES A. TOBEY.

In conformity with the requirements of the Acts[1] of Congress of July 2, 1862, and August 30, 1890, and Section 1225 of the Revised Statutes of the United States, as amended by Act of Congress approved November 3, 1893, and the Acts of the General Court of Massachusetts in furtherance thereof, the Institute provides instruction in Military Science and Tactics.[2]

Attendance at military exercises is required of all male students who take a majority of their studies in the first year, except aliens, college graduates, students who were twenty-one years of age at the beginning of the term in question, or who have passed an examination on the military course, or presented records for equivalent work at other colleges.

For these exercises they are required to provide themselves with uniforms, which are made from measure and by contract, in order to secure uniformity of material and manufacture, as well as cheapness. The whole cost to each student does not exceed sixteen dollars. A student presenting to the Faculty a certificate of physical disability from the Institute Medical Adviser (see page 55) may be excused from the prescribed drill exercises and in lieu thereof will be required to

[1] "For the endowment, support and maintenance of at least one college where the leading object shall be without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."

[2] An officer of the regular army, with the rank of Professor, has the work in charge. On the graduation of every class he is required by statute to obtain from the President and report to the adjutant-general of the army the *names of such students belonging to the class as have shown special aptitude for military service*, and to furnish a copy of this report to the adjutant-general of the State.

attend a course of theoretical studies in Military Science (Course B). But all such certificates must be presented *within ten days after entrance* and no student to whom the military requirement applies may omit military exercises unless he has appeared before the committee of the Faculty and received his excuse in writing from the Secretary.

In the permanent organization of the regiment, cadet officers are appointed by the Professor of Military Science, subject to the approval of the Faculty.

20. MILITARY SCIENCE. A.

Professor Cole.

This course consists of two hours drill per week and one hour per week theoretical instruction by lectures and demonstrations in the various branches of military science and the military history and policy of the United States. An examination based on the theoretical instruction will be held at the end of each term.

[REQUIRED IN ALL COURSES.]

21. MILITARY SCIENCE. B.

Professor Cole.

This course may be the same as Course 20 or may be extended to two hours per week with subjects assigned for study in addition to the lectures at the option of the Professor of Military Science.

22. TARGET PRACTICE.

Professor Cole.

This course is elective and open to students of all classes so far as time and the facilities available will admit.

[ELECTIVE.]

DEPARTMENT OF PHYSICAL TRAINING.

ALFRED E. BURTON, S.B., Sc.D.
Dean.

FRANK M. KANALY.
Instructor in Physical Training.

CARLETON J. SPEAR.
Assistant in Physical Training.

The gymnasium of the Institute is situated on Garrison Street. The building affords ample accommodation for the training of classes in gymnastics and indoor games.

The gymnasium is open to all students free of charge, and the instruction is especially arranged to fit individual needs. Bronze medals, known as the Cabot Medals for Improvement in Physical Development, are awarded to the five or six men showing the greatest physical improvement for the year. These medals are the gift of the late Samuel Cabot, for many years a member of the Corporation of the Institute.

An athletic field on the Institute's land in Cambridge gives an opportunity for track-team contests and inter-class games. This athletic field is provided with a quarter-mile running track, straight-away tracks for 100-yard and 220-yard dashes, tennis courts, etc. It is under the direction of an Advisory Council on Athletics, composed of alumni and undergraduate students.

25. PHYSICAL TRAINING.

Mr. Kanaly and assistant.

Four lectures on the relation of exercise to health and on personal hygiene are given to the first-year class at the beginning of the school year, and all first-year men take a physical examination during the first month from

which anthropometric charts are plotted. The class is then divided into four sections for gymnastic exercise, each section having two hours a week of work for twenty weeks under the direction of the instructor. All students not specifically excused, a majority of whose work is in the first year, are required to take these lectures and exercises.

[REQUIRED IN ALL COURSES.]

DEPARTMENT OF CIVIL AND SANITARY ENGINEERING.

CHARLES M. SPOFFORD, S.B.
Hayward Professor of Civil Engineering.

GEORGE F. SWAIN, S.B., LL.D.
Gordon McKay Professor of Civil Engineering.

C. FRANK ALLEN, S.B.
Professor of Railroad Engineering.

DWIGHT PORTER, PH.B.
Professor of Hydraulic and Sanitary Engineering.

ALFRED E. BURTON, S.B., SC.D.
Professor of Topographical Engineering.

LEWIS J. JOHNSON, A.B., C.E.
Professor of Civil Engineering.

ARTHUR G. ROBBINS, S.B.
Professor of Topographical Engineering.

GEORGE C. WHIPPLE, S.B.
Gordon McKay Professor of Sanitary Engineering.

CHARLES B. BREED, S.B.
Professor of Railroad Engineering.

HECTOR J. HUGHES, A.B., S.B.
Professor of Civil Engineering.

HAROLD K. BARROWS, S.B.
Associate Professor of Hydraulic Engineering.

GEORGE E. RUSSELL, S.B.
Associate Professor of Hydraulic Engineering.

GEORGE L. HOSMER.
Assistant Professor of Civil Engineering.

JOHN W. HOWARD, S.B.
Assistant Professor of Topographical Engineering.

Instructors.

HOWARD B. LUTHER, S.B., Dipl. Ing.
CLARENCE H. SUTHERLAND, A.B., S.B.
JAMES M. BARKER, S.B.
CHARLES R. GOW, B.S.

Assistants.

WALTER C. EBERHARD, S.B.
JOHN HYNEMAN, S.B.
PERCIVAL J. MUNN, S.B.
GEORGE W. SIMONS, JR., S.B.
HOWARD E. THOMAS, S.B.
ELLIS S. TISDALE, S.B.
ANDREW N. WARDLE, S.B.

The instruction in Civil Engineering is given by means of lectures and recitations, and by practice in the field, the drafting-room, and the laboratory. The professional work begins in the second year, with practice in the use of surveying instruments, accompanied by drafting-room work consisting of computations and the preparation and interpretation of maps and profiles. This work is preliminary to an extensive summer course in which thorough training is given in surveying and railroad field work. The study of Mechanics is also begun in this year, and the course in Mechanism is given. Descriptive Geometry is completed, and followed by the course in Stereotomy.

In the third year the professional work includes the courses in Railroad Engineering, Highway Engineering, Advanced Surveying, Geodesy, Materials, and the Elements of Structures, in which the student is shown the application of Surveying, Descriptive Geometry, Mechanics, and other branches. In the fourth year the work is almost entirely professional, and leads the student into the details of the various branches of Engineering.

In all this work, the object is to enable the student to apply intelligently to practical problems the principles that he has studied; to give power, to avoid rule-of-thumb methods, and to train the student to have courage and self-reliance in solving the problems that the engineer has to meet.

100. SURVEYING AND PLOTTING.

Professors Robbins, Hosmer, Howard, and assistants.

PREPARATION: M10; M12; D12, D16 or D12a; D16a.

A course of fifteen two-hour exercises per term throughout the second year consisting of lectures and recitations supplemented by exercises in the field and drafting-room. The field-work is confined to the manipulation and use of the chain, compass, transit, and level. The object is to make the student familiar with these instruments before beginning the extensive surveying field-work required at the Summer Camp. The work in the drafting-room consists in making computations which arise in the work of the surveyor, in making scale drawings, profiles, and contour maps, and studying their application to the solution of engineering problems.

The text-book used is The Principles and Practice of Surveying by Professors Breed and Hosmer, Vol. I.

[REQUIRED IN COURSES I., XI.; XV., OPTIONS 1 AND 2, IN SUMMER.]

101. SURVEYING INSTRUMENTS.

Professors Robbins, Hosmer, Howard, and assistants.

PREPARATION: M10; D11; D15.

This very brief course given during the second term of the second year consists of six exercises illustrating the use of surveying instruments.

[REQUIRED IN COURSE XIII.]

102. SURVEYING.

Professors Robbins, Hosmer, Howard, and assistants.

PREPARATION: M10; D11; D15.

A short course of thirty hours, given in the first term to third year students of Course II., and in the second term to second year students of Courses VI. and VII. This course includes field-work, computations, and drafting. The methods of using the compass and chain, the transit and tape, and the level in making plane surveys are explained by lectures and by field exercises. In the drawing room are made the computations and drawings necessary to interpret surveying field notes.

[REQUIRED IN COURSES II., VI., VII., XV., OPTION 1.]

103. SURVEYING.

Professors Robbins, Hosmer, Howard, and assistants.

PREPARATION: M10; D11; D15.

A short course similar to 102, consisting of thirty hours of exercise and fifteen hours of preparation. Given in the first term of the second year.

[REQUIRED IN COURSE IV., OPTION 2.]

104. SURVEYING.

Professor Howard.

Beginning with the Class of 1918, instruction in surveying to students of Courses III. and XII. will be given at some mining region in the months of June and July following the first or second year. About five weeks' time

will be devoted to field and class-room instruction in plane and topographic surveying. Immediately following this, about two weeks will be devoted to instruction in underground surveying.

[Required in Courses III., Options 1, 3, and XII.]

107. PLANE SURVEYING.

Professors Robbins, Hosmer, Howard, and assistants.

Preparation: 100; M21.

This course given at the Summer Camp consists of field-work supplemented by lectures and work in the drafting-room. The field-work consists in making surveys with the compass and chain and with the transit and tape, the running of profiles and cross-sectioning with the level, and in the astronomical determination of a meridian.

The work in the drafting-room consists in making computations which arise in surveying operations and in making scale drawings, profiles, and contour maps from the field-notes.

The text-book used is The Principles and Practice of Surveying by Professors Breed and Hosmer, Vol. I.

[Required in Courses I., XI., XV., Option 1.]

108. GEODETIC AND TOPOGRAPHIC SURVEYING.

Professors Robbins, Hosmer, Howard, and assistants.

Preparation: 801; 107, taken simultaneously.

This course given at the Summer Camp consists of lectures, field work and work in the drafting-room.

The field work consists of the measurement of a base line, triangulation, and the determination of position astronomically; the making of topographic surveys with the transit; the making of large and small scale maps with the plane table; the use of the sextant in hydrographic surveys; the traverse plane table in making road traverses for small scale maps. The course also includes trigonometric and barometric leveling. The work in the drafting-room consists of making the computations and drawings necessary to interpret the results of the field observations.

The text-books used are The Principles and Practice of Surveying by Professors Breed and Hosmer, Vol. II., and a text-book on Practical Astronomy by Professor Hosmer.

[Required in Courses I., XI., XV., Option 1.]

109. ADVANCED SURVEYING.

Professors Robbins, Hosmer, Howard, and assistants.

PREPARATION: 108.

This course of thirty hours in the first term of the third year is devoted to the construction of stadia diagrams, the completion of the computations and map work of (108) taken during the summer, and in the making of topographic maps from surveys made with the camera.

[REQUIRED IN COURSES I., XI.]

112. ASTRONOMY.

Professors Hosmer, Howard.

PREPARATION: M20; 100, taken simultaneously.

This course consists of thirty exercises in the second term of the second year. Special attention is given to those astronomical observations which may be needed in the practice of the surveyor. Observations with the engineer's transit for latitude, longitude, time and azimuth are a required part of the work.

The text-book used is Hosmer's Practical Astronomy.

[REQUIRED IN COURSE I.]

113. GEODESY.

Professors Hosmer, Howard.

PREPARATION: 112.

This course consists of thirty lectures or recitations in the second term of the third year. The methods of conducting a geodetic survey are discussed in detail, and the more important methods of determining the figure of the earth, both by arc measurements and by pendulum observations, are briefly considered.

The text-book is Crandall's Geodesy.

[REQUIRED IN COURSE I.]

120. RAILROAD FIELD-WORK.

Professors Allen, Breed, and assistants.

PREPARATION: 100; 107, taken simultaneously.

This course is given at the Summer Camp. A survey of a railroad is made about two miles in length. A reconnoissance is first made, and this is followed by a preliminary survey with transit and level and the taking of

contours as a basis for fixing the position of the location survey which is next carried out. All this work follows modern practice in laying out railroads. There is also a systematic drill in running in curves of various kinds, including transition curves, and in staking out earthwork. A small amount of class work of an elementary sort is given at the Camp.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

121. RAILROAD ENGINEERING.

Professors Allen, Breed.

PREPARATION: M22; 100; 120.

This course, of two hours per week during the entire year, consists of a thorough study of curves and earthwork and their application in location and construction. The first term is devoted to the mathematics of curves, with applications to the location of railroads, highways, sewers, pipe lines, etc. The second term is devoted principally to the methods of staking out and computing earthwork, and to the easement curve. Recitation work predominates, particularly in the first term, and many problems are assigned for solution outside and in the class-room. The applications of this course have been in part taken up in course 120 and are further enforced by course 123. The text-books used are Professor Allen's work on Railroad Curves and Earthwork, and his Field and Office Tables.

So much of this course as relates specifically to railroads (twenty hours in all) is omitted by students in Courses I, Option 3, XI, XV, Option 1.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

123. RAILROAD DRAWING.

Professors Allen, Breed.

PREPARATION: 100; 120; 121, taken simultaneously.

This course, given in the third year, supplements the class work of course 121, and the field-work of 120. It requires 60 hours in each term for Course I., Options 1 and 2 and 45 hours in the first term and 75 hours in the second term for Courses I., Option 3 and XI. From notes taken in the field, a map and a profile of the preliminary survey for a railroad are plotted and finished. A further problem consists of a careful study in adjusting a line of railroad location upon a contour map, involving computation of the earthwork, and the preparation of a "mass diagram" for the determination of "haul" and of "borrow and waste." Additional problems are a drawing of a turnout for Course I., Options 1 and 2; a highway location drawing for Course I., Option 3, and a problem in reservoir construction involving balancing of earthwork and estimate of quantities for Course XI.

[REQUIRED IN COURSES I., XI.]

125. RAILROAD ENGINEERING.

Professors Allen, Breed.

PREPARATION: 120; 121; 236.

The course consists of a series of two lectures or recitations a week during the first term and three during the second term of the fourth year. The subjects treated include the following: maintenance of way; the economics of railroad location, with a critical study of train resistance and the influence of grade, distance, curvature, and rise and fall; rolling stock and motive power-brakes; signals; yards and stations; elimination of grade crossings. The object is to give the student a comprehensive knowledge of Railroad Engineering. The text-books used are Track and Track-Work, by Tratman; Economics of Railroad Location, by Wellington; also neostyled notes on Signals and on Railroad Engineering and Economics of Location, by Professor Allen.

[REQUIRED IN COURSES I., OPTION 2, XV., OPTION 1.]

126. RAILROAD DESIGN.

Professors Allen, Breed.

PREPARATION: 125, taken simultaneously.

A course of seventy-five hours in the drawing-room, extending through both terms of the fourth year, including problems in contour location; the proportioning of culverts and water ways; the design of yards, station grounds, interlocking signals, and other practical railroad problems involving the application of the principles taught in courses 121 and 125. Each student is given a different problem to solve, and the work is critically corrected and discussed in detail.

[REQUIRED IN COURSE I., OPTION 2.]

127. RAILROAD ENGINEERING.

Professors Allen, Breed.

PREPARATION: 125; 126; 128, taken simultaneously.

This course consists of two exercises per week during the entire year and is a continuation of the courses required as preparation. Special attention is given to freight and passenger yards and terminals and to their operation; locomotive terminals; coal handling; railroad economics; railroad electrification; investigations and report writing. The object of this course is to give the student a broader training in the larger railroad problems involving traffic conditions and economics.

The text-books used are Freight Terminals and Trains by Droege; Economics of Railway Operation by Byers; Reports of the American Railway Engineering Association, and various other reports and periodicals.

[ELECTIVE IN COURSE I., GRADUATE YEAR.]

128. RAILROAD DESIGN.

Professors Allen, Breed.

PREPARATION: 126; 127, taken simultaneously.

This course is a continuation of course 126 and consists of ninety hours of drawing room work, extending through both terms of the fifth year, including design of freight, passenger and locomotive terminals; grade crossing abolition; estimate of cost of railroad structures and equipment.

[ELECTIVE IN COURSE I., GRADUATE YEAR.]

129. VALUATION OF PUBLIC SERVICE AND OTHER CORPORATIONS.

Professor Swain.

This course is given as a series of class-room exercises for three hours per week throughout the first term together with much outside reading. It consists of the study of the economic and engineering principles underlying the valuation of railroad and other corporate properties, and the method of making a valuation and the court decisions on the various phases of the subject.

[ELECTIVE IN COURSES I., VI., GRADUATE YEAR.]

130. HIGHWAY ENGINEERING.

Professor Hughes.

PREPARATION: 121, taken simultaneously.

This course consists of fifteen lectures given during the second term of the third year. It comprises an outline of the principles governing the location, construction, and maintenance of roads, and the construction and maintenance of pavements for city streets.

[REQUIRED IN COURSE I., OPTIONS 1 and 2.]

132. HIGHWAY CONSTRUCTION.

Professor Hughes.

PREPARATION: 121; 123, taken simultaneously.

A course of forty-five recitations during the second term of the third year.[1] This course is devoted to the study of modern highway construction and maintenance, including city pavements and sidewalks; inspections of roads under construction, and critical examinations of pavements in use to determine the effect of traffic and other factors on the wear of street surfaces. Blanchard and Drowne's Text-book on Highway Engineering will be used.

[REQUIRED IN COURSE I., OPTION 3.]

133. HIGHWAY DRAINAGE.

Professor Porter.

PREPARATION: 123; 162, taken simultaneously.

A course of fifteen exercises given in the first term of the fourth year, in the study of drainage areas, run-off and design of culverts.

[REQUIRED IN COURSE I., OPTION 3.]

134. ADVANCED HIGHWAY ENGINEERING—RESEARCH.

Professors Hughes, Gill.

PREPARATION: 135; 136.

This course will require three hours of conference, and not less than nine hours of preparation every week throughout the year. The work of the course will consist of individual problems of investigation and research in highway construction and maintenance, and the physical and chemical properties of road-making materials.

[ELECTIVE IN COURSE I., GRADUATE YEAR.]

135. HIGHWAY DESIGN.

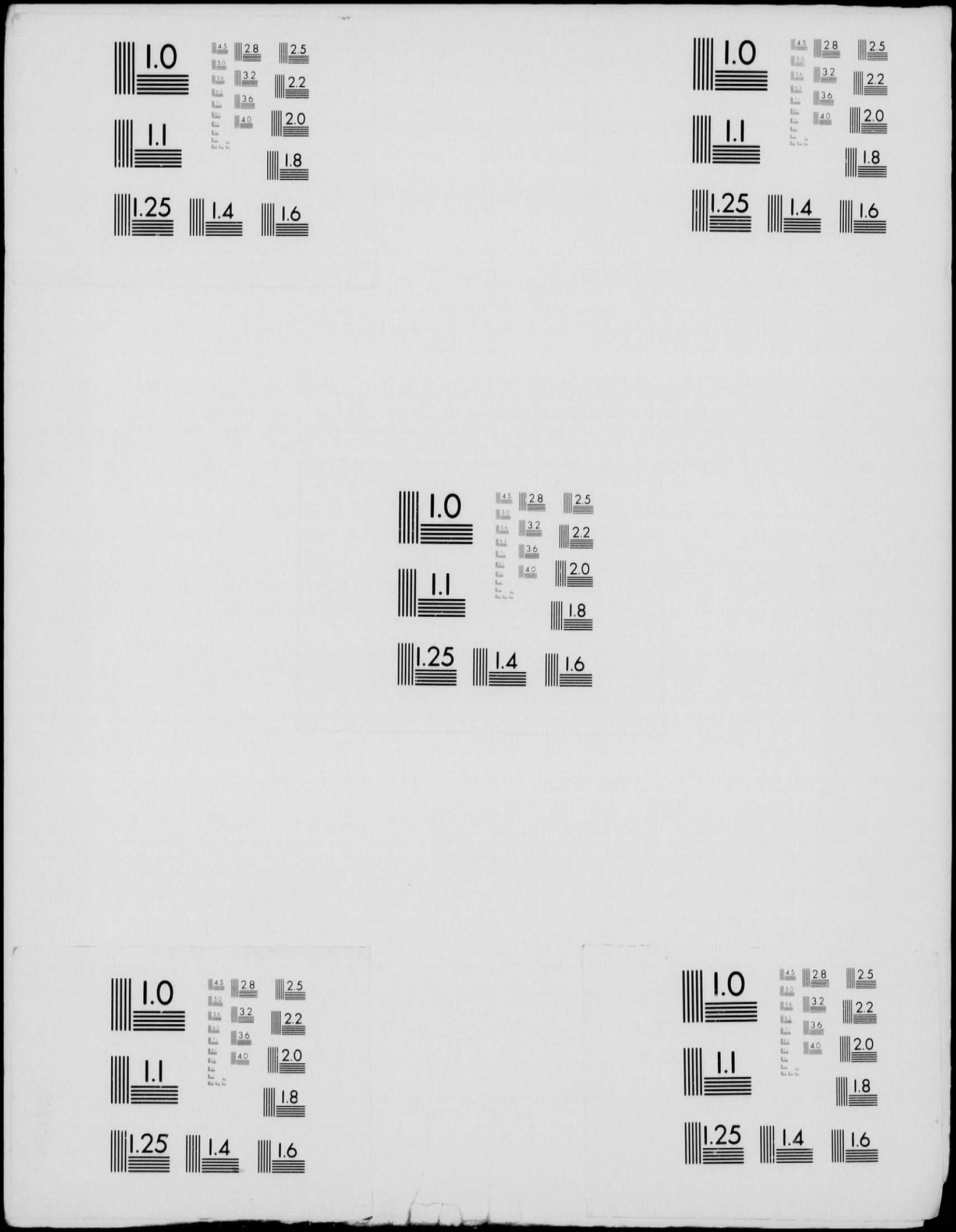
Professor Hughes.

PREPARATION: 137.

A course of sixty hours in the second term of the fourth year in the design of streets and pavements, including detailed designs, finished plans, and estimates of cost of construction.

[REQUIRED IN COURSE I., OPTION 3.]

[1] During the academic year 1915–1916 the course will be given in the first term of the fourth year for students in the Class of 1916.


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136. HIGHWAY ECONOMICS.

Professor Hughes.

PREPARATION: 133; 137.

A course of thirty recitations given in the second term of the fourth year in the methods of financing the construction and maintenance of highways and pavements, and upon the relative merits of different pavements with reference to wear, and the cost of construction and maintenance.

[REQUIRED IN COURSE I., OPTION 3.]

137. HIGHWAY SPECIFICATIONS.

Professor Hughes.

PREPARATION: Ec 60; 132; 139.

A course of forty-five hours of lectures and recitations during the first term of the fourth year, treating of the principles of contracts and specifications with special applications to highway construction, and practice in writing highway specifications.

[REQUIRED IN COURSE I., OPTION 3. NOT GIVEN IN 1915–1916.]

139. TESTING HIGHWAY MATERIALS.

Professors Hughes, Hayward.

PREPARATION: 217; 132, taken simultaneously.

A course of thirty hours of lectures and laboratory work during the second term of the third year, in which physical tests of various kinds of materials used in highway construction are made.

[REQUIRED IN COURSE I., OPTION 3.]

140. THEORY OF STRUCTURES.

Messrs. Barker, Luther and Sutherland.

PREPARATION: 217.

This course consists of forty-five class-room exercises in the second term of the third year, and is devoted to a study of the loads, reactions, shears, and moments in their relation to structures of various kinds, principally roofs and bridges. The practical designing of beams and girders is also taken up. The text-book is The Theory of Structures by Professor Spofford.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

141. THEORY OF STRUCTURES.

Mr. Sutherland.

PREPARATION: 228, taken simultaneously.

This course of three exercises a week in the second term of the third year is essentially identical with course 140, except that somewhat greater attention is given to the conditions and structures met with in the practice of the architect. The text-book is the same as for course 140.

[REQUIRED IN COURSE IV., OPTION 2.]

143. MATERIALS.

Professor Johnson; Mr. O'Neill, and Special Lecturers.

PREPARATION: 217 or 220; 140 or 141, taken simultaneously.

This is a course of thirty exercises in the second term of the third year, designed to acquaint the student with the properties of the various materials used by the engineer, such as stone, brick, cement, concrete, wood, iron, and steel. The text-book used is Johnson, The Materials of Construction.

[REQUIRED IN COURSES I., XI., IV., OPTION 2, XV., OPTION 1. COURSE IV., OPTION 2 OMITS 5 HOURS OF PREPARATION.]

144. STATIONARY STRUCTURES.

Mr. Barker.

PREPARATION: 218.

This is a course of three hours a week during the second term of the fourth year designed to give students in electrical engineering a knowledge of the fundamentals of the theory of structures. The text-book used is Spofford's Theory of Structures.

[REQUIRED IN COURSE VI.]

145. THEORY OF STRUCTURES.

Professor Swain; Mr. Barker.

PREPARATION: 229.

This is a course specially arranged for the Naval Constructors, and consists of forty-five classroom exercises during the second term of the graduate year, together with about sixty hours in the drawing-room. It is intended to

give an outline of the methods of computing and designing structures, with the object of enabling the students to meet the simpler structural problems arising in the design of ships. The text-book is the same as for course 140.

[REQUIRED IN COURSES XIII.A., XIII.B.]

148. FOUNDATIONS.

Mr. Gow.

PREPARATION: 149 or 151, taken simultaneously; or 225.

A course of fifteen exercises in the first term of the fourth year, devoted to the study of the methods of constructing foundations for bridges, buildings, and other structures. Baker's Masonry Construction is used as a text-book.

[REQUIRED IN COURSES I., II., IV., OPTION 2, XV., OPTION 1.]

149. THEORY OF STRUCTURES; BRIDGES AND SIMILAR STRUCTURES.

Professors Spofford, Johnson; Mr. Sutherland.

PREPARATION: 140; 143.

This is an extended course consisting of three exercises a week throughout the fourth year, in continuation of course 140. It treats of the computation and design of structures of wood, steel, and masonry, by analytical and by graphical methods. The subjects considered are: the plate girder, roof and bridge trusses of various forms, trestles of wood and steel, earth pressure, retaining walls, masonry dams, arches of metal, stone, and concrete, and reinforced concrete structures. The object is to train the student thoroughly in the application of the principles of Mechanics to the design of structures. The text-book is "The Theory of Structures" by Professor Spofford.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

150. ADVANCED STRUCTURES.

Professor Swain.

PREPARATION: 149.

This course consists of thirty class-room exercises in the second term of the fourth year, in continuation of course 149. It treats of the deflections of framed structures, continuous girders, swing bridges and certain other subjects. The course is given by classroom exercises supplemented by Spofford's "Theory of Structures."

[REQUIRED IN COURSE I.]

151. THEORY OF STRUCTURES.

Professor Spofford.

PREPARATION: 141; 143.

A course of three hours per week, extending throughout the fourth year, essentially similar to course 149, except that it is more specifically adapted for students in Architectural Engineering. The text-book is the same as for course 149.

[REQUIRED IN COURSE IV., OPTION 2.]

153. BRIDGE DESIGN.

Messrs. Barker, Sutherland.

PREPARATION: 149, taken simultaneously.

A drawing-room course of six hours a week with frequent lectures, throughout the fourth year. It aims to show the student the relations of the theory of structures to engineering practice through the preparation of designs and working drawings for a plate girder railway bridge, a wooden roof truss, a reinforced concrete structure and a steel truss highway bridge. Emphasis is laid on the cultivation of careful, systematic and practical habits of computation.

[REQUIRED IN COURSE I.]

154. STRUCTURAL DESIGN.

Professor Johnson.

PREPARATION: 149, taken simultaneously.

This is a course similar in character to course 153, but much shorter, consisting of sixty hours, in the first term of the fourth year, and intended to give only an outline of the subject.

[REQUIRED IN COURSE XI.]

155. STRUCTURAL DESIGN.

Messrs. Barker, Sutherland.

PREPARATION: 149, taken simultaneously.

A drafting-room course of five hours per week throughout the second term of the fourth year, accompanied by frequent lectures in which the students are instructed in the design of structures in steel and concrete.

[REQUIRED IN COURSE XV., OPTION 1. NOT GIVEN IN 1915–1916.]

156. STRUCTURES OF METAL, WOOD, AND MASONRY.

Professor Swain; Mr. Luther.

PREPARATION: 150; 153 or 492.

This course is a continuation of course 150 and consists of three hours per week in the class-room throughout the year. The course requires a large amount of preparation involving the solution of problems and investigation of references. Among the subjects considered are the computation and design of steel frames for bridges, buildings, towers, standpipes, etc.; structures of concrete and reinforced concrete, such as dams, standpipes, subways and tunnels, buildings and reservoirs; steel and reinforced concrete arches, suspension bridges, and the general study of indeterminate structures by various methods.

[ELECTIVE IN COURSES I., XI., GRADUATE YEAR, AND IN IV., OPTION 2. OPEN TO UNDERGRADUATES ONLY BY PETITION.]

156a. ADVANCED STRUCTURAL DESIGN.

Professor Swain; Mr. Luther.

PREPARATION: 150; 153 or 492; 156, taken simultaneously.

This course consists of six hours' work per week throughout the year in the drafting-room. The problems selected will be adapted to the individual needs of the student.

[ELECTIVE IN COURSES I., IV., OPTION 2, GRADUATE YEAR.]

157. REINFORCED CONCRETE THEORY.

Mr. Sutherland.

PREPARATION: 140.

An elective course of thirty class-room exercises in the first term of the fourth year in which a study is made of the theory of reinforced concrete construction.

[ELECTIVE FOR UNDERGRADUATE STUDENTS. ADMISSION ONLY BY PETITION.]

158. REINFORCED CONCRETE DESIGN.

Professor Johnson; Mr. Sutherland.

PREPARATION: 149.

This course consists of forty-five hours of class-room exercises in the first term in which instruction is given in the theoretical and practical principles

involved in the design of structures of reinforced concrete. The problems considered are chiefly those of building construction with some attention given to retaining walls and beam bridges.

[ELECTIVE IN COURSES I., XI., GRADUATE YEAR, AND IN IV., OPTION 2.]

159. REINFORCED CONCRETE RESEARCH.

Professor Johnson; Mr. Sutherland.

PREPARATION: 149; 158.

This course is given in the second term and includes conferences, reading, computing, laboratory investigation, visits to work under construction, preparation of reports, designs, estimates, and technical papers, participation in technical discussions, or anything likely to advance knowledge of the subject. In this course ability to read German and French is of great assistance. The work of each student will, as far as possible, be arranged to meet his individual needs or preferences.

[ELECTIVE IN GRADUATE YEAR OF COURSES I., IV., OPTION 2, XI.]

160. HYDROGRAPHIC SURVEYING.

Professor Russell and assistants.

PREPARATION: 107; 108, taken simultaneously.

(a) *Stream Gaging.*—This course given at the Summer Camp is designed to teach the methods of measuring in the field large volumes of water flowing in open channels. The work in the field is prefaced by ten hours of class-room work, in which time the student studies the laws relating to the distribution of velocity in the cross-section of streams and the construction and use of instruments designed to measure the velocity. The problem of establishing and maintaining a gaging-station is also discussed. In the field each student, as a member of a small party, partakes in making several complete gagings, by means of current meters and floats, of the volume flowing in a stream where quantities ranging from one to several hundred cubic feet per second are found. In the drafting-room are taught the best methods of computing the discharge from data obtained in the field. Notes prepared by Professor Porter are used in this course as a text-book.

(b) *Soundings.*—Gardner's Lake furnishes splendid opportunity for instruction in the theory and practice of charting large bodies of water. The student is instructed in the use of the sextant and the transit for locating soundings, and different methods of sounding are practised. In the drafting-room the student is given opportunity for plotting a portion of the data secured.

[REQUIRED IN COURSES I., XI.]

162. THEORETICAL HYDRAULICS.

Professors Porter, Hughes, Russell.

PREPARATION: 215.

A course of forty-five text-book exercises given in the first term of the fourth year, with the solution of numerous problems, covering the principles of hydrostatic and hydrodynamic pressure, the flow of water through orifices and nozzles, over weirs and through pipes and open channels, and the losses from friction and other sources. Russell's Hydraulics is used as a text-book.

[REQUIRED IN COURSES I., XI.]

163. THEORETICAL HYDRAULICS.

Professor Barrows; Mr. Luther.

PREPARATION: 215.

A brief course of twenty text-book exercises for Course III., Options 1 and 2 and fifteen exercises for Courses X., XIII., and XIII.B., taking up selected portions of the work given in course 162. Given in the fourth year. The text-book used is Russell's Hydraulics.

[REQUIRED IN COURSES III., OPTIONS 1 AND 2, X., XIII., XIII.B.]

164. THEORETICAL HYDRAULICS.

Professors Barrows, Russell; Mr. Luther.

PREPARATION: 215.

A course of thirty text-book exercises, dealing with selected portions of the work given in course 162, especially with flow through pipes. Given in the first term of the fourth year. The text-book used is Russell's Hydraulics.

[REQUIRED IN COURSES II., VI., XV., OPTIONS 1 AND 2.]

168. HYDRAULIC ENGINEERING.

Professor Russell.

PREPARATION: 164.

A course of forty-five exercises in the second term of the fourth year, devoted in part to a study of the hydraulic principles underlying the proper design of impulse wheels and reaction turbines; and, in part, to problems of stream flow, storage and the general arrangement of water power plants.

[REQUIRED IN COURSE II.]

169. HYDRAULIC ENGINEERING.

Professor Barrows.

PREPARATION: 164.

A course of thirty hours during the second term of the fourth year in continuation of course 164. This is essentially a course in water power engineering, including a study of theory and practice of hydraulic turbines and impulse wheels, the study of hydrology and storage, and estimates of available power and the general arrangement of water power plants. The text-book used is Daugherty's Hydraulic Turbines and Notes on Water Power Engineering by Professor Barrows.

[REQUIRED IN COURSES VI., XV., OPTIONS 1 AND 2.]

172. HYDRAULIC LABORATORY.

Professor Taft, and assistants.

PREPARATION: 162.

A course of eight laboratory exercises of two hours each in the second term of the fourth year. The time is devoted to testing pumps, ejectors, pulsometers, etc.; to measuring water by means of weirs, meters, nozzles and orifices; and to making efficiency tests of water wheels.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

173. WATER POWER ENGINEERING.

Professor Barrows.

PREPARATION: 144 or 149; 169 or 176; 182, taken simultaneously.

This course is a continuation of courses 169, 176, and comprises three classroom exercises per week during the entire year. It includes detailed studies of hydrology, storage and available power with particular reference to some water power project, the designs for which are made in course 182 (taken simultaneously with 173).

Studies and reports upon details of water power development are also made, as well as of the comparative economy and valuation of water power. One or more visits are made each year to water power plants in New England and reports made upon important features. Mead's Water Power Engineering is used for reference.

[ELECTIVE IN COURSES I., VI., GRADUATE YEAR.]

175. HYDRAULIC AND SANITARY ENGINEERING.

Professor Porter.

PREPARATION: 162, taken simultaneously.

A course of three exercises a week in the first term. This course and 176 form a continuous series of exercises extending throughout the fourth year, and treating of the application of the principles of Hydraulics to engineering, especially to what is classed as sanitary work. The class-room work is supplemented by many problems, and by work in design (course 179). The course in the first term deals mainly with a study of works for the sewerage of cities and towns and for the treatment and disposal of sewage; together with a course in irrigation in which are studied diversion weirs, canals, distributaries, falls, regulators, and other special works employed in this branch of engineering. The text-books used are Folwell's Sewerage, Swan and Horton's Hydraulic Diagrams, and Newell and Murphy's Principles of Irrigation Engineering.

[REQUIRED IN COURSE I., OPTION 1.]

176. HYDRAULIC AND SANITARY ENGINEERING.

Professor Porter.

PREPARATION: 175.

This course of three hours per week in the second term of the fourth year is a continuation of course 175, and is partially described under that head. The subject of water supply is taken up, and embraces the study of the quantity of water required for city and town supplies, estimation of the yield from drainage basins, stream flow and ground water flow, computations to determine the necessary storage to insure a given supply, the proportioning of standpipes, conduits, and distribution systems, conditions affecting the quality of water, and sedimentation and filtration works for improving the quality. The subject of water power is also studied with attention to the considerations governing the location and development of water-power plants, modes of estimating the power capacity of given water privileges, the elementary principles involved in impulse wheels and turbines, and commercial tests of turbines. The text-books used are Turneaure and Russell's Public Water Supplies and Daugherty's Hydraulic Turbines.

[REQUIRED IN COURSE I., OPTION 1.]

177. SANITARY ENGINEERING.

Professor Whipple.

PREPARATION: 162, taken simultaneously.

A course of three exercises a week in the first term. This course and 178 form a continuous series of exercises extending throughout the fourth year. The course will treat comprehensively the general principles of sanitary engineering and will include such matters as city planning, housing, fire prevention, street cleaning, refuse disposal, sewerage and sewage disposal. The class-room work will be supplemented by many problems and will be arranged so as to work in harmony with course 179 in sanitary design. The reading of assigned references will form an important part of the work. The required text-books will be Folwell's Sewerage and Fuller's Sewage Disposal.

[REQUIRED IN COURSE XI.]

178. SANITARY ENGINEERING.

Professor Whipple.

PREPARATION: 177.

This course is in continuation of 177 and requires six hours per week in the second term of the fourth year. A large part of the time will be devoted to the subject of public water supplies, in the study of which the following matters will be taken up; quantity of water required for city supplies, estimation of yields of catchment areas, ground water supplies, storage computations, quality of water and methods of water purification. Reference will also be made to public health administration and a sufficient number of exercises will be devoted to vital statistics. The work will consist of class-room exercises and exercises in the drafting room. The text-book used will be Turneaure and Russell's Public Water Supplies.

[REQUIRED IN COURSE XI.]

179. HYDRAULIC AND SANITARY DESIGNING.

Professors Porter, Barrows, Russell.

PREPARATION: 175; 149 and 176, taken simultaneously.

In this course of six hours a week (two hours for Course I.), in the second term, typical subjects for design are assigned, the data seldom being the same for any two students, and are worked out in detail in the drawing-room, subject to the criticism and suggestions of the instructor in charge. Problems commonly taken up are: the preliminary design of a system of sewers for a small town, the design of a cross-section of a large sewer to be built in ground of specified character and to conform to given requirements as to carrying capacity and a design for a high masonry dam.

[REQUIRED IN COURSES I., OPTION 1, XI.]

181. ENGINEERING OF WATER AND SEWAGE PURIFICATION.

Professor Porter.

PREPARATION: 149; 176; 183, taken simultaneously.

A course of one hundred and twenty hours in the first term dealing with the principles and methods applied in the purification of water supplies and of sewage, with a study in detail of engineering features involved in the construction of filter basins, septic tanks, contact beds, continuous filters and land disposal areas.

[ELECTIVE IN COURSES I. AND XI., GRADUATE YEAR.]

182. WATER POWER DESIGN.

Professor Barrows.

PREPARATION: 173, taken simultaneously.

This course supplements 173, and consists of six hours per week throughout the year devoted to the design of works connected with water power development.

[ELECTIVE IN COURSES I., VI., GRADUATE YEAR.]

183. SANITARY DESIGN.

Professor Porter.

PREPARATION: 181, taken simultaneously.

This course supplements 181, and consists of six hours per week throughout the year devoted to the design of works connected with the purification of water and sewage.

[ELECTIVE IN COURSES I., XI., GRADUATE YEAR.]

190. VITAL STATISTICS.

Professor Whipple.

A course of fifteen two-hour exercises in the first term of the fourth year. The work includes a general consideration of the statistical method, the collection of statistics, the consideration of errors, and preparation and

critical analyses of morbidity and mortality rates. Special attention is given to the use of vital statistics in connection with the work of departments of public health.

[Required in Course VII. Elective to Properly Qualified Graduate Students, and to Under-graduates other than those in Course VII. by Petition only.]

195. TOPOGRAPHICAL DRAWING.

Professors Burton, Robbins, Hosmer, Howard, and assistants.

Preparation: D11 and D15; D32.

This course consists of two hours per week in the drafting-room for one term, and is devoted to the study of the different conventional signs employed in making topographical maps. Each student is required to make a number of plates, and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

[Required in Courses I., XI.]

197. STEREOTOMY.

Professor Russell and assistants.

Preparation: D23.

A series of three hours per week in the second term of the second year, in the applications of Descriptive Geometry to the making of drawings for masonry structures, such as intersecting arches and walls, abutments, piers, and culverts. The time is nearly all spent at the drawing board, but a moderate amount is assigned to outside preparation. The text-book used is a set of notes on Stereotomy specially prepared for the use of students in this course by Professor Porter.

[Required in Course I.]

199. SPECIFICATIONS AND CONTRACTS.

Professor Swain.

Preparation: Ec 60.

A course of thirty hours during the second term discussing the application of contract and other law to specifications used by the engineer. The course

involves a detailed study of the provisions commonly found in engineering specifications from the legal as well as from the engineering point of view.

[ELECTIVE IN COURSES I. AND XI., GRADUATE YEAR. OPEN TO UNDERGRADUATES ONLY BY PETITION.]

SPECIAL LECTURES.

In addition to the above regular courses of instruction, occasional lectures are given by prominent engineers, in active practice in their profession, upon subjects with which they are especially familiar. Students also have the opportunity to hear many lectures by practising engineers at the meetings of the Society of Arts, and of the Civil Engineering Society.

DEPARTMENT OF MECHANICAL ENGINEERING, APPLIED MECHANICS AND MECHANIC ARTS.

EDWARD F. MILLER, S.B.
Professor of Steam Engineering.

ALLYNE L. MERRILL, S.B.
Professor of Mechanism.

LIONEL S. MARKS, S.B., M.M.E.
Professor of Mechanical Engineering.

CHARLES E. FULLER, S.B.
Professor of Theoretical and Applied Mechanics.

WILLIAM A. JOHNSTON, S.B.
Professor of Theoretical and Applied Mechanics.

CHARLES F. PARK, S.B.
Professor of Mechanism.

GEORGE B. HAVEN, S.B.
Professor of Machine Design.

JOSEPH C. RILEY, S.B.
Associate Professor of Heat Engineering.

CHARLES W. BERRY, S.B.
Associate Professor of Heat Engineering.

HARRISON W. HAYWARD, S.B.
Associate Professor of Theoretical and Applied Mechanics.

ARTHUR E. NORTON, PH.B.
Assistant Professor of Engineering Drawing.

THEODORE H. TAFT, S.B.
Assistant Professor of Mechanical Engineering.

WALTER H. JAMES, S.B.
Assistant Professor of Mechanical Engineering Drawing.

LAWRENCE S. SMITH, S.B.
Assistant Professor of Theoretical and Applied Mechanics.

GEORGE W. SWETT, S.B.
Assistant Professor of Machine Design

Instructors.

JAMES R. LAMBIRTH.
ROBERT H. SMITH.
CHARLES E. LITTLEFIELD.
ROY G. BURNHAM, S.B.
MYRON W. DOLE, S.B.
ADDISON F. HOLMES, S.B.
WALTER HUMPHREYS, S.B.
IRVING H. COWDREY, S.B.
MALCOLM C. MACKENZIE.
JEREMIAH F. O'NEIL.
JESSE J. EAMES, S.B.
WILLIAM H. JONES, S.B.
FRANK A. BROWN.
DEAN PEABODY, JR., S.B.
WILLIAM H. WENGERT, B.S., S.B.
RALPH G. ADAMS, S.B.
DEWITT M. TAYLOR, S.B.
KENNETH C. ROBINSON, S.B.
GEORGE H. CLARK, S.B.

Assistants.

ARTHUR B. ENGLISH.
JAMES T. SHORROCK.
HARRY G. DAVIES.
HARRY M. MOSHER.
ARTHUR L. BROWN, S.B.
CHARLES W. BURRAGE, S.B.
ELLIS W. BREWSTER, S.B.
ARTHUR F. PETTS, S.B.
HORATIO W. BROWN, S.B.

Many of the subjects taught by the Mechanical Engineering Department are fundamentals in nearly all of the different branches of engineering; consequently instruction is given not only to the students in Mechanical Engineering but also to those taking Civil, Sanitary, Electrical, Chemical, Naval Architecture and Marine Engineering; to students in Architecture, Electrochemistry and to those taking the Metallurgical option in Mining Engineering. To meet the requirements of the various departments, courses of different length are given in a number of subjects.

The instruction which is given by means of lectures, recitations, drawing room and laboratory work, is planned to develop in the mind of the student the power of thinking for himself and to cultivate in him the ability to apply to the solution of practical problems sound theoretical knowledge.

The instruction in Applied Mechanics is given in the second, third and fourth years. The fundamental principles of Statics, Kinetics and the Strength of Materials are developed in an extended series of lectures and recitations. The work is

so planned as to impart to the student a thorough knowledge of such principles as will be of practical use in his profession.

Particular attention is given to the solution of problems which involve the application of these principles in engineering practice and which test the student's ability to apply what he has learned.

The instruction is followed by a series of lectures and recitations intended to familiarize the student with such data upon the strength of materials as have been obtained by means of experiments. In connection with this portion of the work and in illustration of it, a series of laboratory exercises is given in which the student is taught to make tests on the strength and resisting properties of materials, especial emphasis being laid upon tests made upon full-sized pieces under the conditions of practice. The theory of friction, of continuous girders, of stone and iron arches and the theory of elasticity and its applications are also treated at considerable length.

The instruction in Mechanic Arts aims to give a systematic training in the typical operations to be performed with the different tools and appliances used in the foundry, in the forge shop, in the machine shop and in wood working.

The student is taught how to sharpen and to adjust all edge tools used, also the proper speeds, cutting angles and feeds for the various materials worked.

In order to make a student familiar in as short a time as possible with the different operations and with the different methods used in any branch of the work, every problem given him is so chosen as to bring in each time one or more new operations.

The instruction is mainly by lecture, each new operation being described and discussed just before the work is to be undertaken; notes and text-books are also used. Supplementary illustrated lectures are given in connection with many of the courses descriptive of industrial appliances and methods of production used in large establishments. Excursions are taken with the instructor to the various forge shops, machine shops and foundries near Boston.

200. MECHANISM.

Professors Merrill, Park, James, Norton; Messrs. Dole, Mackenzie.

PREPARATION: M12, D12 or D12a, D16 or D16a, and 801, which may be taken simultaneously.

This course consists of sixty-five lectures and recitations (sixty in Course X.) during the first and second terms, of the second year. It includes a systematic study, not only of the motions and forms of the various mechanisms occurring in machines, and the manner of supporting and guiding the parts, independently of their strength, but also of the design of gear-teeth and the theory and practice of designing valve gears for steam engines, including the plain slide-valve, link motions, radial valve-gears, double valves, and drop cut-off valves.

[REQUIRED IN COURSES II., VI., X., XIII., XIII.B.]

201. MECHANISM.

Professor Merrill; Messrs. Dole, Humphreys, Mackenzie, Adams.

PREPARATION: M12, D12 or D12a, D16 or D16a, and 801, which may be taken simultaneously.

A course of thirty hours given in the first or second terms of the second or third year. A brief course, omitting valve-gears. Not given in Course III., Option 2, until 1916–1917.

[REQUIRED IN COURSES I., III., OPTION 2, VIII., OPTION 3, XI., XIV., XV.]

204. MECHANISM OF MACHINES.

Professor Swett; Mr. Wengert.

PREPARATION: 200, 208.

In order to supplement the work in pure mechanism taken in the second year, thirty lectures with thirty-five hours preparation in the second term of the third year are devoted to a consideration of applied mechanisms. A large number of complicated machines such as those used in textile and other industrial operations are described in complete detail by the use of the stereopticon. In this manner the application of fundamental mechanisms to a great variety of uses is studied. The advisability of using certain mechanisms when considered from the constructive standpoint is discussed. In studying the application of the mechanical principles con-

sideration is given to the methods of manufacture of the various machine parts. In this manner an attempt is made to furnish the student with a fund of practical mechanisms, each designed to accomplish a definite purpose, upon which he may draw for future use. Each student is required to sketch and describe in detail certain of the mechanisms taken up in the lectures and to perform the calculations necessary in regard to velocities and cutting speeds.

[Required in Course II.]

206. MECHANICAL ENGINEERING DRAWING.

Professor James; Messrs. Dole, Mackenzie, and assistants.

Preparation: 200, which may be taken simultaneously.

A course of lectures and drawing-room exercises during both terms of the second year. The character of the instruction and the amount of time devoted to it vary with the different professional courses. The course is intended to give a general understanding of working drawings of machinery and some familiarity with the methods of representation and dimensioning. In addition, some training is given in the solution of practical problems supplementary to the course in Mechanism, such as problems in belting, the design of cams, gear-teeth, etc.

[Required in Courses II., VI., X., XIII.]

207. MECHANICAL ENGINEERING DRAWING.

Professor James; Mr. Mackenzie and assistants.

Preparation: D12 or D12a, D16 or D16a, which may be taken simultaneously.

A course of lectures and drawing-room exercises in the first term of the second or third year devoted to the making of dimensioned working drawings of simple machines from measurements. The instruction includes conventional representations and the process of blue-printing.

[Required in Courses XIV., XV., Option 3.]

208. MACHINE DRAWING.

Professor James; Messrs. Burnham, and Adams.

Preparation: 200; 206; for Course XV. 201.

A course of lectures and drawing-room exercises in the third year giving thorough instruction in making and using working drawings of

machinery, both detail and assembly drawings. Considerable attention is given to the study of modern drafting-room systems.

[REQUIRED IN COURSES II., III., OPTION 2, VI., X., XV., OPTION 2.]

209. MECHANICAL ENGINEERING DRAWING.

Professor James; Messrs. Burnham and Adams.

PREPARATION: 208; 215 or 219.

A course of ninety hours (one hundred and five in Course XV.) in the second term of the third year giving advanced work of the same nature as Course 208. In addition, a certain amount of time is devoted to the study of problems in mechanism design such as would be met in designing a machine or in investigating the action of an existing machine.

[REQUIRED IN COURSES II., XV., OPTION 2.]

215. APPLIED MECHANICS (Statics—Stresses in Frames—Kinetics).

Professors Johnston, Fuller, Hayward, Smith; Messrs. Holmes, Cowdrey, Peabody.

PREPARATION: M22 and 801, which may be taken simultaneously.

A course of forty-five lectures (or recitations) in the second term of the second year for Courses I., II., VI., XI., XIII., XIV., and XV. Options 1 and 2, and in the first term of the third year for Course III.; also a course of sixty lectures (or recitations) in the first term of the third year for Course X., and in the first term of the fourth year for Course XV., Option 3. The course comprises a study of statics, consisting of the general methods and applications of statics, including the determination of reactions, stresses in frames; of distributed forces, center of gravity; of moment of inertia, radius of gyration of plane areas and solids including principal axes and principal moments of inertia; of kinematics and kinetics including the equations for uniform and varying rectilinear and curvilinear motion, centrifugal force, unresisted projectile, pendulum, harmonic motion, rotation, combined rotation and translation, momentum and angular momentum, center of percussion, impact, work, power and kinetic energy.

[REQUIRED IN COURSES I., II., III., VI., X., XI., XIII., XIV., XV.]

216. APPLIED MECHANICS (Strength of Materials).

Professors Johnston, Fuller, Hayward, Smith; Mr. Holmes.

PREPARATION: M22; 215; 801.

A course of forty-five lectures (or recitations), during the first term of the third year.

This course comprises a study of the strength of materials, including the stresses and deformations in bodies subjected to tension, to compression, to shearing; common theory of beams with thorough discussion of the distribution of stresses, shearing forces, bending moments, longitudinal shear, slopes, and deflections; stresses in hooks, in columns, and in beams subjected to tension or compression as well as bending; torsional stresses and stresses in springs.

[REQUIRED IN COURSES II., XIII., XIIIA., XIIIB., XV., OPTION 2.]

217. APPLIED MECHANICS (Strength of Materials).

Professors Johnston, Fuller, Hayward, Smith; Mr. Holmes.

PREPARATION: M22; 215; 801.

A course of sixty lectures (or recitations) in the first term of the third year. The course comprises a study of the strength of materials as described in course 216 with additional applications to simple frames subjected to bending stresses; also a brief study of strains and the relations of the stresses on different planes.

[REQUIRED IN COURSES I., XI., XV., OPTION 1.]

218. APPLIED MECHANICS (Strength of Materials).

Professors Johnston, Fuller, Hayward, Smith; Mr. Holmes.

PREPARATION: M22; 215; 801.

A course of forty-five lectures (or recitations) in the first term of the third year for Course VI., and in the second term of the third year for Courses III. and X. The course comprises a study of the strength of materials as described in course 216. Also a brief study of the experimental data on the strength of materials.

[REQUIRED IN COURSES III., VI., X.]

219. APPLIED MECHANICS (Statics—Stresses in Frames—Strength of Materials).

Professors Johnston, Fuller, Hayward; Mr. Holmes.

PREPARATION: M22; 801.

A course of forty lectures (or recitations) in the first term of the third year. The course comprises the study of statics, with applications; of center of gravity and moments of inertia of plane surfaces; also the strength of materials, mathematically treated, including the stresses and deformations in bodies subjected to tension, to compression, to shearing; also the common theory of beams with thorough discussion of the distribution of the stresses, shearing forces, bending moments, and longitudinal shear.

[REQUIRED IN COURSE IV., OPTION 1.]

220. APPLIED MECHANICS (Statics—Stresses in Frames—Strength of Materials).

Professors Johnston, Fuller, Hayward, Smith.

PREPARATION: M22; 801.

A course of sixty lectures (or recitations) in the first term of the third year. The course includes a study of statics, with applications; of center of gravity and moment of inertia of plane surfaces; of kinetics; of the strength of materials. The work given is similar to part of that described in courses 215 and 216.

[REQUIRED IN COURSE IV., OPTION 2.]

221. APPLIED MECHANICS (Strength of Materials).

Professor Johnston.

PREPARATION: M22; 801.

A course of thirty lectures, or recitations in the second term of the third year.

This course comprises a study of the strength of materials including the common theories of bending, of torsion and of columns; covering a part of the work given in course 216.

[REQUIRED IN COURSE VIII., OPTION 3.]

225. APPLIED MECHANICS (Dynamics—Strength of Materials—Graphic Statics).

Professors Fuller, Johnston.

PREPARATION: 216.

A course of forty-five lectures, or recitations, in the second term of the third year.

The course includes the study of the methods of the design of riveted joints; a mathematical treatment of the continuous girder, planned to apply to parts of machinery and structures where continuity exists. The student is required to solve a considerable number of problems illustrating the application of the fundamental principles dealt with in this portion of the work. The course also includes a study of the general methods of Graphic Statics with applications to the determination of stresses in roof trusses and other framed structures, and to the determination of the stability of masonry arches and abutments. A number of problems illustrating these principles are worked out by the student on the drawing board during this part of the course.

The last part of the course comprises a study of the application of the principles of Dynamics in the determination of stresses due to the inertia of moving parts of machines, the theories of friction, as applied to the distribution of friction on journals and pivots and the transmission of power by belting and ropes.

[REQUIRED IN COURSES II., XV., OPTION 2.]

226. APPLIED MECHANICS (Strength of Materials—Graphic Statics).

Professors Fuller, Johnston.

PREPARATION: 216.

A course of thirty lectures, or recitations, in the second term of the third year.

The course comprises a study of the design of riveted joints, a mathematical treatment of the continuous girder and a portion of the work in Graphic Statics and Dynamics which is given in course 225.

[REQUIRED IN COURSES XIII., XIIIB.]

226a. APPLIED MECHANICS (Strength of Material—Graphic Statics—Theory of Elasticity.)

Professors Fuller, Johnston.

PREPARATION: 216.

A course of forty-five lectures, or recitations, in the second term of the third year.

The course comprises a study of experimental data on the strength of materials similar to that given in course 229; the design of riveted joints; the general methods of Graphic Statics with applications to the determination of stresses in roof trusses and other framed structures; the elementary principles of the theory of elasticity, with applications to the determination of stresses in flat plates, shafting, cylinders and spheres.

[REQUIRED IN COURSE XIIIA.]

227. APPLIED MECHANICS (Strength of Materials—Graphic Statics).

Professors Fuller, Johnston, Hayward.

PREPARATION: 219.

A course of forty-five lectures (or recitations) in the second term of the third year. The course comprises a study of the strength of materials, mathematically treated, including slopes and deflections in beams, the stresses in hooks, columns, and in beams subjected to tension or compression as well as bending; torsional stresses; also the study of data on the strength of materials which have been obtained by means of experiments on full size pieces under practical conditions; a study of the tests required in the standard specifications to determine the quality of materials: also the study of the general methods of Graphic Statics with applications to the determination of stresses in roof trusses and other frame structures.

[REQUIRED IN COURSE IV., OPTION 1.]

228. APPLIED MECHANICS (Graphic Statics—Strength of Materials).

Professors Fuller, Johnston, Hayward.

PREPARATION: 220.

A course of sixty lectures, or recitations, in the second term of the third year.

The course comprises a more extended study of the strength of materials and of experimental data than is given in course 227; also a more complete application of the methods of Graphic Statics to the determination of stresses in roof trusses, arches and other frames and the stability of masonry arches and abutments.

[REQUIRED IN COURSE IV., OPTION 2.]

229. APPLIED MECHANICS (Stability of Structures—Strength of Materials).

Professors Fuller, Johnston.

PREPARATION: 225.

A course of forty-five lectures, or recitations in the first term of the fourth year.

The course comprises a study of experimental data on the strength of materials with especial reference to tests on full sized beams, columns, shafting and other pieces under practical conditions; of experiments to determine the effect on physical properties of different materials of varying conditions of stress, of temperature, and of treatment; and of standard specifications for the composition and physical properties of the different materials used in construction.

The course also includes a study of the methods of treatment of non-homogeneous beams, particularly of the theories underlying the design of reinforced concrete structures; of the construction of simple forms of roof trusses, girders, and arches; the stresses in suspension cords; the theory of curved beams and applications; and the derivation and use of the formulas for the stresses and strains in shafting subjected to combined bending and torsion, thick cylinders and spheres, and flat plates. A considerable number of problems, illustrating applications of these principles in practice, are solved by the students in this course.

[REQUIRED IN COURSES II., XIII., XIII.A., XIIIB.]

230. APPLIED MECHANICS (Theory of Reinforced Concrete Beams and Columns—Continuous Girders—Elastic Arch.)

Professors Fuller, Johnston.

PREPARATION: 228.

A course of twenty-five lectures and recitations in the first term of the fourth year. The course comprises a study of the methods of treatment of non-homogeneous beams with particular reference to the theories underlying the design of concrete structures; also a mathematical treatment of the continuous girder with applications to problems involving the determination of stresses and deflections in cases of beams which are continuous over more than two supports; and the theory of the elastic arch.

[REQUIRED IN COURSE IV., OPTION 2.]

231. ADVANCED THEORY OF ELASTICITY.

Professors Fuller, Johnston.

This course is open to graduates of Course II., and begins with a detailed study of those portions of the general theory that have not been treated

in the undergraduate course. Subsequently, the work will be planned to suit the special needs of the student, one important consideration being the nature of his research work. Some of the topics from which a selection will be made are the theories of torsional and of transverse stress, the theories of impact, the stresses in, and the vibrations of thin rods, plates and shells, the inflexional elastica, thermal effects, etc.

[ELECTIVE IN COURSE II., GRADUATE YEAR.]

233. PHYSICAL CHEMISTRY OF ENGINEERING ALLOYS.

Professor Fay.

PREPARATION: 502; 801.

A course of fifteen lectures given in the second term of the third year. The object of the course is to present to the student the relationships which exist between the constitution of alloys and their physical properties. Equilibrium diagrams of binary alloys will be discussed briefly and the iron-carbon diagram will be discussed in detail, with special reference to the microstructure, and the relationship between structure, heat treatment and mechanical properties.

[REQUIRED IN COURSES II., XIII., XIV.]

235. TESTING MATERIALS LABORATORY.

Professor Hayward; Messrs. Holmes, Cowdrey, Peabody, and assistants.

PREPARATION: 218 or 225; 229, which may be taken simultaneously.

A course of thirty hours, laboratory and preparation, in the first term of the fourth year. The tests made by the students in the Testing Materials Laboratory vary somewhat from year to year but include tests to determine the modulus of elasticity, limit of elasticity, yield point and tensile strength of steel bars, commercial tests on steel bars; tests of the deflection and of the transverse strength of a full-sized iron or steel I-beam, or of a wooden beam subjected to a transverse load; transverse tests on cast iron; tests to determine the modulus of elasticity and the tensile strength of wire; torsional tests of wire; tests to determine the shearing modulus of elasticity and torsional strength of 2-inch steel bar; tests on cement mortars including practice in laboratory methods; tests of the strength of different kinds and sizes of ropes and of different knots used in fastening ropes; tests to determine the ratio of the modulus of rupture to the tensile strength in cast iron and steel; hardness tests on steel and alloys; the crushing strength of timber.

[REQUIRED IN COURSES II., III., OPTIONS 1 AND 2, X., XIII., XIIIA., XIIIB., XV., OPTIONS 1 AND 2.]

236. TESTING MATERIALS LABORATORY.

Professor Hayward; Messrs. Holmes, Cowdrey, Peabody and assistants.

PREPARATION: 217.

A course of thirty hours lectures and laboratory work during the second term of the third year.

The laboratory work is similar to that given in course 235.

[REQUIRED IN COURSES I., VIII, OPTION 3, AND XI.]

237. TESTING MATERIALS LABORATORY.

Professor Hayward; Messrs. Holmes, Cowdrey, Peabody, and assistants.

PREPARATION: 218, taken simultaneously.

A course of twenty hours in the first term of the third year. The course comprises a part of course 235.

[REQUIRED IN COURSE VI.]

238. TESTING MATERIALS LABORATORY.

Professor Hayward; Messrs. Holmes, Cowdrey, Peabody, and assistants.

PREPARATION: 228; 230, taken simultaneously.

This course of thirty hours, given in the first term of the fourth year, is similar to course 235.

[REQUIRED IN COURSE IV., OPTION 2.]

239. TESTING MATERIALS LABORATORY.

Professor Hayward; Mr. Peabody.

PREPARATION: 228; 230, taken simultaneously.

A course of thirty-five hours in the first term of the fourth year, having as its object the familiarizing of the students with the ingredients of concrete, both plain and reinforced, and giving some training in the selection of a proper aggregate from materials which may be at hand, their treatment for various purposes and proper methods of placing. The work done in the Laboratory includes the testing of unknown cement, sand and stone, and the determination of their suitability for use in concrete, and the

testing of reinforcing steel. Lectures are given correlating the laboratory work. Considerable attention is given to cement handling plants, floors, walks, water-proofing, paints, etc.

[Required in Course IV., Option 2.]

ANALYTICAL MECHANICS.

A course of thirty hours in the first and second terms.
A more detailed description may be found under course M65.

[Elective in Courses II., and VIII., Graduate Year.]

243. DYNAMICS OF MACHINES.

Professor Riley.

Preparation: 245 or 246; 229, which may be taken simultaneously.

A course of twenty-five lectures and drawing exercises in the first term of the fourth year. The greater part of the time is devoted to a study of the forces due to inertia of the moving parts of machinery, including crank-and-connecting-rod mechanisms, cams, governors, fly-wheels, etc. Both analytical and graphical methods of differentiation and integration are applied to determine the relations between the motions and the forces associated with them. A study of the measurement of power by means of torsion meters and absorption dynamometers is also included in this course.

[Required in Course II.]

245. HEAT ENGINEERING.

Professors Miller, Marks, Riley, Berry.

Preparation: M22; 200; 206; 216 or 218; 802 taken simultaneously; for Course XIV., M22; 201; 802.

A course of lectures or recitations during both terms of the third or fourth year. It includes a detailed study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; of the flow of fluids through orifices, nozzles, pipes and meters, a discussion of the action of the steam injector; a study of the various cycles of the hot air, internal combustion, and steam engines, of the turbine, air compressor, and refrigeration systems. These engineering applications are treated from the physical, analytical and graphical points of view, so as to give the student a good foundation in the principles of thermodynamics, not only as applied to the discussion of ideal cases, but also in the solution of actual heat engineering problems. The course also

includes a study of the simple, compound and multiple expansion steam engine, of the different types of gas engines, of the gas producer, of compressed air and refrigerating machines, and the methods of testing such machines. A careful study of the mechanical and various thermal efficiencies is made from data based upon reliable tests made on steam engines and turbines, gas engines, compressors and refrigerating systems. The mastery of principles and the discussion of data are much simplified by an extensive use of both the pressure volume and the temperature entropy diagrams. The theoretical work of the course is paralleled by a suitably graded set of drill and engineering problems to be solved independently by the student. The subjects of steam boilers and gas engines are treated at considerable length. Several lectures are given on condensers, air pumps, and the various accessories of a steam plant. The amount and arrangement of the work are varied for the different professional courses.

[Required in Courses II., III., Option 2, VI., VIII., Option 3, X., XIII., XIIIb. Elective in Course III., Graduate Year.]

246. HEAT ENGINEERING.

Professor Peabody.

A course of forty lectures extending through the year on thermodynamics and the mechanism of the steam-engine, similar to the preceding course, but specially adapted to the needs of students taking Course XIIIa.

[Required in Course XIIIa.]

247. HEAT ENGINEERING.

Professor Miller.

Preparation: M22; 201; 802 (taken simultaneously in Course XV.).

A course of forty-five lectures and recitations is given each term of the third or fourth year, on valve-gears, steam engines, power station accessories, thermodynamics and steam boilers.

[Required in Courses I., XI., XV.]

248. HEAT ENGINEERING.

Professor Berry.

Preparation: M22; 201; 802.

A course of sixty lectures and recitations extending throughout the fourth year on the principles of thermodynamics and on their application to the solution of heat engineering problems.

Less time is devoted to the description of purely mechanical features than in the other courses.

[REQUIRED IN COURSE XIV.]

250. ADVANCED HEAT ENGINEERING.

Professors Miller, Marks, Riley, Berry.

A course of study and reading in advanced engineering thermodynamics will be outlined to meet the needs of each student, especial attention being given to the literature bearing on the subject matter of his research work. The distribution of time between study and experimentation will differ with the character of the investigation undertaken by each student.

[ELECTIVE IN COURSE II., GRADUATE YEAR.]

251. INTERNAL COMBUSTION ENGINES.

Professor Riley.

PREPARATION: 246.

This course of twenty lectures or recitations is given in the second term. Internal combustion engines of all kinds are discussed with reference to mechanical details of design required by the various fuels and conditions of operation. About half of the course is devoted to oil and gasoline engines, including the types applied to marine propulsion. Several text-books are used for reference, but most of the reading is assigned from current articles in the technical press and transactions of engineering societies. The lectures are illustrated by lantern slides, photographs and drawings.

[REQUIRED IN COURSES XIIIA., XIIIB., SENIOR YEAR.]

251a. AERO ENGINES.

Professor Riley.

A course of thirty lectures and recitations in the first term. The subject matter of this course is confined to gasoline engines for aeroplanes and airships. A study is made of theoretical principles which may be applied in the design of such light-weight, high-speed motors, including methods of balancing the reciprocating parts and obtaining satisfactory uniform torque. The mechanical arrangements of the principal aero engines in present use are studied in detail.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

252. INTERNAL COMBUSTION ENGINES.

Professor Riley.

PREPARATION: 245, 246, or 247.

This course of fifteen lectures is given during the last eight weeks of the first term. This work is in extension of that given in the courses in Heat Engineering and is similar to that of 251.

[ELECTIVE.]

253. REFRIGERATION.

Professor Berry.

PREPARATION: 245, 246 or 247.

A course of fifteen lectures or recitations in the second term of the fourth year. The course includes a study of the principles underlying the mechanical production of heat, the physical properties of different refrigerants, a description of standard types of refrigerating machines and systems, and a discussion of actual refrigeration problems such as ice-making, warehouse construction, operative difficulties, etc. Brief mention is made of low temperature production by liquefaction of gases and the use of the power-absorbing thermodynamic cycle as a warming engine.

[REQUIRED IN COURSE II.]

254. REFRIGERATION.

Professor Berry.

PREPARATION: 245, 246 or 247.

A course of thirty lectures or recitations in the first or second term similar to the preceding course but of wider scope. Additional time is spent upon the thermodynamics of the different refrigerants and upon the requirements of low temperature refrigeration.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

255. HEATING AND VENTILATION.

Professors Miller, Park; Mr. Snow.

PREPARATION: 245, 270.

A course of fifteen lectures given in the second term of the fourth year. The aim of the course is to give a working acquaintance with the essential engineering principles underlying a correct practice of heating and ventilating work.

[REQUIRED IN COURSE II.]

256. HEATING AND VENTILATION.

Professors Miller, Park; Mr. Snow.

PREPARATION: 801.

Three lectures each week during the first term of the third year. The course includes an elementary study of: (a) The nature of heat and of the thermal phenomenon as they are related to the theory and practice of heating and ventilation; (b) The fundamental principles of heating and ventilating engineering; (c) Methods employed in heating and ventilating work; (d) Hygiene, warming and ventilation.

[REQUIRED IN COURSE IV., OPTIONS 1 AND 2.]

258. STEAM AND MECHANICAL APPLIANCES FOR BUILDINGS.

Professor Miller.

A course of fifteen lectures with fifteen hours preparation and eight hours laboratory work given in the second term of the fourth year. In this course the various steam and mechanical appliances used in connection with the equipment of buildings are discussed.

[REQUIRED IN COURSE IV., OPTION 2.]

259. POWER IN MINING.

Professor Taft.

PREPARATION: 218; 302; 801; 802.

The work in this course of three hours per week in the second term of the fourth year, covers, by lectures, recitations and problems, the principles and types of machines used as sources of power and motors in mining work.

This includes the elements of perfect gases, saturated and superheated vapors and the flow of fluids; a study of the principles of different types of boilers, steam engines, simple and compound; a short study of valve gears, of steam turbines, internal combustion engines, air compressors and power plant accessories.

[REQUIRED IN COURSE III., OPTIONS 1, 3. OPTION 1 ONLY AFTER 1916–1917.]

260. ENGINEERING LABORATORY.

Professor Taft; Messrs. Eames, Jones, Taylor, Robinson, and assistants.

PREPARATION: 245, 246 or 247.

The work in the Engineering Laboratory begins in the second term of the third year and consists of ten two-hour exercises, seven for Course III., Option 2, devoted to elementary experiments which are preparatory to those of the fourth year.

These include the use of the indicator; the method of obtaining the horse-power and steam consumption of a simple engine; the setting of plain slide, piston and Corliss valves; the calibration of steam and vacuum gages; the testing of different types of calorimeters; the measurement of the flow of steam and air through orifices; the determination of the clearances of an engine, etc.

[REQUIRED IN COURSES II., III., OPTION 2, VI., XIII., XIIIB.]

261. ENGINEERING LABORATORY.

Professors Miller, Taft; Messrs. Eames, Jones, Taylor, Robinson, and assistants.

PREPARATION: 200; 245 or 246; 260 (except for Course X.); also for Course II., 163, 243, taken simultaneously.

This course of four hours a week throughout the fourth year is a continuation of the preceding. The work can best be illustrated by the following list of tests made by the students during the past few years:

Tests to determine the efficiency of chain drives.
Tests of the transmission of power by belting.
Tests of the performance of a surface condenser.
Tests of a duplex steam pump, 16, 10½ x 12.
Tests to determine the accuracy of planimeters.
Tests of a 36-horse-power gas-engine.
Tests to determine the efficiency of pulley blocks.
Tests of the flow of steam.
Valve setting (plain slide-valve).
Tests of a pulsometer.
Calibration of orifices for the flow of water.
Determination of the clearance of an engine.
The use of the Emerson power scale.
Valve setting (double valve).
Tests of gauges, steam and vacuum.
Tests of the steam injector.

The use of three different kinds of calorimeters.
Tests of a Humphrey turbine.
Tests of a rotary pump of a capacity of 1,000 gallons per minute.
Measurements of the flow of air.
Tests of the water ejector.
Tests of 36-inch American impulse wheel.
Tests of an air-pump.
Tests on coefficient of friction.
Moment of inertia of connecting rod.
Tests of three-stage air-compressor, 2,500 lbs.
High temperature measurements.
Heat of combustion of coal.
Measurements of the flow of water by means of orifices and weirs.
Test of a 48-inch Pelton water wheel.
Tests of a Rider hot-air engine.
Valve setting (Harris-Corliss engine).
Analysis of chimney gas.
Explosive force and time of reaching maximum pressure of different mixtures of gas and air.
Tests of a hydraulic ram.
A 120-hour plant test on engines and boilers at the Institute.
Tests on a centrifugal pump 40-horse-power input.
Tests on an Emerson pulsometer pump.
Tests on a dry-air pump.
Tests on a 500-kw. Parsons turbine so arranged as to give the pressure at each barrel of each stage.
Tests of one or more types of gasoline engine.
Tests on a 25-car train of Westinghouse air-brakes.
Tests on a 150-kw. Curtis turbine.
A 120-hour continuous test on a battery of Babcock & Wilcox boilers of 1,000 boiler horse-power, together with a plant test on the engine used in the Institute power plant.

The method of conducting the laboratory tests is as follows: tests are made under the direction of seven instructors, three students generally working together on one test. As the students are applying in their laboratory work knowledge they have already gained in the class-room it is necessary only for the instructors to explain the arrangements of piping and connections for any piece of apparatus before beginning work. This makes it possible for a great deal of valuable laboratory work to be done in a period of two hours. Each student in his turn is put in charge of the tests made by that group. Whenever it is safe, the students are made to start the apparatus and do all the work of getting ready for the test. Each student writes a complete report of the test, giving the arrangements, methods of testing, with details of computation. The observations taken on every test are returned to the instructor, who works up the test and crit-

ically compares the student's computation with his own. Course VI. omits fifteen hours in each term, and Course X. omits all of the work of the second term. Course XIIIA. takes sixty hours in the second term. As Course X. has not had 260, the first part of the Course is made up of the more elementary experiments. Courses 532 and 814 are a part of course 261.

[REQUIRED IN COURSES II., VI., X., XIII., XIIIA., XIIIB., XV., OPTIONS 2 AND 3.]

262. ENGINEERING LABORATORY.

Professors Miller, Taft; Messrs. Eames, Jones, Taylor, Robinson, and assistants.

PREPARATION: 245; 260.

Four hours a week during the second term of the fourth year. See course 261.

[REQUIRED IN COURSE III., OPTION 2.]

263. ENGINEERING LABORATORY.

Professors Miller, Taft; Messrs. Eames, Jones, Taylor, Robinson, and assistants.

PREPARATION: 162, 247, taken simultaneously.

A course of seven laboratory exercises of two hours each, with ten hours outside calculation, given in the first term of the fourth year.

The time is devoted to steam engine testing, including the use of the indicator, valve setting, measurement of the flow of air and steam through orifices, testing air compressors, gas engines, etc.

[REQUIRED IN COURSES I., XI.]

266. BOILER DESIGN.

Professors Haven, Swett; Mr. Wengert.

PREPARATION: 208; 225 and 245 taken simultaneously.

This course consists of fifteen lectures and thirty hours of drawing-room work in the second term of the third year. It includes a detailed study of the design of pressure vessels as exemplified by the modern steam boiler. A series of designs of boilers varying in working pressure and horse-power forms the basis of instruction in this course. Careful attention is given to the arrangement of tube sheets to secure good circulation. The different methods of staying boiler heads are analyzed and calculations made to determine the various stresses which exist in such portions of steam boilers.

A thorough study is made of the theory of riveted joints and their application to boiler shells. Standard practice is adopted in the use of manholes, steam nozzles, brackets and other mountings.

In connection with the general instruction given in the subject each student works out in the drawing-room the complete design of a boiler, following certain standard specifications, and prepares the working drawings necessary for use in the shop. Rational, rather than empirical formulæ are employed in the design wherever possible.

[REQUIRED IN COURSE II.]

267. MACHINE DESIGN.

Professors Haven, Swett; Mr. Wengert.

PREPARATION: 266; 229 and 243, taken simultaneously. For Course XV: 225; 235, taken simultaneously.

To this work are devoted, including the time used for lectures, calculations and drawings, four hours per week throughout the fourth year. The main object of this course is a broad application of the principles already embodied in the study of Applied Mechanics. Each student makes a number of complete designs including machines such as straightening presses, power shears, punches and riveters, as well as flywheels, gears and shafting. Special features of machines such as crank-shafts, connecting-rods and bearings, are made the subject of careful analysis. The constructive features of each design are carefully discussed. Each student then works out in detail the calculations necessary to determine the dimensions of every part, as far as possible by the use of rational rather than empirical formulæ.

Lastly, the working drawings necessary for building the machine are completed. The scope of the designs is such as to include most of the elementary principles and is therefore sufficiently broad to enable the student to plan and design machines of greater magnitude.

[REQUIRED IN COURSES II., XV., OPTION 2.]

268. MACHINE DESIGN (Advanced).

Professors Haven, Swett.

PREPARATION: 267.

This course is laid out to suit the special requirements of the candidate. It involves the design of a machine of considerable magnitude and one embodying complex stresses. Such problems as the design of a water-turbine, pump, air compressor, traveling crane, or special automatic machine, form the basis of instruction in this course. When desirable, the candidate may choose the design of some special piece of apparatus to be

used in an original investigation as the subject of his study. The work in this course is of a more advanced character and requires more original effort than that in the undergraduate course in Machine Design.

[ELECTIVE IN COURSES II., III., GRADUATE YEAR.]

270. FACTORY CONSTRUCTION.

Professors Haven, Fuller, Hayward.

PREPARATION: 225; 245; 229; taken simultaneously.

To this work are devoted forty-five hours, divided between lectures, calculations and drawing-room work, during the first term of the fourth year. The course consists of a detailed study of structures used for industrial purposes such as machine shops, factories and textile plants. The principles of building construction including brick and stone work, floors, windows, columns and roofs, are carefully described and studied. A series of typical structures each well adapted to its use, forms the basis of instruction. The manner in which the character of a manufacturing process often determines the type of structure for its housing is emphasized. The uses of concrete, the principles of slow-burning construction, the methods of fire protection, and the elementary principles of shop sanitation, are considered in this course. In the drawing-room each student works out a design of a structure for a definite purpose and makes the necessary drawings for its erection.

[REQUIRED IN COURSE II.]

272. POWER PLANT DESIGN.

Professors Miller, Riley; Mr. Clark.

PREPARATION: 225; 245; 267, taken simultaneously.

A course of sixty hours in the second term of the fourth year. The course consists largely of drawing-room work and calculations with such lectures given by members of the Mechanical and Electrical Departments as may be needed from time to time. The work of the course consists in making the working drawings necessary to show the location of boilers, engines, auxiliaries, piping, coal pockets, etc., for a power house, and also drawings and calculations of some of the details.

[REQUIRED IN COURSE II.]

274. INDUSTRIAL MANAGEMENT.

Professor Park.

PREPARATION: 277, 278, 279, or 280, taken simultaneously.

This course of fifteen lectures in the second term of the fourth year (graduate year for Course XIIIA.) includes a study of the organization and relations of the various departments of an industrial establishment, the location, arrangement, construction and equipment of industrial works for efficiency and economy in manufacturing, efficacious conditions for labor, process mapping or routing, scheduling of work, classification of metal working plants and the machine shop problem, the office and engineering department, forms of industrial organization and differentiation of responsibility, reports, methods of superintendence, employment and cost of labor, systems of compensating labor, and a discussion of the effect on cost of different systems of distributing indirect expenses, and current methods of "efficiency engineering."

[REQUIRED IN COURSES II., XIIIA.]

275. GENERAL ENGINEERING LECTURES.

This course consists of a series of fifteen lectures with fifteen hours preparation, given partly by the instructing staff and partly by outside engineers, and covers matters of general engineering interest. Such subjects as Resistance and Propulsion of Ships, Recent Development in Locomotive Construction, Power Station Economies, Relations of Employer and Employee Regarding Patents, will be treated.

[REQUIRED IN COURSE II.]

277. ENGINE DESIGN.

Professor Riley.

PREPARATION: 243 and the first term of 267.

A course of lectures and drawing exercises given fifty hours in the second term of the fourth year.

The option in Engine Design begins with a detailed study of reciprocating steam-engines. Typical engines by leading builders are discussed with reference to special requirements of the services in which they operate, and to shop methods of construction, as well as to the way in which the thermodynamic and mechanical problems are worked out. In the drawing-room the student designs an engine, applying the scientific principles of heat engineering and mechanics to determine the best steam distribution and also the size and strength of the engine's essential parts. This course

follows soon after the instruction in Dynamics of Machines, and is taken together with the second term work in Machine Design, both of which courses are directly applied in this work.

[Required in Course II., Option 1.]

278. LOCOMOTIVE ENGINEERING.

Professor Fuller.

Preparation: 163; 229; 243; 267, taken simultaneously.

A course of lectures and recitations given thirty hours in the second term of the fourth year.

The Option in Locomotive Construction begins with a careful study of the form and proportions of the details of the more usual types of locomotives. Sets of complete detail drawings of modern locomotives, both simple and compound, are used for this purpose, a considerable number of such drawings having been furnished to the department by different locomotive builders. The students make calculations of the stresses to which the various parts are subjected, and thus learn to determine the strength of the different members, modern locomotives being used for this purpose. A study is made, also, in some detail, of the compound locomotive, of train-resistance, of air-brakes, of heating cars by steam from the locomotive, of the modes of conducting locomotive tests, of the economy and performance of both simple and compound locomotives, as shown by tests, etc.

[Required in Course II., Option 2.]

279. MILL ENGINEERING.

Professor Haven.

Preparation: 163; 229; 243; 267, taken simultaneously.

A course of lectures, recitations and drawing exercises given seventy-five hours in the second term of the fourth year.

The Option in Mill Engineering includes the study of mill and building construction and stability, chimney construction and design; the calculation of stresses in an existing modern mill building from working drawings; a discussion of cotton-mill organization and equipment, including the economical arrangement and methods of driving machinery; a study of the different methods of distributing power, the design of the power plant, and determination of cost of power; all leading up to the solution of a problem involving the design of a complete mill plant.

[Required in Course II., Option 3.]

280. STEAM TURBINE ENGINEERING.

Professor Peabody.

PREPARATION: 163; 229; 243 and 267, taken simultaneously.

A course of lectures, recitations, and drawing-room exercises totaling one hundred and thirty-five hours in the second term of the fourth year.

The option in Steam Turbine Engineering gives a discussion of the arrangement and construction of various types of steam-turbine and methods of determining sizes and proportions required for the development and distribution of power and to secure sufficient strength and favorable conditions for operation.

[REQUIRED IN COURSE II., OPTION 4.]

284. FORGING.

Messrs. Lambirth and Brown.

PREPARATION: D11 or D12, D31 or D32, completed or taken simultaneously.

This course consists of thirty-two-hour exercises, one per week during the first term, and two per week for eight weeks in the second term of the second year.

The course includes systematic instruction in the use of each tool as it is taken up, the study of each material worked, with an explanation of its various grades and of the proper methods of treatment for each, and the discussion of methods of making large forgings. The ground covered includes instruction in the building and care of fires, heating, drawing, forming, bending and twisting, upsetting, upsetting while bending, upsetting for square corners, punching, bolt making, welding (including careful instruction in scarfing for the various welds), chain making, and the construction of hooks and ring bolts. The work in steel includes drawing, forming, welding, refining and tempering, and spring and tool making. Training is given in the use of the power hammer and drop forging is also included.

[REQUIRED IN COURSES II., XIII., XIIIB.]

284a. FORGING.

Messrs. Lambirth and Brown.

PREPARATION: D11 or D12, D31 or D32, completed or taken simultaneously.

This course is similar to course 284 but of greater length, sixty hours given in the first term and forty-five hours given in the second term. The increase in time allows more thoroughness and the introduction of additional work.

[ELECTIVE.]

285. FORGING.

Messrs. Lambirth and Brown.

PREPARATION: D12 or D12a, D32.

This course consists of forty-five hours given in the second term of the fourth year. It covers nearly the same ground as that of course 284, but in a less thorough manner.

[REQUIRED IN COURSE III., OPTIONS 1, 2.]

285a. FORGING.

Messrs. Lambirth and Brown.

PREPARATION: D12 or D12a, D32.

This course of thirty hours in the second term is similar to that of Course 285, but with certain abbreviations.

[REQUIRED IN COURSE III., OPTION 2. Not given in 1915–1916.]

287. FOUNDRY WORK.

Mr. O'Neill and assistant.

PREPARATION: D12, D32, completed or taken simultaneously.

This is a course of forty-five hours in the foundry during the second term of the second year (third year for Course XIII., fourth year for Course III., Option 2). Instruction is first given in cutting over and tempering sand and the use of moulder's tools, making two, and three part green sand moulds and making, baking, and testing cores. Ramming, venting, facing, spruing, use of risers, the clamping and weighting of moulds, stopping off, bedding, loose-piece moulding, and use of chills are considered in proper order. Following this come exercises in multiple and duplicate production by use of snap flasks, slip jackets and machines, such as the power squeezer, hinged turn-over, and jarring stripping plate moulding machines. Here the mounting and gating of wood and metal patterns on plates, the use of follow boards, and making of sand and plaster matches is described and illustrated by examples. Floor and sweep moulding are taken up by means of selected typical examples. Castings are first made in white metal for practice, then in brass and in cast iron, when the students are taught pouring, and the running of metal furnaces.

The laboratory work is supplemented by illustrated lectures on loam, large floor and sweep moulding, steel and aluminum casting, foundry appliances and modern methods of production.

[REQUIRED IN COURSES II., III., OPTION 2, after 1916–1917, XIII., XIIIB., XV., OPTION 3.]

288. FOUNDRY WORK.

Mr. O'Neill and assistant.

PREPARATION: D12 or D12a, D32.

This is a course of thirty-five hours in the foundry during the first term of the fourth year. It covers nearly the same ground as that of course 287, but with certain abbreviations.

[REQUIRED IN COURSE X.]

289. WOOD-WORK AND PATTERN-MAKING.

Mr. O'Neill and assistant.

PREPARATION: 287.

This course is a combination of Courses 289a, 289b, and 289c with certain abbreviations.

A course of sixty hours given in the first term of the third year. The course begins with the elements of Joinery and Wood-Turning and leads to the work in Pattern-Making. The exercises include sawing, planing, chiseling, boring, etc.; laying out work; jig, band and circular sawing; and lathe work, including center, chuck, and face plate turning. Thorough training is given in the adjustment, use, sharpening and care of wood-working tools, machines and appliances.

In the making of patterns and core boxes, the principles of molding are carefully considered. The projects include patterns of pipe-fittings, valves, pulleys, gears, hangers, machine parts, etc. The laboratory work is supplemented by illustrated lectures on the construction and foundry application of solid, split and loose-piece patterns; large complete, part and skeleton patterns for floor, loam and sweep work; master and metal patterns; mounting of patterns on plates and their preparation for use on moulding machines.

[REQUIRED IN COURSE II.]

289a. CARPENTRY AND
289b. WOOD-TURNING.

Mr. O'Neill and assistant.

PREPARATION: D11, D31, completed or taken simultaneously.

This course consists of sixty hours given in the first term. The object of the work is a thorough training in the adjustment, use, and sharpening of the ordinary wood-working tools. The exercises in Carpentry include instruction in sawing; planing; chiseling, including chamfering, grooving, and plain moulding work; framing, including tenoning, splicing, mortising and fitting braces; use of the ordinary moulding planes and making mouldings; making and use of the mitre box in fit-

ting mouldings; nailing; dovetailing; gluing; and the proper use of sandpaper. The exercises in Wood-turning include systematic instruction and experience in the use of the wood lathe in center and chuck turning, the discussion of the proper adjustment of cutting speeds for various materials and conditions, and careful training in the use of turning tools such as gouges, turning chisels, nosing tools, right and left side tools, parting tool, calipers, and dividers. Particular attention is given to the production of smooth work by the cutting action of the tools. The course includes also the making of simple patterns.

[ELECTIVE.]

289c. PATTERN-WORK.

Mr. O'Neill and assistant.

PREPARATION: 287 or 288; 289a; 289b.

This course of thirty hours is given in the first term and includes a discussion of the principles of moulding in connection with the making of patterns and core-boxes, and the methods of building up patterns. The projects in this course include patterns of pipe-fittings, valves, pulleys, gears, hangers, machine parts, etc. The laboratory work is supplemented by illustrated lectures on the construction and foundry application of solid, split and loose-piece patterns; large complete, part and skeleton patterns; for floor, loam and sweep work; master and metal patterns; mounting of patterns on plates and their preparation for use on moulding machines.

[ELECTIVE.]

290. VISE AND BENCH WORK.

Messrs. Smith, Littlefield, and assistant.

PREPARATION: D12, D32, completed or taken simultaneously.

A course of thirty hours during the second term of the third year in mechanical processes where the tools are guided principally by hand. The instruction is given by lectures and demonstration at the beginning of each period, supplemented by the text-book. The course is arranged to advance the students in a logical, systematic and progressive manner, and in the shortest time. Each student is required to do problems which involve the application of the following principles and processes:—laying out work, angles of cutting tools, grinding tools, chipping cast iron, chipping key-ways, pneumatic chipping and drilling, classification of files and methods of operating, filing cast iron, filing and fitting steel and wrought iron, alignment and babbitting of bearings, scraping bronze and babbit bearings, steam pipe fitting, autogeneous welding, and measuring the hardness of common metals and hardened, tempered and heat-treated steels with the scleroscope.

[REQUIRED IN COURSES II., XIII., XIIIB.]

290a. CHIPPING AND FILING.

Messrs. Smith, Littlefield, and assistant.

PREPARATION: D12, D32, completed or taken simultaneously.

This course is similar to course 290, but of greater length, more extended training being given in certain portions of the work.

It consists of forty-five hours in the second term. The exercises in Chipping begin with a study of the tools used, with reasons for their shapes, sizes, and cutting angles. The work includes chipping chamfers, flat, concave, and convex surfaces, key-ways, and "chipping to shoulder." The exercises in Filing begin with a study of the names and classification of files, a discussion of the "cut," tooth angles, and uses of each form, and methods of holding and operating. The instruction covers methods of holding and "laying out" work, cross filing, draw filing, free-hand filing, production of flat surfaces, surfaces at right angles, parallel surfaces, chamfering, filing to template, use of hack-saw, fitting, including parallel, drive, and slide fits, finishing and polishing, the construction, care, and use of scraping tools, and the production of flat surfaces, each student making a pair of small surface plates. The course includes also instruction in pneumatic chipping and drilling, steam pipe fitting, and autogenous welding.

[ELECTIVE.]

290b. VISE AND BENCH WORK.

Messrs. Smith, Littlefield, and assistant.

PREPARATION: D12 or D12a; D32.

This course is similar to course 290 but of much shorter length, consisting of ten hours in the first term of the fourth year.

It includes laying out work, grinding tools, hand and pneumatic chipping, filing, alignment and babbitting of bearings, belt lacing, pipe fitting, and measuring the hardness of metals with the scleroscope.

[REQUIRED IN COURSE X.]

291. MACHINE-TOOL WORK.

Mr. Smith and assistants.

PREPARATION: 290.

This is a course of one hundred and five hours, forty-five hours in the first term, sixty hours in the second term of the fourth year. When necessary, instruction is given in the mechanism of the machine-tools used and careful attention is paid to the various adjustments for the work in hand. The different measuring tools and devices, with the advantages, methods of use, and limits of accuracy of each are considered. As each cutting tool is taken up, its cutting angles and general adjust-

ments are discussed, together with the "feeds" and cutting speeds suitable for each material worked and for each machine. The course includes instruction in centering, squaring, straight and taper turning and fitting, outside and inside screw cutting, chucking, reaming, finishing and polishing, drilling, tapping, mandrel making, grinding and lapping, boring, brass turning and finishing, ornamental turning, planing flat and V surfaces, fitting, the use of the milling machine, gear-cutting, tool-making, including taps, drills, reamers, milling cutters, and cylindrical gages.

[REQUIRED IN COURSES II., XIII., XIIIB.]

291a. MACHINE-TOOL WORK.

Mr. Smith and assistants.

PREPARATION: 290 OR 290a.

This course is similar to course 291 but it is one hundred and fifty hours in length, sixty hours in the first term and ninety hours in the second term.

[ELECTIVE.]

292. MACHINE-TOOL WORK.

Mr. Smith and assistants.

PREPARATION: 290b.

This is a course of forty-five hours in the second term of the fourth year. Instruction is given in general machine-tool work, consisting of centering, straight and taper turning and fitting, screw cutting, chucking, finishing, accurate drilling, tapping, cylindrical grinding, shaping and planing, plain and index milling and gear cutting.

[REQUIRED IN COURSE X.]

294. METAL TURNING.

Messrs. Smith, Littlefield, and assistants.

PREPARATION: D11, D12 or D12a, D31 or D32, completed or taken simultaneously.

This is a course of sixty hours, thirty hours each term of the second year. A brief course in Chipping, Filing and Scraping precedes a course in Machine-tool work, special attention being given to brass work. The course includes lathe work, drilling and milling, the object being to give students a training sufficient to enable them to construct experimental apparatus.

[REQUIRED IN COURSES VI., VIII., OPTION 3, XIV.]

295. METAL TURNING.

Mr. Smith and assistants.

PREPARATION: D11, completed or taken simultaneously.

This course of forty-five hours, is given in the first term of the fourth year for Course III., Option 2; in the second year for Course VIII., Options 1 and 2, and in the third year for Course XV., Option 3. The course begins with exercises in elementary Chipping and Filing, which are followed by instruction in lathe work, covering, centering, straight turning, screw cutting, chucking, finishing and polishing, drilling, and tapping.

[REQUIRED IN COURSES III., OPTION 2, AFTER 1916–1917 VIII., OPTIONS 1 AND 2, XV., OPTION 3.]

297. MECHANIC ARTS.

Messrs. Smith, Littlefield, O'Neill.

PREPARATION: D12; D32.

This summer course of seventy-five hours, is a combination of the courses in Vise and Bench Work 290b and in Machine Tool Work 292 with certain changes and with the addition of some foundry work. It is intended to give training in the use of hand tools and in general machine tool work and also instruction in foundry practice.

[REQUIRED IN COURSE XV., OPTION 2.]

SPECIAL LECTURES.

Besides the teaching by the regular corps of instructors, lectures upon special subjects are given by gentlemen actively engaged in the profession.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY.

HEINRICH O. HOFMAN, E.M., MET.E., PH.D.
Professor of Metallurgy.

HENRY L. SMYTH, A.B., C.E.
Professor of Mining and Metallurgy.

ALBERT SAUVEUR, S.B.
Professor of Metallurgy and Metallography.

EDWARD D. PETERS, M.D., DR. ING.
Gordon McKay Professor of Metallurgy.

LOUIS C. GRATON, S.B.
Professor of Mining Geology.

CHARLES H. WHITE, S.B., A.M.
Professor of Mining and Metallurgy.

GEORGE S. RAYMER, A.B., E.M.
Assistant Professor of Mining.

CHARLES E LOCKE, S.B.
Assistant Professor of Mining Engineering and Metallurgy.

EDWARD E. BUGBEE, S.B.
Assistant Professor of Mining Engineering and Metallurgy.

CARLE R. HAYWARD, S.B.
Assistant Professor of Mining Engineering and Metallurgy.

Instructor.

RUFUS C. REED, S.B.

Assistants.

FREDERICK O. STILLMAN, S.B. LOUIS W. CURRIER, S.B.

The study of Mining and Metallurgy covers such a large field of technical endeavor that the courses given cannot follow the details of the several branches. The aim of all instruction is to ground the student in the fundamental principles of the professional studies, and to train his mind and hand that he may be a close observer, a good reasoner, and a conscientious worker.

Instruction is given by lectures and recitations, by laboratory work, and by summer schools. Work in the Department covers studies in Mining, Ore-Dressing, Metallurgy, Metallography, and Assaying. With these are interwoven auxiliary courses in Physics, Chemistry, Mineralogy, Geology, and in Civil, Mechanical, and Electrical Engineering. The manner in which these studies are taken by students pursuing three different Options is given on pages 91–95; descriptions of the subjects are to be found as indicated by the accompanying numbers. All students in the Department follow the same studies for the first year; in the second year there are some differences in the Options; they become very marked in the third and fourth years.

301. ELEMENTS OF MINING ENGINEERING.

Professor Locke.

PREPARATION: D12A; D16A; 502.

A course of fifteen lectures in the second term of the second year. The time is devoted to mechanics and machinery in general, from the viewpoint of the mining engineer, with the special object of preparing the student so that he may readily understand special machinery considered later in courses 302, 303, etc.

[REQUIRED IN COURSE III., OPTIONS 1, 3.]

302. MINING ENGINEERING.

Professor Locke.

PREPARATION: 100; 301; 801; 1201; 215, taken simultaneously.

A course of ninety lectures, three hours per week through the third year. In the first term are discussed the tools of mining, methods of prospecting, and the opening up of deposits, including the sinking of shafts and slopes, the driving of levels, and the working of stopes or rooms for ore or coal, timbering and hydraulicking.

In the second term the subjects considered are tramming, hoisting ore, coal, and men, pumping, ventilating, lighting, explosions, fires, mining law, underground surveying, accounting and the handling of men. The text-book is Richards, "Mining Notes."

[REQUIRED IN COURSE III., OPTION 1; OPTION 3 IN 1915–1916.]

303. MINING ENGINEERING: ORE-DRESSING.

Professor Locke.

PREPARATION: 218; 801; 1201.

This course of lectures three hours per week in the first term of the fourth year is a continuation of the preceding. The greater part of the time is devoted to wet concentration, including crushing machinery, screens, classifiers, jigs, vanners and tables. Magnetic, flotation, pneumatic, electrostatic and other minor processes are also discussed. It is aimed to correlate the lectures with the ore dressing laboratory work of Course 351. The text-book used is Richards' "Text Book of Ore Dressing."

[REQUIRED IN COURSE III. AFTER 1916–1917 IN OPTION 1 ONLY.]

305. MINING AND METALLURGICAL CALCULATIONS.

Professors Locke, Hayward.

PREPARATION: 303 OR 307, AND EITHER 331, FIRST TERM, OR 335.

A course of two hours per week during the second term (Classes of 1916 and 1917 will have one hour a week during the whole of the fourth year) of the fourth year, devoted to the solution of problems relating to the efficiency of processes and apparatus in metallurgy and in ore dressing. The metallurgical work deals chiefly with thermal lines. The ore dressing work is devoted to the calculation and interpretation of results of operations, and to a discussion of typical examples of smelter schedules. J. W. Richards' "Metallurgical Calculations" is used as a reference book.

[REQUIRED IN COURSE III., OPTIONS 1, 2.]

306. MINING ENGINEERING.

Professor Raymer.

PREPARATION: 513; 1208; 1251.

A course of thirty lectures during the first term of the third year, covering the principles of Metal and Coal Mining.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1916–1917.[1]]

307. ORE DRESSING.

Professor Locke.

PREPARATION: 306; 321.

This course in the first term of the fourth year consists of fifteen lectures and twenty-four hours in the laboratory. The ground covered in the lec-

[1] See note on page 254.

tures embodies the principles of ordinary wet gravity concentration, flotation, and magnetic separation. The most important crushing and concentrating machines of interest to the metallurgist are treated briefly. The laboratory work covers three seven-hour periods for three weeks and three seminars of one hour; the work is identical with part of the ore dressing of course 351. The text-book is Richards' "Text-Book of Ore Dressing."

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1917–1918.[1]]

308. MINING ENGINEERING: ORE DRESSING, LEACHING.

Professor Raymer.

PREPARATION: 218; 321; 1201.

A course of lectures, nine hours per week, lasting from Feb. 3 to April 22, and of laboratory work, nine hours per week, extending through the term, in the second term of the fourth year. The principles of amalgamation, concentration, dressing, and leaching of ores are fully discussed.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1917–1918.[1]]

309. PROBLEMS IN DRESSING AND MILLING OF ORES.

Professor Raymer.

PREPARATION: 308.

This course of one hundred and twenty hours in the first term consists of laboratory work and a report; it has for its object the determination of the best method of treatment for an ore, and the design of a plant.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

311. ADVANCED MINING ENGINEERING.

Professor Locke.

PREPARATION: 302.

A course of one hundred and thirty-five hours in the first and two hundred hours in the second term. The first term is devoted mainly to lectures, conferences, and assigned readings, being supplementary to course 302, and covering details of subjects and calculation of problems omitted in the earlier course on account of lack of time. The second term is devoted to the design of a mine plant starting with certain assumed conditions.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

[1] See note on page 254.

312. ADVANCED ORE DRESSING.

Professor Locke.

PREPARATION: 303.

A course of one hundred and thirty-five hours in the first term devoted to lectures, conferences and readings, covering ground omitted in course 303; and two hundred hours in the second term devoted to the design of a mill under certain assumed conditions.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

313. MINING PLANT.

Professor Raymer.

PREPARATION: 315; 316; 317.

A course of lectures in the fourth year, nine hours per week (April 22 to May 27), on the hoisting, haulage, drainage, and ventilation equipment of mines.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1917–1918.[1]]

314. MINERAL LANDS: ACQUISITION, TENURE.

Professor Raymer.

PREPARATION: 313; 316; 317.

This course of ninety hours in the first term deals with the methods of acquiring and holding lode and placer claims; with laws and regulations covering the location and patenting of lode claims, placers, and mill sites, conflicts, extralateral rights, tunnel rights, and a study of court decisions in the important cases.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

315. MINING: PROSPECTING, EXPLORING, EXPLOITATION.

Professor Smyth.

PREPARATION: 1208; 1237; 1264.

A course of thirty lectures, with thirty hours preparation, given in the second term of the third year. The subjects discussed are property in minerals, prospecting, or search for mineral deposits on the surface, exploring, including stripping, trenching, test-pitting and drilling, breaking ground, and the principles of exploitation.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1916–1917.[1]]

[1] See note on page 254.

316. METAL MINING: EXPLOITATION.

Professor Smyth.

PREPARATION: 218; 315; 317, 318, taken simultaneously.

This course consists of six lectures, one hour of conference, and six hours in the draughting room per week, for the first thirteen weeks of the first term of the fourth year.

The lectures deal in detail with shaft-sinking, drifting, raising, methods of mining, operating routine, organization and costs. The required work includes two problems a week, and one project.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1917–1918.[1]]

317. COAL MINING.

Mr. Norris.

PREPARATION: 315; 316, taken simultaneously.

This course consists of ten lectures a week for the last two weeks of the first term of the fourth year. The lectures cover as completely as possible the development, mining, preparation and marketing of coal.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1917–1918.[1]]

318. MINING LABORATORY.

Mr.

PREPARATION: 218; 315; 316, taken simultaneously.

A course of fifty conferences and sixty laboratory hours, in the last three weeks of the first term and the first eight weeks of the second term of the fourth year. The course deals with the construction, testing and selection of mining machinery and supplies.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1917–1918.[1]]

319. MINING PROJECTS AND DESIGN.

Professors Smyth, Raymer.

PREPARATION: 313; 316; 317.

This course of one hundred and fifty hours consists in the working-out in considerable detail of a mining project. It is given in the first seven weeks of the second term.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

[1] See note on page 254.

320. MINE EXAMINATION AND REPORTS.

Professor Smyth.

PREPARATION: 308; 316; 317.

This course of two hundred hours is given in the last eight weeks of the second term. It includes lectures and conferences on mine valuation, examination, and reports; and the examination of a mine and the preparation of a report.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

321. FIRE ASSAYING.

Professor Bugbee; Mr. Reed.

PREPARATION: 512; 1201.

This course consists of one lecture and one four-hour laboratory exercise a week, extending through the first term of the third year. The work includes the crushing and sampling of ores, the assay of ores for gold, silver and lead and also of bullions, solutions, matte and miscellaneous furnace products. The fire assay of copper, tin and mercury is discussed in the lecture, but not undertaken in the laboratory. Particular attention is given to the chemical and metallurgical principles involved, and great stress is laid on the accuracy, care and neatness of the work and notes. In 1915–1916 this course is given in the second term.

"Notes on Fire Assaying," prepared by Professor Bugbee, will be used as a text.

[REQUIRED IN COURSE III.]

322. FIRE ASSAYING.

Professor Bugbee; Mr. Reed.

PREPARATION: 512.

This is a short course of ten lectures and ten two-hour laboratory exercises in the first term of the third year which covers only the assay of ores for silver, gold, and lead. "Notes on Fire Assaying," prepared by Professor Bugbee, will be used as a text.

[REQUIRED IN COURSE XIV.]

323. WET ASSAYING.

Professor White.

PREPARATION: 513.

A course of lectures and laboratory exercises given to Option 1 in the third year, second term, and to Option 2 in the fourth year, second term.

The lectures given to Option 1 treat of the methods of sampling and analyzing metallurgical materials and products. The methods described are those found best adapted to present-day practice, and include the exact processes demanded by the umpire as well as the shorter methods required for the control of metallurgical operations. The laboratory work may be varied to meet the requirements of the individual student, and is chosen from the following subjects: the analysis of ores for their essential metallic elements and important impurities; of steel, including the special steels; of bullion; brass; bronze; and other alloys; of fluxes and fuels, including oil and gas; of mattes; slags; boiler water; and refractories.

The lectures given to Option 2 describe the mine and smelter methods of analysis required in the production of the metals. The laboratory work consists chiefly in the application of those methods which have been found most useful in connection with the production of the non-ferrous metals. It consists in the analysis of bullion, mattes, slags, fuels, fluxes, and refractories.

[Required in Course III., Options 1, 2. Not Given until 1916–1917.[1]]

331. METALLURGY.

Professors Hofman, Peters, Bugbee, Hayward.

Preparation: 514; 321; 801; 351, taken simultaneously.

This course of ninety lectures extends throughout the fourth year. The first term is given to a detailed discussion of the metallurgy of lead, copper, silver and gold; special attention is given to the properties of metals, the constitution and properties of alloys, the principles on which are based the operations sampling, drying, roasting, smelting, amalgamating, leaching and electro-depositing. The work in the metallurgical laboratory (course 351) is so arranged as to run parallel with that in the class room. In the forty-five lectures of the second term are treated in detail, the metallurgy of zinc and aluminum, of iron and steel, and of fuels and refractory materials. General metallurgy is confined to a full treatment of the subjects of fuels and refractories, as the necessary general discussions of metallurgical apparatus, products, etc., have been given in connection with the several metals. The text-books are Hofman, "General Metallurgy," "Copper," and Stoughton, "Iron and Steel." For the Class of 1918 and thereafter this course will occupy sixty hours in the first term and forty-five hours in the second term.

[Required in Course III. After 1916–1917 in Option 1, only.]

[1] See note on page 254.

332. METALLURGY OF ENGINEERING MATERIALS.

Professors Hofman, Hayward.

PREPARATION: 502.

This is a course of forty-five exercises in the second term. Its aim is to make the engineer familiar with the industrial use of fuels, with the production of the metals and alloys used in construction, and the effects foreign constituents have upon them. The instruction is given by lectures and laboratory demonstrations, the latter being confined to the heat-treatment and microscopical examination of the leading metals and alloys.

[REQUIRED IN COURSES XIII.A, XIII.B.]

333. METALLOGRAPHY.

Professor Sauveur.

PREPARATION: 335; 513; 567; 813, taken simultaneously.

A course of twenty-five lectures in the first term of the fourth year. It includes the study of the micro-structure of iron and steel, of non-ferrous metals, and of several commercial alloys; the influence of thermal and mechanical treatments on these structures; the study of equilibrium diagrams, and of the phase rule applied to alloys.

The laboratory work consists of sixty hours devoted to the preparation for microscopical examination of various grades of iron and steel variously treated and of some alloys, and to the taking of photo-micrographs of their structures; it includes the construction of the equilibrium diagrams of iron-carbon and other alloys. "The Metallography of Iron and Steel," by Albert Sauveur, is used as a text-book. "Metallography," by C. H. Desch, and "Physical Metallurgy," by Walter Rosenhain serve as books of reference.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1917–1918.[1]]

334. METALLOGRAPHY.

Professor Hayward.

PREPARATION: 801; 813, taken simultaneously.

A course of eight lectures in the first term of the fourth year, descriptive of the constitution and micro-structure of metals and alloys and of the relations between their properties, chemical and mechanical treatment and structure. The application of the microscope to the study of alloys is covered by seven hours in the laboratory.

[REQUIRED IN COURSE III., OPTIONS 1, 2. FOR CLASSES OF 1916 AND 1917 ONLY.]

[1] See note on page 254.

335. GENERAL METALLURGY.

Professor Hofman.

PREPARATION: 321; 513; 1208; 355, taken simultaneously.

This is a course of forty-five lectures in the second term of the third year. It covers in a general manner the properties of metals and metallic compounds, treats in detail fuels and refractories, discusses the principles which govern pyro-, hydro-, and electro-metallurgical processes, and considers some typical apparatus used in these processes.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1916–1917.[1]]

336. PRINCIPLES OF METALLURGY.

Professors Sauveur, Peters.

PREPARATION: 512; 1201.

A course of forty-five lectures in the first term of the third year devoted to a general study of metallurgical materials, operations and products, and of the physical and chemical principles upon which the art of metallurgy is based.

The laboratory work consists of fifteen hours devoted to simple experiments dealing with the calorific power of fuels, melting points of metals, pyrometry, reduction of some metallic oxides, etc.

[REQUIRED IN COURSE III., OPTION 3. NOT GIVEN UNTIL 1916–1917.[1]]

337. METALLURGY: LEAD, GOLD AND SILVER.

Professors Hofman, Bugbee.

PREPARATION: 321; 513; 1208; 355, taken simultaneously.

Of this course of thirty-five lectures in the second term of the third year, fifteen are devoted to lead, and twenty to gold and silver. Under the heading of lead are discussed the theory and practice of the smelting of lead ores and the desilverization of lead bullion. The extraction of gold and silver from ores by means of amalgamation and lixiviation forms the second division. In this the larger part of the allotted time is devoted to a study of the cyanide process. Besides the chemical side, due emphasis is laid upon modern methods of handling, classifying, and filtering sands and slimes. The course concludes with a brief discussion of the parting of gold and silver.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1916–1917.[1]]

[1] See note on page 254.

338. LEACHING GOLD AND SILVER ORES.

Professor White.

PREPARATION: 308.

A course of lectures and laboratory work of one hundred and twenty hours in the first term.

The lectures include a description of the chemical and physical properties of gold and silver and of such of their compounds as are of importance in connection with the leaching processes, and a description of those processes which have been applied commercially for the extraction of gold and silver by solution, the greater emphasis, by far, being placed upon the process of cyanidation and its problems. The students consult the literature of the subject for the study of the best modern plants and report upon the methods by which the more important problems have been solved with various ores under the conditions existing in the principal gold and silver districts of the world.

For laboratory work, the student is given an ore with which he is not familiar upon which he operates in a logical and systematic way to develop the most profitable method of treatment, the results of which are embodied in a detailed report at the end of the course.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

339. METALLURGY: COPPER.

Professor Peters.

PREPARATION: 335, taken simultaneously, or 336.

A course of thirty lectures in the second term of the third year. Text-books: Hofman, "Metallurgy of Copper"; Peters, "Principles of Copper Smelting."

[REQUIRED IN COURSE III., OPTIONS 2, 3. NOT GIVEN UNTIL 1916–1917.[1]]

340. METALLURGY: ZINC AND MINOR METALS.

Professors Hofman, Peters.

PREPARATION: 339.

A course of thirty lectures in the second term of the fourth year devoted to the metallurgy of zinc, aluminum, mercury, nickel, cobalt, tin, arsenic, antimony, bismuth, and platinum.

[REQUIRED IN COURSE III., OPTIONS 2, 3. NOT GIVEN UNTIL 1917–1918.[1]]

[1] See note on page 254.

341. METALLURGY: IRON AND STEEL.

Professor Sauveur.

PREPARATION: 335; 355; 567.

A course of forty-five lectures in the first term of the fourth year. It includes a description of the methods used for the production of cast iron, steel and wrought iron, raw materials, mechanical appliances and mechanical operations being duly considered, but special emphasis being laid on the chemical and physical principles upon which the art is based; the study of the treatments, both mechanical and thermal, by which iron and steel after their manufacture, are converted into finished implements; the study of the properties of iron and steel and of the relations existing between those properties and the chemical compositions, treatments and structures of the metals considered.

The laboratory work consists of thirty hours devoted to a practical demonstration for the rationale of the heat treatment of iron and steel such as annealing, hardening and tempering; it includes the determination of the thermal critical points of iron and steel and the determination of the strength, elastic limit, ductility, hardness, magnetic properties, etc., of various grades of these metals after various mechanical and heart treatments. "Laboratory Experiments in Metallurgy," by Albert Sauveur and H. M. Boylston is used as a laboratory text and note-book.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1917–1918.[1]]

349. METALLURGICAL PLANT DESIGN.

Professors Hofman, Bugbee, Hayward.

PREPARATION: 305; 339; 340; 341.

This course in the second term of one hundred hours aims to make the student conversant with some construction details of metallurgical plants. It involves the fundamental calculations for a given problem, and the study of detail in working drawings, to be followed by the preparation of drawings of a plant as a whole and of some of the apparatus in detail.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

351. METALLURGICAL LABORATORY.

Professors Hofman, Locke, Bugbee, Hayward; Mr. Reed.

PREPARATION: 801; 321; 303, 331, 356, taken simultaneously.

A course of laboratory work, eight hours per week for twelve and a half weeks during the first term of the fourth year, in which the students make a practical study of the working of the machines, furnaces, etc., used in the processes of ore dressing and metallurgy. Ores are crushed by means

[1] See note on page 254.

of breakers, rolls, and stamps. They are then sized and sorted with screens and classifiers, and finally concentrated with jigs, revolving and Wilfley tables, Frue and Embrey vanners, and magnetic machines. In metallurgical work, copper, lead, silver, and gold ores are tested and the processes used include roasting, smelting, amalgamating, leaching and electrolytic treatment. This course will be changed in 1917 to include Metallography (334).

[REQUIRED IN COURSE III. AFTER 1916–1917 IN OPTION 1 ONLY.]

352. METALLURGICAL LABORATORY.

Professors Hofman, Hayward.

PREPARATION: 322; 514; 356, taken simultaneously.

In this course given eight hours a week for three weeks in the first term of the fourth year the work is identical with the purely metallurgical work of course 351.

[REQUIRED IN COURSE XIV.]

355. METALLURGICAL LABORATORY: NON-FERROUS.

Professors Hofman, Bugbee, Hayward.

PREPARATION: 321; 1208.

This course of eight hours of laboratory work with weekly conferences is given for the first ten weeks of the second term of the third year. It is taken simultaneously with the class-room work, and aims to render the student familiar with the leading metallurgical operations. The exercises deal with roasting, smelting, leaching, and electro-deposition. The work is similar to the metallurgical part of course 351.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN UNTIL 1916–1917.[1]]

356. LABORATORY REPORTS.

Professors Hofman, Locke, Bugbee, Hayward; Mr. Reed.

PREPARATION: 351 or 352 taken simultaneously.

A seminar accompanying courses 351 and 352, held one hour per week during the first term of the fourth year, in which the students and instructors meet and discuss the various points brought out by the week's work. Students in Course XIV. attend three seminars, which are connected with the work of course 352. This course is continued for Course III., throughout the second term in connection with thesis work. In 1917 this course will be included in Metallurgical Laboratory (351).

[REQUIRED IN COURSES III., XIV.]

[1] See note on page 254.

360. METALLURGY AND THE PHYSICS OF METALS.

Professor Sauveur.

PREPARATION: 334; 341.

This is essentially a research course devoted to the investigation of problems dealing with the treatment and properties of metals. It may be taken in the first or second term, or in both, the time required varying between two hundred and forty and nine hundred and sixty hours according to the nature of the investigation and the time the student is able to devote to it.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

361. MECHANICAL TREATMENT OF METALS.

Professors Hofman, Hayward.

PREPARATION: 334; 339; 341.

This course of ten lectures and twenty laboratory exercises deals in the class room with the principles governing the mechanical treatment of metals and studies in the laboratory microscopically and otherwise the physical changes metals and alloys undergo when subjected to mechanical deformation by rolling, drawing, and punching.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

362. ECONOMICS OF METALLURGICAL PLANTS.

Professor Peters.

PREPARATION: 339; 340; 341.

This course of fifteen lectures treats mainly of the application of modern business principles and methods to the locating, erecting, and managing of metallurgical plants. While much that is given in this course will be applicable to metallurgical operations in general, especial attention will be devoted to copper. Smelter fumes will be discussed briefly.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

363. DEVELOPMENT OF METALLURGICAL PROCESSES.

Professor Peters.

PREPARATION: 339, 340; 341.

A course of thirty lectures devoted to the historical development of the metallurgical processes used in the production of the more important non-ferrous metals. Especial attention is given to the developments of the past few years. Amalgamation and cyaniding are not discussed.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

364. METALLURGY OF COPPER (Advanced).

Professor Peters.

PREPARATION: 339; 363.

A course of thirty lectures intended to supplement and elaborate the regular undergraduate lectures on the metallurgy of copper. The furnace processes are studied with considerable minuteness, and the principles underlying the more important operations are analyzed and discussed. Matte, slag, smelter fumes, and other products and educts are studied.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

MINING CAMP.

Mr. Weeks (Harvard).

PREPARATION: 104.

This course is given at the Elizabeth Mine, Vermont, in June and July, and lasts six weeks. The subjects studied are underground surveying, drilling, blasting, timbering, tracklaying, blacksmith work, etc.

[ELECTIVE IN COURSE III., OPTION 3.]

Note: Subjects marked (1) become parts of the regular Courses in Mining Engineering and Metallurgy at the times specified. They may be given, however, before the dates assigned if applied for by a sufficient number of students.

DEPARTMENT OF ARCHITECTURE.

RALPH ADAMS CRAM, LITT.D.
Professor of Architecture.

H. LANGFORD WARREN, A.M.
Professor of Architecture at Harvard University.
Lecturer on Architectural History.

WILLIAM H. LAWRENCE, S.B.
Professor of Architectural Engineering.

JOHN O. SUMNER, A.B.
Professor of History.

HARRY W. GARDNER, S.B.
Associate Professor of Architecture.

W. FELTON BROWN.
Associate Professor of Freehand Drawing.

EDGAR I. WILLIAMS, S.M.
Assistant Professor of Architecture.

Instructors.

C. HOWARD WALKER.
CLARENCE E. MORROW, S.B.
CHARLES EVERETT, A.B., A.D.P.G.
ISRAEL P. LORD.
ALEXANDER S. JENNEY.
RUSSELL W. PORTER, S.B.

Assistant.

IDA D. LORING.

The courses offered by the Department naturally divide themselves into three groups: (1) those courses that are considered essential for all students in Architecture who are working for the degree; (2) those developed especially for the students in the General Option; (3) those developed for the students in Architectural Engineering.

The two Options run very nearly parallel for the first two years, a small difference occurring in the second year. At the beginning of the third year the line of demarcation between the professional work of the Options becomes more marked, and in the fourth year it is very sharply defined; but the general subjects, common to both Options, which continue through the four years emphasize the close relation

between the two and the interdependence of one upon the other in a complete architectural equipment.

The students of both Options mingle in a common drawing-room so that the ideas and work of each may be influenced by those of the other. They thus learn to feel that one Option is but the complement of the other, and to realize their responsibility not alone to their particular department of study but to the whole profession. Thus is accomplished in the Engineering student a flexibility, and in the student of Design a sincerity, that can scarcely be brought about in any other way.

In all professional work the methods of instruction are, so far as possible, individual. Even in such courses as Architectural History and European Civilization and Art, which must be presented in the lecture room, written exercises and required personal conferences keep the instructor in touch with the progress of each student. In the courses in Design and Freehand Drawing individual criticism and correction form to a very large extent the basis of instruction.

As we believe that the function of the architectural school is to give training in fundamentals, our efforts are concentrated upon imparting to the student a very clear understanding of the general principles of the subject, and upon training his powers of analysis and application. It is believed undesirable, in fact dangerous, to spend much time upon the hampering limitations of ordinary practice before the student has acquired sufficient knowledge of the subject to discriminate between the general and the special case.

Daily progress and attention to work is insisted upon, and the results of class exercises during the term are considered quite as trustworthy a measure of a student's development and power as are the formal examinations.

The student is strongly advised to spend a part of the summer vacation in an office. The experience that he gets there of practical problems and conditions will be a great aid to him in a clearer understanding of the value of his school work.

411. SHADES AND SHADOWS.

Professor Gardner.

PREPARATION: D14; D18; D41, taken simultaneously.

A course of fifteen two-hour drawing-room exercises during eight weeks in the first term of the second year. Each of the exercises is in the nature of an examination, and requires one hour of preparation. This course gives the student an understanding of the principles of Descriptive Geometry methods in casting the conventional shadows used in architectural rendering. These methods are further supplemented by shorter ones often useful in actual practice.

[REQUIRED IN COURSE IV.]

412. PERSPECTIVE.

Professor Lawrence.

PREPARATION: D14; D18; 411.

A series of ten two-hour exercises in the last ten weeks of the second term of the first year, consisting of lectures, recitations, and class-room work. Each exercise is supplemented by four hours of drawing or preparation. The subjects considered are the general theory of conical projection and its application to perspective drawing, methods of direct division, direct measurement, relations between lines and points in the perspective projection, method of cubes, method of perspective plan, curves, shadows, and apparent distortion.

[REQUIRED IN COURSE IV.]

413. APPLIED PERSPECTIVE.

Professors Lawrence, Gardner.

PREPARATION: D14; D18; 412.

A series of fifteen two-hour drawing-room exercises in the first term of the second year, intended to give the student facility in studying the actual appearance of objects represented in orthographic projection, and in translating into orthographic projection objects represented in perspective.

[REQUIRED IN COURSE IV., OPTION 1.]

414. APPLIED PERSPECTIVE.

Professor Gardner.

PREPARATION: 413; 471 taken simultaneously.

A course of twenty hours in the second term of the second year in which perspective studies of some of the problems in Design will be made.

[REQUIRED IN COURSE IV., OPTION 1.]

415. APPLIED PERSPECTIVE.

Mr. Lord.

PREPARATION: 413; 414; 472 or 473 taken simultaneously.

A course of thirty hours in each term of the third year, similar in nature to 414, given in connection with the problems in Design.

[REQUIRED IN COURSE IV., OPTION 1.]

421. SPECIFICATIONS AND WORKING DRAWINGS.

Mr. Jenney.

PREPARATION: D11; D15.

A course of sixty hours in the second term of the third year for Option 1, and of the second year for Option 2, divided between conferences in the class room, visits to shops and to buildings in the course of erection, and drawing-room exercises. The principles governing the making of architectural working-drawings and details will be discussed in the class room, plans of the work of some eminent architects will be examined and discussed. Wherever possible visits will be made to the buildings erected from these plans. The study of building materials and their influence upon architectural designing will be an important part of this course.

[REQUIRED IN COURSE IV.]

422. PROFESSIONAL RELATIONS, CONTRACTS, ETC.

Mr. Jenney.

PREPARATION: 421.

A course of fifteen one-hour conferences in each term of the fourth year, dealing with the relations between the architect and his client, the practitioners of the allied arts and crafts, the contractors, the American Institute of Architects and other professional organizations, and with the general public. This series of conferences will be conducted by Mr. Jenney in the class room, but from time to time men who are eminent in their respective callings will be asked to speak upon the topics under discussion.

[REQUIRED IN COURSE IV.]

431. HISTORY OF ORNAMENT.

Mr. Walker; Professor Gardner.

PREPARATION: D42; 471, taken simultaneously.

A course of fifteen one-hour lectures given in the second term of the second year. The course explains the historical development of ornament, and

teaches facility in the general treatment of color in decoration. Acquaintance is also made with the characteristics of different styles. Instruction is given by lectures, and to the students of Option I by problems in design which are criticised before the class.

[Required in Course IV.]

441. ARCHITECTURAL HISTORY.

Professor Warren.

Preparation: H33, First Term.

A course of fifteen one-hour lectures in the second term of the second year, given with the aid of the stereopticon.

The course is devoted to Greek, Roman and Byzantine architecture. The Assyrian, Persian, and Greek architecture required as preparation for this course, are embodied in the first term of H33.

[Required in Course IV.]

442. ARCHITECTURAL HISTORY.

Professor Warren.

Preparation: 441; 471.

A course of fifteen one-hour lectures in each term of the third year, given with the aid of the stereopticon. Five additional hours in each term are devoted to written exercises.

The course deals mainly with Romanesque and Gothic architecture.

[Required in Course IV.]

444. HISTORY AND ARCHAEOLOGY; SPECIAL RESEARCH.

Professor Cram.

Preparation: 442.

Opportunities are given in the Graduate Course for the study of chosen periods in Architectural History, for which the large collections of the Department, as well as those freely opened to students by the Museum of Fine Arts and the Public Library, offer complete facilities.

[Elective in Course IV., Graduate Year.]

451. PHILOSOPHY OF ARCHITECTURE.

Professor Cram.

PREPARATION: 473, H34, taken simultaneously.

A series of fifteen one-hour conferences in each term of the fourth year in which architecture is considered from a theoretical rather than a historical point of view. The course serves to supplement the drawing-room instruction in Design in furnishing a résumé of the fundamental principles of architecture and its relationship to civilization and the other arts allied with architecture.

[REQUIRED IN COURSE IV., OPTION I.]

452. ADVANCED ARCHITECTURAL PROBLEMS.

Professors Cram, Williams.

PREPARATION: 474, FIRST TERM.

A course in the second term of the graduate year consisting of a design problem chosen by each student in consultation with a member of the Department Faculty, together with historical research, collateral reading, and a written dissertation covering the historical, theoretical, and practical aspects of the problem. It is intended that the student should, as far as practicable, choose the subject and stylistic treatment in which he is most interested. The instruction will be individual.

[ELECTIVE IN COURSE IV., GRADUATE YEAR.]

453. WATER COLOR.

Professor Brown.

PREPARATION: D42, taken simultaneously.

This course begins in the second term of the second year, and continues through the first term of the third year with one two-hour exercise per week. Its purpose is to impress the student with the importance of combining good drawing, values, and color as applied to architectural subjects. Color-principles and color-harmony will be studied so as to give the student a practical and artistic base upon which to build. Sketching out-of-doors will be undertaken in three simple values from the point of view that landscape is the proper background for architecture. With this end in view twelve sketches from nature will be required from each Option I student as vacation work, to be submitted in the fall for criticism.

[REQUIRED IN COURSE IV., OPTION I.]

454. ARCHITECTURE, THEORY AND PRACTICE.

Professor Cram.

A series of fifteen one-hour conferences each term, demonstrating the adaptation of theory to practical problems through consideration of sketches, working drawings, and photographs of buildings actually constructed.

[ELECTIVE IN GRADUATE YEAR.]

471. DESIGN I.

Professor Gardner.

PREPARATION: D14; D18; 411[1]; D41.

A course of seven hours per week in the first term and nine in the second term of the second year.

This course lays the foundation for the æsthetic training of the student. He is made to study and analyze the elements of the best examples of Classical Architecture, in order to cultivate his taste and sense of proportion. The fundamental principles of Architecture are inculcated, and the influences governing design are explained and discussed. By means of problems in design the student is taught the methods of study, the principles of academic rendering, and obtains the necessary training of the hand and the eye. The course is given by means of individual instruction in the class room, and by criticism of the students' work before the class.

[REQUIRED IN COURSE IV.]

472. DESIGN II.

Professor Williams; Mr. Lord.

PREPARATION: 471; D42.

A continuation of course 471, given during the first term of the third year, one hundred and fifty hours for Option 1, and one hundred and thirty-five hours for Option 2. In the second term there are two hundred and fifteen hours in the course and it is given only to Option 1.

[REQUIRED IN COURSE IV.]

[1] Students otherwise qualified to take the subject may receive the necessary instruction in Shades and Shadows during the first term.

473. DESIGN III.

Professor Williams; Mr. Everett.

PREPARATION: 412; 431; 472; D43.

A course of twenty-two hours per week during the first term of the fourth year, and twenty-eight hours per week during the second term, forming a continuation of the preceding course, 472. The second term is devoted largely to the preparation of the graduating theses.

[REQUIRED IN COURSE IV., OPTION 1.]

474. ADVANCED ARCHITECTURAL DESIGN.

Professor Williams; Mr. Everett.

PREPARATION: 473.

This course is a continuation of 473. It aims to give the student training in design through the study of buildings of monumental character, special attention being given to the analysis of the conditions of the problem. Sketch-problems of a day's duration are given at intervals throughout the year.

[ELECTIVE IN COURSE IV., GRADUATE YEAR.]

481. CONSTRUCTIVE DESIGN I.

Professor Lawrence; Mr. Morrow.

PREPARATION: 220; 227; 228.

A course in elementary architectural construction of eight hours per week during the first term of the fourth year. The subjects treated are: the theory of construction, loads, reactions, the design of beams, wooden and cast-iron columns, slow burning construction, and a simple wooden roof truss. Instruction is given by lectures and problems in design and one exercise in the testing laboratory.

[REQUIRED IN COURSE IV., OPTION 1.]

482. CONSTRUCTIVE DESIGN II.

Professor Lawrence; Mr. Morrow.

PREPARATION: 227.

A short course of forty-five hours given in the second term of the fourth year, as a continuation of course 481.

[REQUIRED IN COURSE IV., OPTION 1.]

483. CONSTRUCTIVE DESIGN III.

Professor Lawrence.

PREPARATION: 481.

This course is a continuation of the course in Constructive Design, 481. It consists of a series of lectures and problems in practical design, occupying eight hours per week for fifteen weeks. The subjects studied are the theory and design of the plate and box girder, steel columns, simple steel roof trusses, and general framing.

[ELECTIVE IN COURSE IV., GRADUATE YEAR.]

490. STRUCTURAL DRAWING.

Professor Lawrence; Mr. Morrow.

PREPARATION: D14; D18.

A course of fifteen two-hour periods given in the first term of the third year intended to supply information and a certain amount of practice in drawing required by the structural designer. The student will be made familiar with methods of the template and fabrication shops by lectures and by visits to structural works and buildings in process of erection. Measured drawings will be made of structural details including a full set of drawings for a plate girder. This course will not touch upon the manufacture of material or the computation of stresses.

[REQUIRED IN COURSE IV., OPTION 2.]

491. STRUCTURAL DESIGN.

Professor Lawrence.

PREPARATION: 490; 239; 141, taken simultaneously.

A course of one hundred and fifty hours in the second term of the third year. The time is devoted to the careful consideration of architectural loads, building laws, and practical problems in the design of elementary structures in wood, cast iron, and steel.

[REQUIRED IN COURSE IV., OPTION 2.]

492. STRUCTURAL DESIGN.

Professor Lawrence; Mr. Rockwood.

PREPARATION: 239; 491; 351, taken simultaneously.

A course of sixteen hours per week during the first term and twenty-nine hours per week during the second term of the fourth year, a part of

the time during the second term being devoted to thesis work. Practical problems in architectural construction are given, including general framing in steel, plate and box girders, and riveted and pin trusses, and structures in reinforced concrete. Great importance is placed upon the study of the details of design, and in each problem carefully worked out and dimensioned drawings are made.

[REQUIRED IN COURSE IV., OPTION 2.]

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING.

HENRY P. TALBOT, PH.D.
Professor of Inorganic Chemistry.

ARTHUR A. NOYES, PH.D., LL.D., SC.D.
Professor of Theoretical Chemistry.

WILLIAM H. WALKER, PH.D., ENG.D.
Professor of Chemical Engineering.

HENRY FAY, PH.D., SC.D.
Professor of Analytical Chemistry.

AUGUSTUS H. GILL, PH.D.
Professor of Technical Chemical Analysis.

F. JEWETT MOORE, PH.D.
Professor of Organic Chemistry.

WARREN K. LEWIS, PH.D.
Professor of Chemical Engineering.

WILLIS R. WHITNEY, PH.D.
Non-resident Professor of Chemical Research.

SAMUEL P. MULLIKEN, PH.D.
Associate Professor of Organic Chemical Research.

MILES S. SHERRILL, PH.D.
Associate Professor of Theoretical Chemistry.

ALPHEUS G. WOODMAN, S.B.
Associate Professor of Food Analysis.

ARTHUR A. BLANCHARD, PH.D.
Associate Professor of Inorganic Chemistry.

FRANK H. THORP, PH.D.
Assistant Professor of Industrial Chemistry.

ELLWOOD B. SPEAR, PH.D.
Assistant Professor of Inorganic Chemistry.

WILLIAM T. HALL, S.B.
Assistant Professor of Analytical Chemistry.

ROBERT S. WILLIAMS, PH.D.
Assistant Professor of Analytical Chemistry.

EDWARD MUELLER, PH.D.
Assistant Professor of Inorganic Chemistry.

JOSEPH W. PHELAN, S.B.
Assistant Professor of Inorganic Chemistry.

JOHN F. NORTON, PH.D.
Assistant Professor of Chemistry of Sanitation.

Instructors.

FREDERICK R. KNEELAND, S.B.
EARL B. MILLARD, PH.D.
LEICESTER F. HAMILTON, S.B.
ROSS H. DICKSON, S.B.
WALTER A. PATRICK, PH.D.
CLARK S. ROBINSON, S.M.
FREDERIC H. SMYTH, A.M., PH.D.

Research Associate.

RUTH M. THOMAS, S.B.

Assistants.

ALDEN B. CHAMBERLAIN.
HIRAM Y. WATERHOUSE, PH.C.
FRANCIS C. ATWOOD, S.B.
PEI HWANG HSÜ, S.B.
ALLEN ABRAMS, A.B., S.B.
DONALD BELCHER, S.B.
LUCIUS A. BIGELOW, JR., S.B.
ALTON A. COOK, S.B.
MARTIN W. COWLES, S.B.
JOHN N. DALTON, S.B.
ROSCOE G. DICKINSON, S.B.
BURNHAM E. FIELD, S.B.
CLIFTON N. JACOBS, S.B.
ELWIN E. SNYDER, JR., S.M.
NORMAN D. DOANE, S.B.

Purchasing Agent.

ARTHUR C. MELCHER, S.B.

Instruction in general Inorganic Chemistry is given to all students in regular courses during the first term of their first year, and to all except students of the Course in Architecture in the second term of that year. The course is designed not only to impart a knowledge of the principles of the science and of the descriptive chemistry of the metallic and non-metallic elements, but to constitute an introduction to scientific methods of experimentation, observation, and reasoning. Special effort is, therefore, made to impress upon the student the importance of neatness, accuracy, and thoughtfulness in connection with his laboratory practice, and to point out the value in later professional work in all Courses of intelligent observation and ability to interpret the meaning of observed phenomena.

The instruction in chemical subjects is continued in the Courses in Chemistry, Physics, Biology and Public Health and Geology, and in those of Mining, Sanitary, and Chemical Engineering, and includes Analytical, Theoretical, Organic, and Industrial Chemistry, as well as opportunity for elective courses in such specialized lines as Gas, Oil, Air, Water, Food, Sugar, and Proximate Technical Analysis. In all of these subjects class-room instruction is combined with laboratory work. Students in the Courses in Chemistry and Chemical Engineering devote, as a rule, more time to these subjects than students in other Courses, and their work is, accordingly, somewhat more advanced.

The opportunities for research work under the direction of the instructors in the various branches enumerated above are unusually extensive, and the general and special laboratories are well equipped for advanced work of this character. A description of these laboratories will be found on pages 415 to 416 and in the circular describing the Research Laboratory of Physical Chemistry.

The aim throughout all the courses of chemical instruction is to teach the student self-reliance, to inculcate habits of accurate thought and work, and to afford such a training as will fit him to cope successfully with scientific and technical problems.

501. INORGANIC CHEMISTRY I.

Professors Talbot, Blanchard, Spear, Mueller, Phelan; Messrs. Millard, Robinson, Smyth, and assistants.

PREPARATION: 1; 3; 6; 7; 8.

This course comprises two lectures, accompanied by two recitations and four hours of laboratory work per week during the first term of the first year. The fundamental principles of the science are taught in connection with the descriptive chemistry of the non-metallic elements. The lectures are designed to precede the work of the laboratory, in which the student is expected to verify and illustrate the principles and facts which have been discussed in the lecture room. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student, and the training afforded by this course is considered of value to all students of the Institute, whatever

Course they may later select; for students of the Courses in Chemistry and Chemical Engineering it lays the necessary foundation for subsequent chemical study.

No previous study of Chemistry is required for admission to this course, but the instruction is so arranged that students who have already spent considerable time upon chemical work in secondary schools are admitted to lectures and laboratory work of a somewhat advanced character, in which the knowledge which they have already acquired is utilized.

Text-books: Smith, General Chemistry for Colleges; Talbot and Blanchard, Electrolytic Dissociation Theory.

[REQUIRED IN ALL COURSES.]

502. INORGANIC CHEMISTRY I.

Professors Talbot, Blanchard, Spear, Mueller, Phelan; Messrs. Millard, Robinson, Smyth, and assistants.

PREPARATION: 501.

This course, which comprises two lectures, two recitations, and four hours of laboratory work per week in the second term of the first year, is a continuation of the preceding and deals with the chemistry of the metallic elements. The laboratory instruction includes practice in the methods of synthetic inorganic chemistry in the case of those students who continue chemical subjects in the later years, while the students in the other Engineering Courses devote the time to the study of certain applications of Chemistry to engineering practice. Students in the Courses in Physics and Biology devote two extra laboratory hours and one extra recitation hour per week to the subject.

The manual used by those students who continue chemical subjects in later years is Blanchard's Synthetic Inorganic Chemistry. Other students use laboratory notes prepared by Professor Spear.

[REQUIRED IN ALL COURSES EXCEPT IV.]

503. INORGANIC CHEMISTRY II.

Professor Talbot.

PREPARATION: 565.

This course comprises thirty recitations in the second term of the fourth year and is designed to strengthen and broaden the student's knowledge of inorganic chemistry. The outside preparation consists in the reading of assigned portions of a standard text-book and the class-room exercises are intended to assist the student in correlating his knowledge in such a way as to increase its utility, and to assist him in logical deduction and reasoning.

[REQUIRED IN COURSES V., X.]

504. INORGANIC CHEMISTRY III.

Professor Talbot.

PREPARATION: 513; 575, 802.

This course includes the preparation and discussion of memoirs on selected topics in Inorganic Chemistry, in connection with which the student is expected to make extensive use of the library facilities, and to present the results of his reading in concise, orderly form, with due attention to proper sequence and to a discrimination between the important and the unimportant material collected.

[ELECTIVE IN COURSES V., X., GRADUATE YEAR.]

505. SPECIAL TOPICS IN INORGANIC CHEMISTRY.

Dr. Millard.

PREPARATION: 513; 550 or 551; 565.

Subject for 1915–1916: The Investigations and Theories of Werner. Text: "Neuere Anschauungen auf dem Gebiete der Anorganischen Chemie"; assigned readings from the second edition and later publications in the journal literature. The course consists of one hour per week in the first term, with readings assigned. The class will be conducted on the seminar plan.

[ELECTIVE IN COURSES V. AND X., GRADUATE YEAR.]

507. METALLOGRAPHY.

Professors Fay, Williams.

PREPARATION: 565.

In this course of fifteen class exercises, given in the first term of the fourth year (thirty exercises in the second term for Course VIII., Option 3), the general methods used in the study of alloys, the construction and interpretation of equilibrium diagrams and the relations between the constitution of alloys and their physical properties will be considered. The iron-carbon diagram will be studied in detail with its application to the heat treatment and the use of steel. Given in the second term to Course V, Option 2 in 1915–1916.

[REQUIRED IN COURSES V., OPTION 2, VIII., OPTION 3.]

511. QUALITATIVE ANALYSIS.

Professors Fay, Thorp, Williams; Mr. Hamilton, and assistants.

PREPARATION: 6; 7; 502.

The course includes class-room instruction (one hour per week), laboratory practice, and individual conference with instructors in the laboratory. The student is required to analyze alloys, minerals, rocks, pigments, slags, mattes, and industrial products of various sorts and complexity, the assignments differing according to the Course which he is pursuing, the substances being chosen with respect to some point of special interest, either in composition, source, or the purpose for which they are employed. The use of the spectroscope and a study of the reactions of the rarer elements are included in the course when time permits. The amount of time devoted to this subject varies in the different Courses, as indicated on page 169. It is given in the Summer following the first year to Courses III., Option 2, V., X., XIV. and XV., Option 3, and in the first term of the second year to other Courses.

Text-books: A. A. Noyes, Qualitative Chemical Analysis; Treadwell-Hall, Analytical Chemistry, Vol. I.

[REQUIRED IN COURSES III., V., VII., VIII., X., XI., XII., XIV., XV., OPTION 3.]

512. QUANTITATIVE ANALYSIS.

Professors Fay, Thorp, Williams; Mr. Hamilton, and assistants.

PREPARATION: 511.

The course, given in the first or second term of the second year, consists of one hour per week of class-room instruction, and, in addition, laboratory practice, with individual conferences, one half of the term being devoted to Volumetric Analysis, the other to Gravimetric Analysis. This work is regarded as a preliminary training for the more advanced work of the third year, and the time is spent upon simple quantitative analyses which are typical of the sub-divisions of the subject; such, for example as the gravimetric determinations of chlorine; of sulphuric, phosphoric, and carbonic acids, of iron, calcium, and magnesium, the volumetric determinations involving the use of acid and alkali, and such oxidizing agents as potassium bichromate and permanganate, and iodine, as well as the processes of chlorimetry. The calibration of flasks and burettes is included in this course. Great stress is here laid upon the accuracy, care and integrity necessary for successful quantitative work; and, as in the instruction in Qualitative Analysis, the chief endeavor is to promote thoughtful and intelligent

workmanship. Special attention is given to Stoichiometry and the modern theories of solutions as applied to Quantitative Analysis.

Text-books: Talbot, Quantitative Chemical Analysis; Treadwell-Hall, Analytical Chemistry, Vol. II.

[REQUIRED IN COURSES III., V., VII., VIII., X., XI., XII., XIV., XV., OPTION 3.]

513. QUANTITATIVE ANALYSIS.

Professors Fay, Hall, Williams, and assistants.

PREPARATION: 512; L21 or L42.

The class-room instruction of this course consists of one lecture and one recitation per week during the term in which it is given. The principles involved in the methods of analysis are discussed and the applications of these principles to problems other than those being carried out by the student in the laboratory are considered. The course is given in the second term of the second year to Courses V. and X. and in the first term of the third year to other courses.

The laboratory work of this course includes the analysis of silicates, minerals, ores, and industrial products. The instruction of this term is intended primarily to fit the student to judge intelligently of the adaptability and accuracy of the processes employed, rather than to furnish detailed directions for specific analyses, although the latter phase is not overlooked. The time spent in the laboratory varies in the professional Courses, and the assignment and arrangement of work are adapted to the special needs of the student. See pages 174 and 179 for the hours of laboratory work in the various courses.

[REQUIRED IN COURSES III., V., VIII., OPTION 1, X, XIV., XV., OPTION 3.]

514. QUANTITATIVE ANALYSIS.

Professors Fay, Hall, and assistants.

PREPARATION: 513.

The class-room instruction consists of one lecture and one recitation per week during the third year. In the lectures are discussed not only the principles underlying the methods used in the analysis of the commercially important alloys, especially irons and steels, but the effect of various elements upon the chemical and physical properties, and the adaptibility of various alloys for particular industrial purposes.

The laboratory work of this course is devoted largely to a study and comparison of rapid, typical methods of iron and steel analysis. It is

not given with the idea of producing specialists along this line, but is used as an example of the development of rapid, accurate processes for the control of commercial products.

[REQUIRED IN COURSES III., V.]

515. QUALITATIVE ANALYSIS OF RARE METALS.

Professor Noyes.

PREPARATION: 513.

A course of laboratory practice for advanced students, in the first term, including the testing of recently developed methods and the investigation of new procedures for the separation and detection of the rarer metals.

[ELECTIVE IN COURSE V., GRADUATE YEAR.]

516. ORGANIC QUALITATIVE ANALYSIS.

Professor Mulliken.

PREPARATION: 551; 556.

A course of laboratory practice, for advanced students, in systematic methods for the identification of organic compounds. Nine hours per week in the first term.

[ELECTIVE IN COURSE V., GRADUATE YEAR.]

520. WATER AND AIR ANALYSIS.

Professor Norton and assistant.

PREPARATION: 512.

This course of forty-five hours, given in the first or second term of the third or fourth year, consists of thirty-eight hours of laboratory practice in the chemical examination of potable waters, of sewages and of air; and of seven lectures in which the methods of analysis and the sanitary significance of the results are discussed. Text-book: Woodman and Norton, Air, Water and Food.

[REQUIRED IN COURSES V., OPTIONS 2, 3, VII.]

521. INDUSTRIAL WATER ANALYSIS.

Professor Norton and assistant.

PREPARATION: 512.

This course of five lectures and twenty-five hours of laboratory practice, given in the second term of the third year, consists of a study of methods of selection and treatment of water for industrial purposes.

[REQUIRED IN COURSE XI.]

522. WATER SUPPLIES AND WASTES DISPOSAL.

Professor Norton and assistant.

PREPARATION: 521.

A course in the first term of the fourth year consisting of fifteen lectures or conferences and thirty hours of laboratory practice dealing with the chemical problems involved in modern methods of selection and treatment of potable waters and the disposal and purification of wastes. Several trips are taken to inspect examples of the various methods of treatment. Textbook: Woodman and Norton, Air, Water and Food.

[REQUIRED IN COURSE XI.]

523. SANITATION IN CHEMICAL INDUSTRIES.

Professor Norton.

PREPARATION: 520.

A course of thirty class-room exercises in the second term of the fourth year for the discussion of problems of sanitation important to the chemist. This includes water supply and purification for factory purposes, wastes disposal, disinfection, ventilation and occupational diseases. Reports will be required from the students on specially assigned topics.

[REQUIRED IN COURSE V., OPTION 3.]

524. BIOCHEMISTRY.

Professor Norton.

PREPARATION: 730, 512, and 550 or 551.

This course consists of two conferences a week, together with assigned reading, during the first term on the more important phases of biological

chemistry. The chemistry of the general classes of substances composing animal and plant life and the chemistry of metabolic processes are discussed. Respiration is given attention from a chemical standpoint. Physico-chemical topics important to the biologist, such as osmotic pressure, adsorption, diffusion and colloidal chemistry are treated. Recent work on bacterial metabolism is outlined. Finally, the chemistry of immunity is discussed. This would include such subjects as toxins, ptomains and chemotherapy. The conferences are, as far as possible, illustrated with experiments. Text-book: Hammarsten-Hedin-Mandel, A Text-Book of Physiological Chemistry.

[ELECTIVE IN COURSES V., VII., GRADUATE YEAR.]

525. FOOD ANALYSIS.

Professor Woodman and assistant.

PREPARATION: 512.

A course of about seven lectures and thirty-eight hours of laboratory exercise in the third or fourth year, designed to introduce the student to the methods generally employed in determining the character, purity and nutritive value of common food materials. The extent, character and legal status of food adulteration is discussed, and analyses made of typical food products.

[REQUIRED IN COURSES V., OPTIONS 2, 3, VII.]

526. ADVANCED FOOD ANALYSIS.

Professor Woodman and assistant.

PREPARATION: 512; 525.

A course of seventy-five hours of laboratory work and class-room exercises, in the first term of the fourth year, which is designed to illustrate the manner of attacking the chemical problems arising in connection with state and municipal food control. In addition to the laboratory practice, each student is expected to present in conference a detailed written report concerning some particular food material, its forms of adulteration and the most rapid as well as systematic method of detecting them, accompanied by actual figures obtained in the laboratory. Some attention is devoted also to the system of food inspection and to a critical study of methods of food analysis.

[REQUIRED IN COURSE V., OPTION 3.]

527. SUGAR ANALYSIS.

Professor Woodman and assistant.

PREPARATION: 512; 801.

This laboratory course, given two hours per week in the first term of the third year and in the second term of the fourth year for 1915–1916 comprises standardization comparisons by quartz-plate readings, polarizations of sugars by commercial methods, determinations of specific rotary powers, double polarization, determinations of the quotient of purity, the calibration of saccharimeters, and practice in the calculations of optical analysis, as applied to sugars, starches, and the like. About five hours of the time allotted to the course is devoted to class-room discussion of methods.

[REQUIRED IN COURSE V., OPTIONS 2, 3.]

530. PROXIMATE TECHNICAL ANALYSIS.

Professor Gill and assistant.

PREPARATION: L21 or L41; 513; 575; 550 or 551.

A course of fifteen six-hour exercises of conference and laboratory work given in the first or second term of the fourth year upon the methods in common use for the analysis of alkaloids, asphalt, oils, paints, paper, rubber, soaps, and tanning materials. The student is required to consult current literature for methods of analysis, and to present the results of his reading before the entire class for criticism and suggestion before a method is finally adopted.

[REQUIRED IN COURSE V., OPTION 2, 3.]

531. GAS ANALYSIS.

Professor Gill and assistant.

PREPARATION: 512.

A course of eight lectures and fifteen hours of laboratory work, in the first or second term, embracing the qualitative and quantitative analysis of the various gases, the technical analysis of commonly occurring gaseous mixtures, such as illuminating and fuel gas, gases from acid chambers, and chimney gas, and the consideration of the losses due to waste gases. The text-book is Gill, Gas and Fuel Analysis for Engineers.

[REQUIRED IN COURSES III., OPTIONS 1, 2, V., XIV.]

532. GAS AND FUEL ANALYSIS.

Professor Gill and assistant.

PREPARATION: 502; 802.

An eight-hour lecture and laboratory course in the first term of the fourth year, discussing the origin, manufacture, properties, uses, and analysis of the various fuels; also smokeless combustion, and the considerations involved in the economical application of fuel. Given in connection with Engineering Laboratory, 261.

[REQUIRED IN COURSES II., VI., XIII., XIII.B.]

533. DISTILLATION OF FUELS.

Professor Gill.

PREPARATION: 331.

A course of six lectures in the second term, which treats of the chemical processes that take place in the manufacture of charcoal and coke, and in the distillation of oils. The leading principles of the organic processes involved in the operations are made clear to a student versed only in Inorganic Chemistry.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

534. ANALYTICAL AND TECHNICAL CHEMISTRY.

Mr. Kneeland and assistants.

PREPARATION: 502.

This course comprises lectures during the first term, and laboratory exercises during the second term, covering the principles of Organic, Analytical and Technical Chemistry, with particular reference to the needs of Naval Constructors.

[REQUIRED IN COURSE XIII.A.]

536. TESTING OF OILS.

Professor Gill and assistants.

PREPARATION: 512; 550.

A lecture and laboratory course of twenty exercises, covering the mechanical and chemical testing of the mineral, animal, and vegetable oils, with the purpose of detecting adulteration, and of determining their applicability,

and their safety, from the point of view of the manufacturer and of the insurance underwriter. Given in the first term of the fourth year.

Text-book: Gill, Handbook of Oil Analysis.

[ELECTIVE.]

537. CHEMISTRY OF ROAD MATERIALS (Brief Course).

Professor Gill.

PREPARATION: 502.

A course of fifteen lectures and thirty hours in the laboratory in the second term. This course is intended for civil engineers and deals with the applications and tests of bitumens, tars, oils, paints and chemicals used in the preservation of roads and road structures.

[ELECTIVE IN COURSE I., GRADUATE YEAR.]

538. CHEMISTRY OF ROAD MATERIALS.

Professor Gill and assistant.

PREPARATION: 502.

A course of thirty lectures and conferences with ninety hours laboratory work, in the first term of the third year. It considers the source, preparation, application and tests of cements, bitumens, tars, binders, oils and preservative agents used in connection with road making.

[REQUIRED IN COURSE I., OPTION 3.]

550. ORGANIC CHEMISTRY (Brief Course).

Professor Moore.

PREPARATION: 502.

This course of thirty exercises in the first term is designed for students who will not pursue the study of Organic Chemistry further, and includes a general discussion of the most important facts in the chemistry of the compounds of carbon. The typical methods of preparation and the chemical and physical properties of the various classes of compounds are presented, and a brief account is given of the source and technical preparation of the simpler substances of commercial importance.

[REQUIRED IN COURSES VII., VIII., XI., XIV., XV., OPTION 3.]

551. ORGANIC CHEMISTRY I.

Professor Moore.

PREPARATION: 513; for Course V. 565, which may be taken simultaneously.

A course of three lectures and one recitation a week throughout the second term of the third year, and two lectures and one recitation a week in the first term of the fourth year, in which the general principles and theories of Organic Chemistry, the method of preparation, and the characteristic reactions of organic compounds are treated in great detail, including all specific compounds which are of technical or theoretical importance. The lectures are fully illustrated by experiments.

[REQUIRED IN COURSES V., X.]

552. ORGANIC CHEMISTRY II.

Professor Mulliken.

PREPARATION: 551 and 556, or equivalents.

This subject is a continuation of Organic Chemistry I. (551). Its object is to give the advanced student having this fundamental preparation that broader and more intimate acquaintance with the theories, principles, and practical applications of Organic Chemistry that should be possessed by the industrial organic chemist as well as by teachers and research workers in Organic Chemistry. The course consists of two regular exercises weekly throughout the first and second terms, in which groups of important topics, varying from year to year, are thoroughly studied by assigned reading and discussion of monographs and current publications in a seminar accompanied by lectures.

[ELECTIVE IN COURSES V., X., GRADUATE YEAR.]

553. RECENT DEVELOPMENTS IN ORGANIC CHEMISTRY.

Professor Moore.

This course of lectures (one hour per week) is designed for those graduate students and members of the instructing staff whose regular work is in other departments of the science, but who yet desire to keep in touch with what is being done in the organic field. The newer views of the valence of carbon and of oxygen, the relation of color and flourescence to chemical constitution, and other topics of general chemical interest will be discussed.

[ELECTIVE.]

556. ORGANIC CHEMICAL LABORATORY.

Professor Moore; Mr. Kneeland and assistants.

PREPARATION: 513; 551, taken simultaneously.

In this course, given eight hours a week in the second term of the third year and ten hours a week in the first term of the fourth year (six in both terms for Course X.), the student becomes familiar with the operations and apparatus involved in organic work, such as fractional distillation, extraction, crystallization, steam distillation, determinations of melting and boiling points, and the like; and with various general methods of preparation, such as etherification, saponification, nitration, sulphonation, reduction, and oxidation, diazotization, etc. He prepares in all from twenty to thirty compounds, including nitro-benzene, aniline, ethers, phenol, dyestuffs, and other products of synthetic and commercial interest. The work is supplemented by regular conferences with individual students in which the application of the theories of the science to the work in hand is constantly emphasized.

In connection with the foregoing the student makes a systematic study of the characteristic reactions of organic compounds, with special reference to their analytical significance. An important part of the work consists in the identification of unknown compounds and the separation of mixtures through an application of the knowledge gained from experiments with known substances. The instruction in this course also includes qualitative tests for all the important elements occurring in organic compounds, and quantitative determinations of carbon, hydrogen, nitrogen, and the halogens.

[REQUIRED IN COURSES V., X.]

557. ORGANIC CHEMICAL LABORATORY.

Professor Moore; Mr. Kneeland and assistants.

PREPARATION: 512; 550.

This course includes a portion of the instruction described under course 556, the time devoted to the work varying somewhat with the professional Course, as indicated on pages 173 and 178.

[REQUIRED IN COURSES VII., XIV., OPTION 3.]

558. ORGANIC CHEMICAL LABORATORY.

Professor Moore; Mr. Kneeland and assistants.

PREPARATION: 512; 550.

This course consists of one three-hour exercise each week in which the student performs experiments designed to illustrate the principles discussed in 550.

[REQUIRED IN COURSE XI.]

560. ADVANCED ORGANIC LABORATORY.

Professors Moore, Mulliken.

PREPARATION: 551 and 556 or equivalent.

The facilities of the well-equipped Organic Laboratory of the Institute are open to properly qualified students for either research, or work in the preparation and reactions of special classes of organic compounds. The kind and amount of work may be varied to meet individual requirements.

[ELECTIVE.]

565. THEORETICAL CHEMISTRY I.

Professor Sherrill; Dr. Patrick and assistants.

PREPARATION: M21; 801; 807; 512.

This subject consists of forty-five lectures and recitations and nine three-hour laboratory exercises in each term of the third year. In the class-room exercises only the more important general principles of chemistry are considered; but these are treated with great thoroughness, and are illustrated by applying them to a variety of problems, which the students are required to solve. The course is indeed mainly devoted to the discussion of these problems, the aim being to develop power to use the principles, rather than merely to impart a knowledge of the phenomena. The topics considered in the course are the pressure-volume relations of gases, the properties of solutions related to molal composition, the conduction of electricity in solutions, the ionic theory, the mass-action law applied to the rate and equilibrium of chemical changes, heterogeneous equilibrium from the phase-rule stand-point, and thermo-chemistry. The laboratory course serves to emphasize the principles of the subject, rather than to teach physico-chemical methods of measurement; and for this reason it is closely correlated with the class-room work. The principles are, however, illustrated by the determination of physico-chemical constants; for example, of vapor-density and molecular-weight of vapor-pressure, boiling-point,

and freezing-point, of transference-numbers, conductivity, and ionization, of rates of reaction, of the equilibrium-constants of gaseous, dissolved, and solid substances, and of thermochemical constants. Each laboratory exercise is preceded by a half-hour conference in which the experiments to be performed are discussed. Courses VIII. and XV., Option 3, omit the laboratory exercises.

[Required in Courses III., Option 2, V., VIII., X., XIV., XV., Option 3.]

566. THEORETICAL CHEMISTRY II.

Professors Noyes, Sherrill; Dr. Patrick, and assistants.

Preparation: 565.

This subject, which consists of thirty lectures and recitations and six laboratory exercises in each term of the fourth year, is a continuation of subject 565, and is presented in the same way. In the first term are considered the principles of electrochemistry and thermodynamic chemistry—the latter consisting of a discussion of the effect of temperature and pressure on equilibrium from the free-energy-standpoint. The second term is devoted to a consideration of surface-effects in their chemical relations (especially in their bearing upon catalysis and electrolytic polarization), and to the chemistry of colloidal substances. Course VIII., Option 1 and Course X. omit the laboratory exercises.

[Required in Courses V., VII., Second Term, VIII., Option 1, and in the First Term in Course X.]

567. THERMO-CHEMISTRY AND CHEMICAL EQUILIBRIUM.

Professor Mueller.

Preparation: 502; 802.

This course of thirty exercises in the second term of the fourth year consists of informal lectures and recitations devoted to the fundamental principles of the subjects named in the title. These principles are illustrated and emphasized by numerous problems which are solved independently by the students and afterwards discussed in the class-room. The lectures are illustrated by experiments.

[Required in Course III., Options 1, 3.]

575. INDUSTRIAL CHEMISTRY I.

Professor Thorp.

PREPARATION: 502; 550 or 551, 565, which may be taken simultaneously.

This course consists of a series of forty-five lectures and recitations in each term upon the more important technical chemical processes, including those of Metallurgy. Much attention is given to the general operations common to many industries, such as crushing, grinding, lixiviation, filtration, evaporation, distillation, crystallization, etc., and to the details of various types of apparatus used for carrying on these processes. Some of the more important manufacturing industries, such as the production of alkali, fertilizers, glass, pigments, cement, soap, explosives, paper, as well as wood distillation, the refining of petroleum, etc., are also considered in detail. Charts, models, lantern slides, and a large collection of samples are employed as aids to instruction in this course, and in this connection visits are made by the class to various factories in the neighborhood of Boston. The text-book is Thorp, Outlines of Industrial Chemistry.

[REQUIRED IN COURSES V., X., XIV.]

576. CHEMICAL ENGINEERING I.

Professor Walker.

PREPARATION: 218, 565, which may be taken simultaneously.

The intelligent, effective and economical control of a modern industrial process requires on the part of the operating engineer not only a clear, qualitative appreciation of the factors involved, but in addition the power quantitatively to analyze the exact influence of each of these factors upon the results attained. The attempt of this and the following course is to develop with reference to the field of chemical engineering this power in the student. In this course of 30 lectures and recitations given in the second term are considered the principles on which the more important mechanical operations involved in the chemical manufacturing industries depend, together with a study of the types of apparatus available for such operations, and the kind of work for which each is best adapted.

[REQUIRED IN COURSE X.]

577. CHEMICAL ENGINEERING II.

Professor Lewis.

PREPARATION: 575, 576, which may be taken simultaneously.

During the first term of this course of thirty hours throughout the fourth year the time is devoted to a systematic and comprehensive analysis of both the qualitative and quantitative applications under industrial con-

ditions of the principles presented in the previous course. The attempt is made to develop familiarity and mastery of these principles both by detailed discussion in the class room and by the solution of typical problems. It is, however, highly undesirable that the work should be limited to such instruction as it tends to emphasize the method and point of view of the instructor, rather than to develop in the student that individuality necessary for the successful attack of his future problems. Therefore during the second term the work is restricted to the quantitative solution of a relatively small number of problems so chosen as to require careful analysis. Furthermore, in order to develop in the student originality of method, these problems are so far as possible of such a nature that neither previous instruction nor study of the literature will directly reveal a simple method of attack. Moreover, to avoid stereotyping the instruction, the subject matter is widely varied from year to year. While problems are chosen from any suitable branch of chemical industry, especial attention is paid to the processes of sedimentation, lixiviation, crystallization, evaporation, air drying, and electrolysis.

[REQUIRED IN COURSE X.]

579. CHEMICAL ENGINEERING OF SPECIAL INDUSTRIES.

Professor Lewis.

PREPARATION: 565, 575, which may be taken simultaneously.

A course of thirty lectures and conferences in the first term, intended to familiarize the student with the principles of chemical engineering by developing the technique of their application in a single industry. No attempt is made to give factory details and routine except in those cases where general chemical and engineering methods are well illustrated. Each year one of the following topics is studied as typical of important subdivisions of engineering practice:—

a. *Manufacture of leather.* This industry offers exceptional opportunities for the quantitative study of the applications of lixiviation, osmosis, hydrolysis, electrolytic dissociation, diffusion, precipitation of colloids, washing of solids, and air drying, as well as the utility of the methods of proximate analysis in the control of commercial processes.

b. *Evaporation.* The applications of the principles of heat engineering and of the properties of solutions are illustrated in the problems of air and vacuum drying, open and closed pan evaporation, and the design and operation of multiple effect systems.

c. *Fractional Distillation.* The applications of the general principles of chemistry to the separation of mixtures of volatile substances are studied in commercially important cases, and the engineering methods involved are analyzed in the light of the best modern practice.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

580. MATERIALS OF CONSTRUCTION.

Professor Lewis.

PREPARATION: 565, 575; 576; 587.

This subject will consist of thirty lectures and conferences on the mechanical properties and chemical resistance of the commercial materials of construction, including a study of metallography, its methods and results. Especial attention is given to the study of plastica, from the point of view of the engineer in the light of colloidal chemistry.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

581. APPLICATIONS OF CHEMICAL THERMODYNAMICS.

Professor Lewis.

PREPARATION: 565; 576.

A course of thirty lectures and conferences intended to present thermochemistry from a point of view most helpful to the chemical engineer. The previous training in the subject is used as a foundation upon which to build a familiarity and appreciation which shall render the subject matter more readily available in technical work.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

582. PLANT DESIGN.

Professor Lewis.

PREPARATION: 581, taken simultaneously.

A course of sixty hours in each term of the graduate year, consisting of drawing-room work and conferences planned to familiarize the student with the more important methods of chemical engineering design, to develop original power in the solution of problems, to give experience in the selection, criticism, interpretation, and use of material available in the literature, and to emphasize the technique of the laboratory methods of obtaining needed data. Especial attention is paid to graphical methods. The subject matter of the course will vary from year to year, and will be selected from any suitable branch of applied chemistry.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

583. CHEMICAL ENGINEERING LABORATORY.

Professors Walker, Lewis; Mr. Dickson.

PREPARATION: 582, taken simultaneously.

This course of fifteen two-hour exercises during either term of the graduate year is intended to familiarize the student with the principles underlying the operations of chemical industry by quantitative experimentation with typical forms of apparatus in the laboratory. This includes experimental work with the filter press, open and closed pan evaporators, rectifying column, ball mill, crushers and grinders, stirrers, sedimentation tanks, crystallization, gas and electric furnaces of the various types, as well as the possibility of utilizing such of the special equipment of the laboratory as may be of especial value to the individual student. In all cases emphasis is laid upon capacity and efficiency as the controlling factors in operation.

[ELECTIVE IN COURSE X., GRADUATE YEAR.]

584. INDUSTRIAL APPLICATIONS OF CHEMICAL PRINCIPLES.

Professor Blanchard.

PREPARATION: 565, 575.

A seminar course of fifteen hours in the first term in which a few of the important industrial processes will be studied from the standpoint of general chemistry. Particular attention will be directed to determine the theoretical maximum efficiency in each case and methods of attaining it.

[ELECTIVE IN COURSES V., X., XIV., GRADUATE YEAR.]

585. APPLIED CHEMISTRY.

Professor Gill.

PREPARATION: 502.

This course of fifteen exercises in the first term of the second year deals with the properties, testing, and applications of paints, oils, varnishes, lubricants and wood preservatives. Alloys, bearing metals, boiler scale and corrosion of metals are also discussed.

[REQUIRED IN COURSES XIII., XIII.B.]

586. INDUSTRIAL CHEMISTRY.

Professor Walker.

PREPARATION: 550; 557; 565.

In this course of forty-five lectures, given in the first term of the fourth year, the more important industrial chemical processes, including metallurgy, are studied from the point of view of both the chemical reactions forming the basis of the process, and the plant necessary to carry on these reactions. In this way the interrelationship of the different industries as to raw material, sources of energy, and standard types of apparatus is developed and a general survey of the field obtained.

[REQUIRED IN COURSE XV., OPTION 3.]

587. INDUSTRIAL CHEMISTRY II.

Professors Walker, Lewis; Mr. Dickson.

PREPARATION: 513; 565; 575, which may be taken simultaneously.

In this course of one hundred and five hours laboratory practice (one hundred and thirty-five for Course X., ninety for Course V., and forty-five for Course XIV.) given in both the first and second terms, no attempt is made to prepare a large number of chemical products, on the one hand, nor to ape factory methods or scale of operations on the other. The work consists rather in a quantitative study of the preparation and purification of one, or at most two chemical products, selected as types of reactions of industrial importance. The process is first examined in the light of available literature, and is analyzed as to the probable factors which enter into its successful operation. Commencing with the preparation of the raw material it is next carried out in a quantitative manner in the laboratory on as large a scale as is consistent with reasonable accuracy and despatch. In this way the knowledge necessary to an intelligent opinion as to the commercial practicability of the process is obtained, and the data required for the design and equipment of a plant for carrying on the process are accumulated. Each chemical operation is analytically controlled, rapid methods of the requisite accuracy being employed. The physical properties of the solutions, precipitates, and final products are critically observed and made the basis of the choice of the apparatus to be recommended as best adapted for the purpose. Finally, each student submits a technical report upon the process and plant, complete with blue prints of the layout and estimate of costs. In this report especial attention is devoted to the use of clear, though concise English, and to the general appearance of the finished copy. Questions of labor, depreciation, interest and insurance are discussed in the class, and so far as is possible are involved in the students' reports.

[REQUIRED IN COURSES V., OPTIONS 2 AND 3, X., XV., OPTION 3. OPTIONAL IN COURSE XIV.]

588. PROBLEMS IN APPLIED CHEMISTRY.

Professor Lewis.

PREPARATION: 565; 575, which may be taken simultaneously.

A course of thirty conferences and recitations in the second term of the fourth year, involving the discussion and solution of problems illustrating the quantitative application of chemical principles in various industries. The aim of the work is to train the student in the interpretation and use of data in such a way as to secure from them the most information concerning the operation and economy of the processes of applied chemistry. A careful analysis is made of a few specific industries, the outlines of which are already familiar from previous courses. Given in the first term 1915–1916.

[REQUIRED IN COURSE V., OPTION 2.]

590. EXPERIMENTAL PROBLEMS IN INORGANIC CHEMISTRY.

Professor Fay.

591. EXPERIMENTAL PROBLEMS IN THEORETICAL CHEMISTRY.

Professor Noyes.

592. EXPERIMENTAL PROBLEMS IN ORGANIC CHEMISTRY.

Professors Moore, Mulliken.

PREPARATION: For 590; 514, taken simultaneously; For 591; 565, 570, taken simultaneously; For 592; 551, 556, taken simultaneously.

These courses include laboratory practice in the solution of problems of the nature of minor researches, in the respective fields indicated above, which are intended to give the student an opportunity to test his ability to do work of an original character. In connection with this work carefully written reports are required upon the journal literature relating to the topics in hand, and a formal record of results obtained in the laboratory must be presented for acceptance. The problems in inorganic chemistry include also those of analytical chemistry.

[REQUIRED IN COURSE V., OPTION 1. COURSE V., OPTION 2, TAKES 590.]

593. HISTORY OF CHEMISTRY.

Professor Moore.

PREPARATION: 551; 565.

In this course of fifteen exercises, given in the second term of the fourth year the historical development of the important theories of Chemistry is considered. The treatment of the subject is essentially biographical, special attention being given to the life and work of the men who have materially advanced the science by their investigations or theories. In connection with the instruction in this subject each student is required to complete an extended course of reading, which includes a study of one or more of the classical memoirs in Chemistry, and to prepare an essay based on the study of some important period in the history of Chemistry.

[REQUIRED IN COURSE V.]

594. JOURNAL REPORTS.

Professor Fay.

PREPARATION: 551.

A series of fifteen exercises in the first term of the fourth year, in which topics are assigned to individual students for report and discussion before the class. The topics are chosen largely from the current journal literature in English, French and German, with the purpose, in part, of familiarizing the student with the use of such journals as a means of self-education.

[REQUIRED IN COURSE V.]

595. THESIS REPORTS.

Professor Talbot and members of the Instructing Staff.

PREPARATION: 513; 551.

A series of weekly class-room exercises in the second term of the fourth year at which the students are required to report upon the progress of the investigations upon which their theses are to be based. These reports are subject to criticism and suggestion from members of the class, and of the instructing staff.

[REQUIRED IN COURSE V.]

596. THESIS REPORTS AND MEMOIRS.

Professor Walker and members of the Instructing Staff.

A series of thirty exercises in the second term of the fourth year; a part of which are of the same nature as 595. In addition, each student is assigned

several topics in applied chemistry upon which memoirs are prepared and presented for discussion before the class, and members of the instructing staff. In these papers the student is required to present the subjects as completely and critically as is practicable, and to supplement them by experiments, drawings, or tabulated statistics.

[Required in Course X.]

597. RECENT DEVELOPMENTS IN CHEMISTRY.

Professor Talbot and members of the Instructing Staff.

Preparation: 594.

During the most of the second term, weekly meetings are held at which reports and reviews of topics of current interest are presented by members of the instructing staff or graduate students.

[Required in Course V., Elective in Course X.]

SPECIAL LECTURES.

During this year, in addition to the regular courses, it is planned to have special lectures given by the persons named below:

Mr. Arthur D. Little, consulting chemist, upon Cellulose, and the Manufacture of Paper; Mr. James W. Loveland, superintendent with B. T. Babbitt, upon the Manufacture of Soap and Glycerine; Mr. S. W. Wilder, Jr., General Manager of the Merrimac Chemical Company, upon Alumina and Alumina Compounds.

DEPARTMENT OF ELECTRICAL ENGINEERING.

DUGALD C. JACKSON, C.E.
Professor of Electrical Engineering.

ARTHUR E. KENNELLY, S.D., A.M.
Professor of Electrical Engineering.

HARRY E. CLIFFORD, S.B. *(Absent.)*
Gordon McKay Professor of Electrical Engineering.

COMFORT A. ADAMS, S.B., E.E.
Abbott and James Lawrence Professor of Engineering.

FRANK A. LAWS, S.B.
Professor of Electrical Engineering.

RALPH R. LAWRENCE, S.B.
Associate Professor of Electrical Engineering.

HARRISON W. SMITH, A.B., S.B.
Associate Professor of Electrical Engineering.

WILLIAM E. WICKENDEN, B.S.
Assistant Professor of Electrical Engineering.

CHARLES W. GREEN, B.S.
Assistant Professor of Electrical Engineering.

Instructors.

WALDO V. LYON, S.B.
RALPH G. HUDSON, S.B.
F. GARDINER PERRY, S.B.
NATHANIEL S. MARSTON, S.B.
O. ROBERT SCHURIG, A.B., S.B.
NORMAN OSANN, B.S.

Research Associates.

HAWLEY O. TAYLOR, PH.D.

Research Assistants.

DAVID J. MCGRATH, S.B.
ERNEST W. CHAPIN, A.B.
O. ROBERT SCHURIG, A.B., S.B.
HERMAN A. AFFEL, S.B.
ROBERT J. WISEMAN, S.B., ENG.D.
ALLEN S. DANA, S.B.
RUPEN EKSERGIAN, S.B., S.M.
LEON H. WEBBER, S.B., S.M.
HENRY J. G. RUDOLF, S.B.

Assistants.

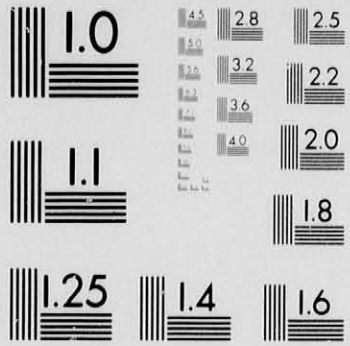
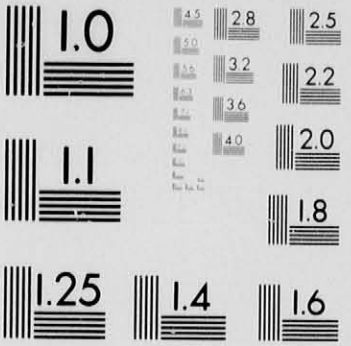
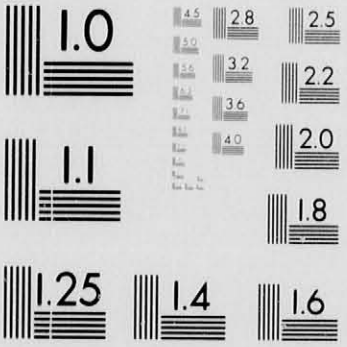
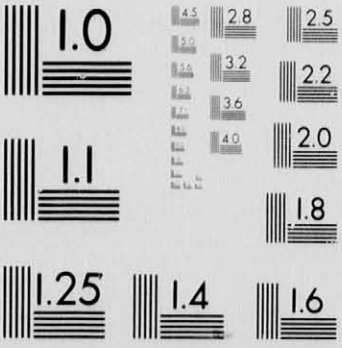
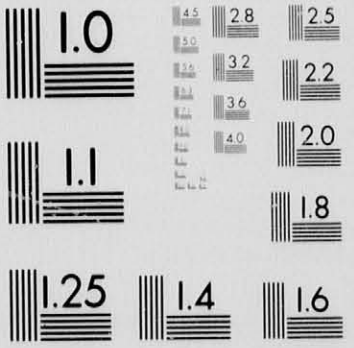
GERALD R. BUTZ, B.S.
ALBERT V. DE BEECH, S.B.
GEORGE O. EATON, S.B.
PHILIP L. ALGER, S.B.
HILDING N. CARLSON, S.B.
VERNON C. KENNEDY, S.B.

The instruction in Electrical Engineering aims to give a foundation in those general principles of Electricity and Magnetism upon which the development and advancement of the electrical art, in all its various phases, have been shown to rest. Coördinated with this instruction in the theory of Electricity and enforcing it, are courses on the larger problems of Engineering, together with the work in the laboratories, embracing a detailed study of the instruments, methods, and plant used in modern electrical engineering practice, special emphasis being laid throughout on a careful study of sources of error, economy of time, and precision of results.

The unusually extensive equipment of the Augustus Lowell Laboratory of Electrical Engineering makes it possible to familiarize the undergraduate student with the various types of apparatus and the engineering methods with which he will be brought into contact in his later professional work, and also affords opportunity for graduate students to carry out original investigations. The latter opportunities are enhanced by the great libraries of the Department.

Journal meetings, in which abstracts of important engineering papers are presented by the students and then discussed, and excursions to important industrial works with which the vicinity of Boston abounds, keep the students in touch with present practice in electrical engineering.

Fourth Year Options.—Fourth year students are expected to select their optional studies from the following: General Studies, Central Stations (637), Dynamo Design (645), Electrochemistry (881), Illumination and Photometry (655), Electric Wiring and Lighting of Buildings (651), Storage Batteries (653), for the first term; and General Studies, Central Stations (637), Mechanical Applications of Electric Power (635), Telephone Engineering (658), Electric Railways (642), for the second term. The optional professional studies illustrate the numerous ways in which theoretical considerations and judgment guide the methods of engineering practice. Each student's selection of the foregoing


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subjects to be included within his Course should be made with the counsel of the teaching staff and must be approved by the Head of the Department. General Studies (English, History, Economics or Modern Languages) must be included to the extent of at least 75 hours among the optional studies selected for the year, except for students who are college graduates.

600. POWER AND ITS TRANSFORMATIONS.

Professor Jackson.

Five lectures to second-year students at the opening of the second term.

[REQUIRED IN COURSE VI.]

611, 612 PRINCIPLES OF ELECTRICAL ENGINEERING.

Professor Wickenden; Messrs. Lyon and Marston.

PREPARATION: M21; M22; 801; 806; 807.

a. Sixty lectures and recitations, and fifteen hours of problem work given in the first term of the third year (611), are devoted to the laws and properties of electric and magnetic circuits and a treatment of the principles of direct current machinery.

b. Forty-five lectures and recitations, and fifteen hours of supervised problem work (omitted by Course XIII.A.), given in the second term of the third year (612) are concerned with the principles of electro-statics and variable currents, the general theory of alternating-current circuits, and the application of these principles to various engineering problems.

In connection with the work much importance is attached to the solution of problems selected with reference to their engineering application.

[REQUIRED IN COURSES VI., XIII.A., XIV.]

614. ELEMENTS OF ELECTRICAL ENGINEERING.

Professor Adams.

PREPARATION: 801.

A course of forty-five lectures and recitations during the first term of the third year for Option 2, and second term of the fourth year for Option 3, in which are considered the fundamental principles of the generation, distribution, and utilization of electrical power.

[REQUIRED IN COURSE XV., OPTIONS 2, 3.]

616, 617. ELEMENTS OF ELECTRICAL ENGINEERING.

Professor Smith and assistant.

PREPARATION: 801.

A course of sixty lectures and recitations in the second term of the third year, (fourth year for Course XIII.B.) (616), continued in the first term of the fourth year (fifth year for Course XIII.B.) (617), treating of the fundamental principles involved in the generation, distribution and utilization of electric power.

[REQUIRED IN COURSES II., XIII.B.]

618, 619. ELEMENTS OF ELECTRICAL ENGINEERING.

Professor Smith and assistant.

PREPARATION: 801.

A course of thirty lectures and recitations, in the first term of the third or fourth year, designed as an introduction to the study of the utilization of electricity for power purposes. The course begins with a brief discussion of the ordinary types of electrical measuring instruments, after which the action and application of direct and alternating current machinery are considered.

[REQUIRED IN COURSES I., III., VIII., X., XIII., XV., OPTION I.]

621, 622. ALTERNATING CURRENT MACHINERY.

Professors Adams, Lawrence[1]*; Mr. Lyon.*

PREPARATION: 612.

This course of lectures, recitations and problems extends from the beginning of the fourth year to the middle of the second term and is devoted to discussions of the various types of alternating current machinery for the generation, transmission, and distribution of power. The special properties of each machine are considered, for the machine as a unit, and when it is used as a part of any electrical system. Some of the general considerations concerning long-distance power transmission are also included.

[REQUIRED IN COURSE VI.]

623. ALTERNATING CURRENT MACHINERY.

Mr. Lyon.

PREPARATION: 612.

This course of lectures, recitations and problems extending through the first term is devoted to discussions of the various types of alter-

[1] In charge.

nating current machinery and is similar to Courses 621 and 622. Certain details of the action and operation of machinery which are not essential for students not intending to become electrical engineers are omitted.

[REQUIRED IN COURSES XIII.A AND XIV.]

625. ALTERNATING CURRENT MACHINERY (Advanced).

Mr. Lyon.

PREPARATION: 621, 622.

A course of thirty lectures during the second term dealing with the advanced analysis of the theory and performance of alternating current machinery. The more difficult questions of armature reaction, hunting of synchronous machines, the magnetic and electrical effects produced by various types of windings, etc., are discussed at considerable length. An important part of the course is the solution of problems, some of which will be worked out in the Electrical Engineering Laboratory.

[ELECTIVE IN COURSE VI., GRADUATE YEAR.]

627. ALTERNATING CURRENTS (Advanced).

Professor Kennelly and assistant.

The work of this graduate course, two lectures per week during the year, is concerned chiefly with the transmission of power by alternating currents and its utilization. Solutions of special problems form an important part of the work. The transmission of telephone currents along conducting lines is also discussed in its relation to the general problem of long-distance alternating current transmission of power.

[ELECTIVE IN COURSE VI., GRADUATE YEAR.]

633. ELECTRIC TRANSMISSION AND DISTRIBUTION OF POWER.

Professor Jackson.

PREPARATION: 621, taken simultaneously.

Thirty lectures and quizzes during the first term of the fourth year, on the problems of electric transmission and distribution of power.

[REQUIRED IN COURSES VI., XIV., XV., OPTION 2.]

635. MECHANICAL APPLICATIONS OF ELECTRIC POWER.

Mr. Hudson.

PREPARATION: 621; 622, taken simultaneously, or 616; 617; 623.

A course of lectures, recitations, and reading, two hours per week during the second term, in which the various types of direct and alternating current machinery are discussed with special reference to their uses in power work and industrial processes.

[REQUIRED IN COURSE XIII.A., GRADUATE YEAR. ELECTIVE IN COURSES II., VI., XIV.]

637. CENTRAL STATIONS.

Mr. Hudson.

PREPARATION: 245 AND 621; 622, taken simultaneously.

This course extending through the fourth year (second term only for Course XV.), consists of lectures, recitations and problems dealing with the design, construction and operation of electric power generating stations, including problems of management and questions of cost.

[REQUIRED IN COURSE XV., OPTION 2. ELECTIVE IN COURSE VI.]

639. DESIGN OF STATIONS AND DISTRIBUTION SYSTEMS.

Professor Wickenden; Mr. Hudson.

This course covers the design and estimates for a complete central station and distributing system.

[ELECTIVE IN COURSE VI., GRADUATE YEAR.]

642. ELECTRIC RAILWAYS.

Professor Jackson.

PREPARATION: 621; 622, taken simultaneously.

A course of thirty lectures and quizzes in the second term of the fourth year, including a discussion of the construction, equipment, and operation of different types of electric roads, together with related problems in power transmission and generation.

[ELECTIVE IN COURSE VI.]

643. ELECTRIC RAILWAYS (Advanced).

Professor Clifford.

A course of thirty lectures per term on the application of electricity to the propulsion of railway trains. Special attention is paid to the pre-determination of size of equipment and energy requirements, the relative advantages of steam and electricity for propulsion, the various systems of electric traction, and to the making of estimates of the cost of construction and operation.

[ELECTIVE IN COURSE VI., GRADUATE YEAR. NOT GIVEN IN 1915–1916.]

645. PRINCIPLES OF DYNAMO DESIGN.

Professor Adams.

PREPARATION: 611; 612.

A course of thirty exercises during the first term of the fourth year, discussing direct current machines and transformers. Materials of construction, methods of construction, and the influence of the various factors in design on manufacture and operation are considered. The chief object of this course is to teach the student that there is a "reason why" in dynamo design, and to cultivate in him the desire to find it.

[ELECTIVE IN COURSE VI.]

647. DYNAMO DESIGN (Advanced).

Professor Adams.

A course of exercises in the second term forming a continuation of the preceding course, treating of alternating current machines.

[ELECTIVE IN COURSE VI.]

651. ELECTRIC WIRING AND LIGHTING OF BUILDINGS.

Mr. Hudson.

A course of fifteen lectures during the first term of the fourth year in which are considered the standard materials and methods used in the wiring and lighting of buildings. Samples of electrical fittings and models of standard electrical construction are exhibited in the Laboratory, where they may be examined by the students.

[REQUIRED IN COURSE IV., OPTION 2. ELECTIVE IN COURSE VI.]

653. STORAGE BATTERIES AND THEIR APPLICATION.

Professor Lawrence.

A course of fifteen lectures in the first term of the fourth year dealing with the theory, care, and application of storage batteries.

[ELECTIVE IN COURSE VI.]

655. ILLUMINATION AND PHOTOMETRY.

Mr. Hudson.

A course of fifteen lectures and ten laboratory exercises in the first term of the fourth year. The lectures are devoted to a discussion of the production, measurement and utilization of light. In the laboratory the student gains experience in the use of the ordinary apparatus designed for monochromatic and heterochromatic photometry.

[ELECTIVE IN COURSE VI.]

658. TELEPHONE ENGINEERING.

Professor Kennelly and assistant.

PREPARATION: 612, 633.

The course deals with the main systems of electrical telegraphy and telephony in practical use, with reference to their principles and modes of application. The various types of telegraph conductor are also taken up in detail, aerial, subterranean and submarine. The various telegraph and telephone lines and systems in most general use are considered, as well as the difficulties encountered in their operation. The engineering theory of electromagnetic-wave transmission over electric circuits is studied in connection with the use of such circuits for signaling purposes. The theory of loaded and composite telephone lines is outlined.

Laboratory work, which may be arranged for by consultation, includes measurements of voltage and current upon several types of artificial lines, and the comparison of measured results with those deduced theoretically.

[ELECTIVE IN COURSE VI.]

661, 662. TECHNICAL ELECTRICAL MEASUREMENTS.

Professor Laws; Mr. Schurig.

PREPARATION: 612; 664; 665, taken simultaneously.

A course of thirty lectures and recitations in the second term of the third year (661), and ten in the first term of the fourth year (662). It is

devoted to a detailed study of the various measuring instruments used in technical work, special attention being given to questions of accuracy and possible sources of error. In the latter part of the course the various alternating current instruments and methods which are of particular importance in station practice are considered.

[Required in Courses VI., VIII., Option 3.]

664, 665. TECHNICAL ELECTRICAL MEASUREMENTS LABORATORY.

Professor Laws; Mr. Schurig and assistants.

Preparation: 806; 807; 808; 612 (and for Course VI., 661, 662), taken simultaneously.

In this laboratory course in both terms of the third year and the first term of the fourth year, particular attention is given to tests to determine the character and behavior of the materials of Electrical Engineering under various circumstances and to the study of measuring instruments. In addition to these matters a considerable amount of time in the latter part of the course is devoted to work supplementary to the lectures on Alternating Currents.

[Required in Courses VI., XIV.]

667. STANDARDIZING LABORATORY.

Professor Laws; Mr. Schurig and assistants.

A course of thirty hours of laboratory exercise in the first term of the senior year, in which special attention is given to the calibration of instruments and to the tests concerned in the acceptance of electrical material.

[Required in Course XIII.A.]

668. ELEMENTARY TECHNICAL ELECTRICAL MEASUREMENTS.

Professor Laws.

A course of ten lectures and five laboratory exercises given in the first term of the graduate year. The course is designed to familiarize the student with the most important electrical instruments and methods of measurement.

[Elective in Course III., Graduate Year.]

669. ELECTRICAL TESTING (Advanced).

Professor Laws.

This is an advanced laboratory course of five to ten hours per week during the first term intended as an introduction to the more elaborate work of special investigation. Each student is assigned a particular problem and is expected to work out carefully the experimental processes involved, so that a just estimate of the value may be reached. To facilitate this work, a very complete collection of instruments and standards has been provided.

[ELECTIVE IN COURSE VI., GRADUATE YEAR.]

670, 671. ELECTRICAL ENGINEERING LABORATORY AND REPORTS.

Professor Green; Mr. Marston, and assistants.

PREPARATION; 611; 612; 806; 807; 808, taken simultaneously for Course VI.; 822.

A course in the first term of the third year devoted to the study of direct-current machinery, and continued through the second term. The tests include the determination of characteristics, efficiency, regulation, and heating, and are supplemented by laboratory conferences. The preliminary reports submitted by students before performing any experiment in the laboratory are prepared in the class-room at hours specially assigned for this work.

[REQUIRED IN COURSES VI., XIV.]

672, 673. ELECTRICAL ENGINEERING LABORATORY AND REPORTS.

Professor Green; Messrs. Perry, Osann, and assistants.

PREPARATION: 671; 621; 622, taken simultaneously.

The work of this course is a continuation of that of course 671, and includes four hours per week in the laboratory for fifteen weeks during the fourth year. Tests are made on alternating current machines for efficiency, heating, regulation, etc. The work in the laboratory is supplemented by preliminary reports and conferences.

[REQUIRED IN COURSES VI., XIV., OPTION I.]

675. ELECTRICAL ENGINEERING LABORATORY (Advanced).

Professors Lawrence, Green.

The work of this course, five hours per week throughout the year, is specially arranged for each student, and deals particularly with the more advanced problems of Alternating Currents.

[ELECTIVE IN COURSE VI., GRADUATE YEAR.]

681, 682. ELECTRICAL ENGINEERING LABORATORY.

Professor Green; Messrs. Perry, Osann, and assistants.

PREPARATION: 618; 619.

A course of laboratory exercises occupying forty-five hours in the first and second terms of the third year of Course I., designed to familiarize the student with the elements of technical measurements and with the characteristics and operation of the ordinary types of electrical machinery.

[REQUIRED IN COURSES I., XV., OPTIONS 1 AND 2.]

684, 685. ELECTRICAL ENGINEERING LABORATORY.

Professor Green; Messrs. Perry, Osann, and assistants.

The work in this course is arranged each year in accordance with the requirements of the individual students. It occupies forty-five hours in the senior year and the same in the graduate year.

[REQUIRED IN COURSE XIII.A.]

687. ELECTRICAL ENGINEERING LABORATORY AND REPORTS.

Professor Green; Messrs. Perry, Osann, and assistants.

PREPARATION: 614 or 618; 617; 619, taken simultaneously.

A course of laboratory exercises in the first term of the fourth year, for Courses II., III., and XIII., designed to familiarize the student with the elements of technical electrical measurements, and with the characteristics and operation of the ordinary types of electrical machinery.

[REQUIRED IN COURSES II., III., XIII., XIII.B.]

689. ELECTRICAL ENGINEERING LABORATORY AND REPORTS.

Professor Green; Messrs. Perry, Osann, and assistants.

PREPARATION: 618 or 619.

A laboratory course of three hours per week during the first or second term of the fourth or third year, devoted to the illustration of the characteristics and operation of the ordinary types of electrical machinery. The work in the laboratory is supplemented by conferences.

[REQUIRED IN COURSES VIII., X., XV., OPTION 3.]

691. JOURNAL MEETINGS.

Professor Lawrence; Mr. Lyon.

PREPARATION: 621; 622, taken simultaneously.

This course is intended to afford training in the preparation and discussion of professional papers and technical reports. Weekly sessions are held for the consideration of current engineering problems. The work is conducted with the coöperation of the Department of English.

[REQUIRED IN COURSE VI., SECOND TERM.]

692. ELECTRICAL ENGINEERING (Seminar).

Department Staff.

A series of conferences of the Instructing Staff and all men pursuing graduate work in the branches relating to Electrical Engineering, for the purpose of reviewing problems of timely interest in electrical engineering. Continued through the year. The principal theme for the year 1914–1915 was the historical development of the sciences and arts underlying modern electrical engineering processes.

[REQUIRED IN COURSE VI., GRADUATE YEAR.]

695. ORGANIZATION AND ADMINISTRATION OF PUBLIC SERVICE COMPANIES.

Professor Jackson.

Three hours of lectures and conference per week through the year, accompanied by extensive assigned reading and examination of operating records.

[ELECTIVE IN COURSE VI., GRADUATE YEAR. OPEN TO UNDERGRADUATES ONLY BY PETITION.]

SPECIAL LECTURES AND EXCURSIONS.

In addition to the above regular courses of instruction, occasional lectures are given before the Electrical Engineering Society by prominent engineers not connected with the Institute upon subjects with which they are especially familiar.

Visits of inspection to the numerous activities of engineering interest about Boston, planned by the Electrical Engineering Society and carried out with the coöperation of the Instructing Staff, are made by third and fourth year students each year, and occasional tests are made of operating electrical plants in the vicinity. More extended trips of inspection under the

guidance of members of the instructing staff are available for fourth year students to electrical enterprises at New York City, Pittsfield, Schenectady and Niagara Falls.

Advantage is also taken of the courtesy of operating companies such as the Edison Electric Illuminating Co. of Boston, the New England Telephone & Telegraph Co., The Boston Elevated Railway Co., and Stone & Webster, to study the methods of organization and commercial operation of electrical enterprises.

DEPARTMENT OF BIOLOGY AND PUBLIC HEALTH.

WILLIAM T. SEDGWICK, PH.D., SC.D.
Professor of Biology and Public Health.

SAMUEL C. PRESCOTT, S.B.
Professor of Industrial Microbiology.

SELSKAR M. GUNN, S.B.
Associate Professor of Sanitary Biology and Public Health.

ROBERT P. BIGELOW, PH.D.
Associate Professor of Zoölogy and Parasitology.

ROBERT S. WESTON, B.S., A.M.
Assistant Professor of Public Health Engineering.

Instructors.

PERCY G. STILES, PH.D. EDWARD A. INGHAM, B.S.
EUGENE C. HOWE, PH.D. CLAIR E. TURNER, A.M.
WILLIAM E. BROWN, B.S.

Assistant.
FOREST J. FUNK, S.B.

In the work of this Department some knowledge of Chemistry and Physics is indispensable by way of preparation, although teachers and special students of mature age are sometimes admitted to some of the lower classes in Biology with only an elementary knowledge of these subjects.

The only course open to first-year students is Microscopical Laboratory. In the second year, courses in General Biology and in the elements of Botany and Zoölogy are provided for those intending to become biologists, or geologists, or to follow the Course in General Science. In the third and fourth years instruction in elementary or more advanced and professional biological and public health subjects is provided, chiefly for students of Biology, Chemistry, Sanitary Engineering, Geology, and General Science,—as is described in detail below.

The use of the microscope is taught in the Microscopical

Laboratory and in the classes in General or Elementary Biology, and the third-year laboratory work in Vertebrate and Comparative Anatomy gives practice in the dissection of the lower animals. More exact and more minute laboratory practice is obtained in the courses in Bacteriology in the third year, and in Industrial Microbiology, Embryology and Parasitology, in the fourth year.

Botany receives considerable attention in the second year, and in this year also is given a general elementary course in Zoölogy, but no attempt is made to teach either advanced Botany or advanced Zoölogy, the aim being rather to lay a solid foundation in the elements of these subjects and upon this to build such professional attainment in Bacteriology, Industrial Microbiology, Physiology, Sanitary Biology and various Public Health subjects, as the time allows.

700. MICROSCOPICAL LABORATORY.

Mr. Ingham.

PREPARATION: 501.

An elementary course of thirty exercises consisting of laboratory practice, quizzes and written recitations, given in the second term of the first year. The aim of the course is to teach the practical use of the microscope, and to make the student familiar with its parts and their proper working. Incidentally, starches, textile fibers, and some other elementary substances are studied during practice with the micrometer, the camera lucida, etc.

[REQUIRED IN COURSE VII.]

701. GENERAL BIOLOGY.

Mr. Ingham.

PREPARATION: 501.

Every student doing work in the Biological Department is expected to take at the outset a course in General Biology. The course here described is the more complete and thorough of those offered in this subject, covering four hours of laboratory work and lectures or recitations each week for the first half of the second year, and bears somewhat the same relation to the study of living things as the elements of Chemistry and Physics

bear to the study of lifeless things. It consists essentially of a general discussion of the fundamental facts and principles common to all the biological sciences, and is illustrated and made real by careful laboratory examination of selected and typical plants and animals. It includes a consideration of such topics as organisms, organs, tissues, cells, protoplasms, metabolism, growth, reproduction, and fermentations, with special reference to the physical and chemical basis of living matter; and, while elementary and preparatory in character and aim, it opens up to the thoughtful student many practical problems and philosophical questions of much interest, relating to life, growth, foods, heredity, evolution, environment, disease, etc.

[Required in Course VII.]

702. ELEMENTS OF BIOLOGY.

Mr. Ingham.

Preparation: 501.

A briefer course, thirty hours, in the first term of the third year, but of the same general character as course 701, designed to give, as far as the time allows, an outline of the study of some of the more important facts and principles and arranged for the benefit of students of Chemistry, Sanitary Engineering, and Geology. Some attention is paid to the microscopical organisms, plant and animal, occurring in reservoirs and other portions of water supplies. This course is a prerequisite for Bacteriology (730) and for the fourth year course in Municipal Sanitation (753).

[Required in Courses V., Options 2, 3, XI., XII.]

703. CRYPTOGAMIC BOTANY.

Mr. Turner.

Preparation: 701.

A course of two lecture hours and two hours laboratory exercise a week in the second term of the second year. The time assigned allows a thorough treatment of the elements of the subject, with abundant laboratory work, lectures, recitations, dissections, drawings, and the like. Beginning with the lowest forms of vegetable life, the slime-moulds, bacteria, seaweeds, and other algæ, rusts, smuts, and various fungi are studied, and afterwards typical liverworts, mosses, ferns and higher cryptogams. Some attention is also paid to the structure and development of the flowering plants. The instruction throughout, though elementary, is comprehensive, giving such a foundation as teachers of elementary Botany and professional biologists or bacteriologists should have.

[Required in Course VII.]

704. INVERTEBRATE ZOÖLOGY.

Mr. Turner.

PREPARATION: 701 or 702.

A synoptic course of two hours per week in the second term, the time being divided about equally between lectures, recitations, and laboratory work. The course covers the whole animal kingdom, and is adapted to the needs of beginners in Biology, of teachers, and of students preparing for more advanced or applied Biology. An unusually rich collection of charts and specimens enables the student to obtain in a comparatively short time a comprehensive survey of all animal groups. Special stress is laid upon the economic aspects of the subject, and parasites, shell fish, and certain food animals, etc., receive much attention. The course is supplementary in character to that in General Biology (701); in the former a few animals are studied in great detail, in the latter, a large number of forms are briefly considered. The two courses taken together—especially if that in Botany (703) be added—furnish a sound elementary knowledge of the principle types of the living world.

[REQUIRED IN COURSES VII., XII.]

710. VERTEBRATE ANATOMY.

Professor Bigelow.

PREPARATION: 701 or 702.

A course of lectures, recitations and laboratory work, five hours per week in the first term of the third year, dealing with the fundamental principles of Vertebrate Anatomy. This course is designed to give the student a complete grasp of the plan of structure of the vertebrates, the group of animals to which man himself belongs. The laboratory work consists of the thorough dissection of a few types of the lower groups of vertebrates, which exhibit the plan of structure characteristic of the phylum in its simpler form. In order that this course may be a valuable exercise in observational science, students are required to discover for themselves the anatomical details of the forms dissected and to record their observations by accurate drawings carefully labeled with descriptive notes.

The text-books used are Kingsley's Comparative Anatomy of Vertebrates, and Kingsley's Guides to Dissections.

[REQUIRED IN COURSE VII.]

711. VERTEBRATE ANATOMY AND HISTOLOGY.

Professor Bigelow.

PREPARATION: 710.

This course is a continuation of the Vertebrate Anatomy of the first term, and is essential as a preparation for the study of physiology and hygiene. It consists of lectures, recitations, and laboratory work occupying six hours a week in the second term of the third year. The time will be devoted entirely to the consideration of the anatomy of mammals, with special reference to the domestic animals and man. About one third of the term will be occupied with the gross anatomy, including careful dissection and drawing and the remainder of the time will be occupied in the study of the minute anatomy of the tissues and organs as revealed by the microscope. Valuable practice is afforded, not only in dissection, but also in the preparation by each student of a series of sections for his own use illustrating the microscopical anatomy of the principal organs of the body. This course affords valuable preparation for the study of medicine, as well as for hygiene and public health.

Text-books:—Kingsley's Comparative Anatomy of the Vertebrates, Bigelow's Directions for Dissection, Lewis and Stöhr, text-book of Histology, second edition, 1914.

[REQUIRED IN COURSE VII.]

712. EMBRYOLOGY.

Professor Bigelow.

PREPARATION: 710.

Five hours a week of lectures and laboratory work in the second term, third year, in the elements of embryology, especially of vertebrates. The chick and the pig will be the forms principally considered.

[REQUIRED IN COURSE VII.]

713. ZOÖLOGY AND PARASITOLOGY.

Professor Bigelow.

PREPARATION: 704.

Two hours a week in the first term of the fourth year. A course of lectures with demonstrations, on invertebrate zoölogy with special reference to the parasitic forms and their relation to disease in man and the domestic animals.

[REQUIRED IN COURSE VII. NOT GIVEN IN 1915–1916.]

714. ANTHROPOLOGY.

Mr. Ingham.

PREPARATION: 701 or 702.

This course consists of fifteen lectures in the second term of the third year, with readings and recitations, and forms an introduction to the advanced study of Biology, History, Sociology, Comparative Politics, and similar economic and sociologic subjects. The place of man in nature, the physical characters of man, the races of man, the evidences of early human life upon the earth, the beginnings of primitive culture, and the historic development of the dominant peoples of modern times are briefly considered.

[REQUIRED IN COURSE VII.]

720. GENERAL PHYSIOLOGY.

Dr. Stiles.

PREPARATION: 710.

Six hours weekly in the second term of the third year. Lectures and recitations upon the general principles of the physiology of protoplasms, with special emphasis upon cellular physiology. To be taken simultaneously with 721 (Physiological Laboratory).

[REQUIRED IN COURSE VII.]

721. PHYSIOLOGICAL LABORATORY (General).

Dr. Howe.

PREPARATION: 710.

Three hours a week in the second term of the third year. An introduction to the whole subject, accompanying course 720.

[REQUIRED IN COURSE VII.]

722. COMPARATIVE PHYSIOLOGY.

Dr. Stiles.

PREPARATION: 720.

A course of three hours per week in the first term of the fourth year, consisting of lectures, conferences, and demonstrations, and covering more of the subject of Physiology in great detail.

[REQUIRED IN COURSE VII., OPTION 1.]

723. PERSONAL HYGIENE.

Dr. Stiles.

PREPARATION: 720.

Lectures, one hour a week during the second term of the fourth year, designed to give an accurate idea of the operation and care of the human mechanism. The course includes an advanced discussion of such topics as the choice of foods, the effects of good and bad air upon the body, muscular activity, fatigue, sleep, rest, recreation, the care of the eyes and other sense organs, bathing and baths, the dangers of the sedentary life, and similar subjects.

[REQUIRED IN COURSE VII.]

724. PLANT PHYSIOLOGY.

Mr. Turner.

PREPARATION: 703.

A series of lectures and recitations, one hour a week during the first term of the fourth year, upon the fundamental physiological phenomena of vegetable cells, tissues, organs, and organisms. The instruction goes hand in hand with that in Comparative Physiology (722), and is designed to emphasize the principles underlying the behavior of plants under various conditions of food, light, temperature, and other elements of different environments.

[REQUIRED IN COURSE VII., OPTION I.]

730. GENERAL BACTERIOLOGY.

Professor Prescott; Mr. Ingham.

PREPARATION: 701 or 702.

A thorough course on the general biology of the bacteria, six hours a week (four for Course XI.) during one term in the third year, for students of Biology and Public Health and for others who desire to take up sanitary or industrial matters depending upon the activity of micro-organisms. The instruction consists of lectures and recitations and extensive laboratory work, in which the student secures a general survey of the behavior and activity of the bacteria, their place in nature and their relation to the environment. The course is a prerequisite for Industrial Microbiology (732) and for all work upon sewage disposal, water supply, and other public health problems in the Biological Department of the Institute.

[REQUIRED IN COURSES V., OPTION 3, VII., XI.]

731. BACTERIOLOGY OF WATER AND SEWAGE.

Professor Prescott; Mr. Ingham.

PREPARATION: 730.

A course of three hours a week in the second term of the third year (for Course VII.) and two hours per week in the first term of the fourth year (for Courses V., XI.), divided between lectures, recitations, and laboratory practice.

The course in General Bacteriology (730) is here supplemented and extended for those students of Chemistry and Engineering who intend to work along sanitary lines, by a more detailed study of the principles and methods of Water and Sewage Bacteriology. The laws which govern the distribution of bacteria in nature, the origin and fate of disease germs in sewage and water supplies, and the agency of bacteria in the purification of sewage and water and the relation of shellfish to polluted water are treated in detail. Special training is given in the latest methods and interpretations of bacteriological analysis.

[REQUIRED IN COURSES V., OPTION 3, VII., XI.]

732. INDUSTRIAL MICROBIOLOGY.

Professor Prescott.

PREPARATION: 550 or 551; 730.

A course of four hours per week in the first term of the fourth year, consisting of lectures (one hour per week) and laboratory work, and dealing with the application of Microbiology to industrial affairs. The roles played by micro-organisms in practical processes such as brewing, vinegar making, tanning, sugar refining, dairying, and the preservation of foods, are considered in detail. The course includes a brief discussion of enzymes, their actions and applications; and the theory and practice of the general phenomena of fermentation are fully discussed.

[REQUIRED IN COURSES V., OPTION 3, VII.]

733. ZYMOLOGY.

Professor Prescott.

PREPARATION: 732, taken simultaneously.

A course of forty-five hours in the first term of the fourth year, including lectures, collateral reading and laboratory experimentation and consisting of an extended discussion of enzymes, their origin, distribution, chemical behavior, and their relation to the theory and practice of different types of fermentation.

[REQUIRED IN COURSE VII.]

734. ADVANCED BACTERIOLOGY.

Mr. Ingham.

PREPARATION: 730; 731.

A course of three hours a week during the first term of the fourth year, consisting chiefly of laboratory work on the more difficult points of bacteriological technique; studies of the metabolism of nitrogen, sulphur, iron, photogenic and other organisms; and lectures and discussions on such subjects as pleomorphism, variation, classification, disinfection, symbiosis, and other questions of current bacteriological literature. The treatment of the subject is intended to be theoretical and purely scientific.

[REQUIRED IN COURSE VII.]

735. BIOLOGY OF INFECTIOUS DISEASES.

Professor Gunn.

PREPARATION: 701.

Lectures and recitations, two hours a week, in the first term of the fourth year, on the biological characteristics of trichinosis, typhoid fever, tuberculosis, Asiatic cholera, and some other infectious diseases of special interest to the sanitarian.

[REQUIRED IN COURSE VII.]

736. PUBLIC HEALTH LABORATORY METHODS.

Professor Gunn.

PREPARATION: 730; 731.

In order to qualify mature students to meet the increasing demand for trained assistants in the various State and municipal bacteriological laboratories already established, or rapidly coming into existence in the United States, instruction is supplied in some of the more important methods employed in such laboratories. The course, given in the second term of the fourth year, consists of one hour lecture a week and two hours of laboratory work in which are taken up the practical methods in use for the cultural diagnosis of diphtheria, examination of specimens for tuberculosis, the Widal serum reaction in typhoid fever, and the microscopical diagnosis of malaria. The student is also familiarized with animal inoculation work and is trained in the modern method of diagnosis by complement fixation.

[REQUIRED IN COURSE VII., OPTION 2.]

737. PUBLIC HEALTH LABORATORY PRACTICE.

Professor Gunn.

PREPARATION: 730; 736.

Special instruction in the methods employed in Board of Health Laboratories, with constant laboratory practice. Designed for special students wishing to perfect themselves in public health laboratory technique.

[ELECTIVE.]

738. DAIRY BACTERIOLOGY.

Professor Prescott.

PREPARATION: 732; 733.

Four hours weekly in the first term consisting of lectures, laboratory work, conferences and field work upon one or more special problems of the milk industries and especially upon the milk supply of large cities. The student will be expected to make personal investigations and critical studies of different systems of supply, such for example as those of individuals, small companies and large contractors; of bacteriological and sanitary control and practice in different cities and different countries; of the pasteurization problem; the inspection problem, transportation, distribution, condensing, concentrating, refrigerating, etc.

[ELECTIVE IN COURSE VII., GRADUATE YEAR.]

739. BACTERIOLOGY OF THE FERMENTATION INDUSTRIES.

Professor Prescott.

PREPARATION: 732; 733.

Two hours weekly in the first term, consisting of lectures, laboratory work and conferences, applied to the investigation of selected problems in some branch of the fermentation industries, such for example as the development or improvement of methods employed in the manufacture of alcohol, lactic acid or other products of bacterial activity. Actual personal studies in the field will be expected, and upon these reports must be submitted for criticism and advice.

[ELECTIVE IN COURSE VII., GRADUATE YEAR.]

740. PROBLEMS IN CHEMICAL AND INDUSTRIAL BIOLOGY.

Professor Prescott.

PREPARATION: 565 (first term); 732, 733.

Lectures, recitations and reports upon special problems, one hour a week throughout the second term of the fourth year. Questions of contemporary interest will be discussed and others assigned as problems to be worked out in such a way as to bring to bear upon them the fundamental data of Physical Chemistry and the applications of bacteriology, zymology, and the like, to industrial and economic biological processes. Readings and reports will also be required.

[REQUIRED IN COURSE VII.]

741. PUBLIC HEALTH LABORATORY PROBLEMS.

Professor Gunn.

PREPARATION: 736; 754.

Six hours weekly in the second term, devoted to actual investigation, under guidance, of the principal questions of current interest and importance in some one department of public health laboratory practice; such for example as the investigation of the purity of inland waters; the vitality of typhoid fever germs in shellfish; the behavior of bacteria in food subjected to cold storage; the fate of bacteria in sewage discharged into harbors and estuaries, the isolation of typhoid bacilli from feces, etc.

[ELECTIVE IN COURSE VII., GRADUATE YEAR.]

750. PUBLIC HEALTH PROBLEMS.

Professor Sedgwick.

PREPARATION: 701; 730.

Fifteen conferences in the first term and fifteen in the second term of the fourth year for senior students of Sanitary Science and Public Health. The course is essentially one in the theory and practice of Hygiene and Sanitation, with discussions of the origin and trend of the underlying principles of Sanitary Science, Public Health Science and Vital Statistics.

[REQUIRED IN COURSE VII., OPTION 2.]

751. EPIDEMIOLOGY.

Professor Sedgwick; Dr. Walcott.

PREPARATION: 720; 731; 750; 753; 754.

One hour a week in the first term, devoted to a detailed consideration of the natural history of epidemics, especially typhoid fever, diphtheria and

scarlet fever, in relation to public water supplies, milk supplies, sewerage systems, and similar causative factors of disease; the intention being to enable the student by a critical examination of the more celebrated and instructive examples to prepare himself for the interpretation of corresponding phenomena arising in actual public health practice.

[ELECTIVE IN COURSE VII., GRADUATE YEAR.]

752. INDUSTRIAL HYGIENE AND SANITATION.

Professor Gunn.

PREPARATION: 750, taken simultaneously.

Lectures and recitations twice a week in the first term of the fourth year. The course deals with the various prejudicial effects of factory life upon health, including occupational accident, industrial poisonings and the effects of defective ventilation and of dusty trades upon the prevalence of tuberculosis and other diseases. The principles are discussed by which these dangers can be minimized under existing conditions of American factory life.

[REQUIRED IN COURSE VII., OPTION 2.]

753. MUNICIPAL SANITATION.

Professor Gunn.

PREPARATION: 731.

This course, given in the second term of the fourth year, four hours a week reviews the most recent progress in public health work by means of lectures, informal discussions and visits to public works of interest and importance. The problems of the municipality are among the most important of modern life, and some of the most difficult are those which concern the public health. In this course detailed consideration is given to the principles of water supply, the disposal of sewage and garbage, air, milk and meat supply, disinfection, the control of contagious diseases by sanitation and other work of a municipal board of health or department of public works. The microscopical analysis of water and sewage is also undertaken so that the student may gain first-hand knowledge of the organisms of most importance in the development of tastes and odors in water supplies.

[REQUIRED IN COURSE VII., OPTION 2.]

754. PRINCIPLES OF SANITARY SCIENCE AND PUBLIC HEALTH.

Professor Sedgwick.

Fifteen lectures (richly illustrated by stereopticon, diagrams and charts) in the second term of the second or fourth year. The principal topics dealt with are health and disease; ancient and modern theories of disease; parasitism; toxins and antitoxins; theories of vital resistance, immunity, etc.; vaccination; epidemiology; and preventive sanitation.

The course is designed to teach those who take it the present state of sanitary science, how to avoid preventable diseases,—such as typhoid fever, smallpox, diphtheria, malaria and yellow-fever,—and, especially, to aid young scientists and engineers in the tropics, in mining camps, in construction camps, or under other unfavorable conditions, in securing and conserving personal health and strength, and thereby greater efficiency, for themselves and their associates. No special preparation is required.

[REQUIRED IN COURSES I., OPTION 1; III.; IV.; V., OPTION 3; VII.; XI; XIII., XV., OPTION 1.]

755. HYGIENE OF VENTILATION AND HEATING.

Professor Sedgwick.

PREPARATION: 701.

Fifteen lectures (with readings), arranged for fourth-year students of Biology and of Mechanical Engineering specializing in Heating and Ventilation. The lectures consist chiefly in considerations of health and disease, their conditions and causes, the physiological regulation of the body temperature, and the sources and remedies of discomfort in private rooms and public halls, due to bad air, overheating, overcrowding, etc.

[REQUIRED IN COURSE VII., OPTION 2.]

756. SANITATION OF SHIPS.

Professor Gunn.

For certain students of Naval Architecture a short course of fifteen lectures is offered, in the second term, in the Elements of Sanitation. Arrangements have been made by which one half of the course is comparable with that in Sanitary Science (754) and consists of instruction in the general principles of sanitation; disease and its causes; the germ theory; infection and contagion and the methods of their dissemination, etc.; while the other half deals directly with sanitary aspects of the heating and ventilation of ships, their sanitary requisites, lighting, water supply, drainage, sewage disposal, and the like.

[REQUIRED IN COURSE XIIIA.]

757. MICROSCOPY OF DRINKING WATERS.

Professor Gunn; Mr. Turner.

PREPARATION: 701 or 702.

This course given one hour a week in the second term of the fourth year, consists of lectures and laboratory work on the microscopical analysis of water. Its aim is to give first hand knowledge of the organisms of most importance in the development of tastes and odors in water supplies. The treatment of water by copper sulphate, aëration, etc. is also discussed. The methods of microscopical examination are considered and practical laboratory work given. The fundamentals of limnology, including dissolved gases and their relations to the microscopic organisms and to soil stripping are likewise briefly treated.

[REQUIRED IN COURSES V., OPTION 3, VII., XI.]

758. SANITATION OF HOUSES AND PUBLIC BUILDINGS.

Professor Gunn.

PREPARATION: 750; 754; 755.

One hour weekly in the second term devoted to the study of the housing problem as it confronts American cities today. Attention is paid to such problems as congestion and overcrowding, building construction, requirements for air space, ventilation, illumination, plumbing, etc. The sociological aspect of the problem is considered in some detail and special emphasis laid upon matters of administration and of housing laws, inspection of buildings and methods to be employed in conducting a housing investigation. Field work is carried on when practicable.

[ELECTIVE IN COURSES VII., XI., GRADUATE YEAR.]

760. THEORY AND PRACTICE OF WATER AND SEWAGE PURIFICATION.

Professor Weston; Mr. Turner.

PREPARATION: 731; 753; 754.

Two hours weekly throughout the year, consisting of conferences and studies prescribed in connection therewith upon the specific problems of water purification and sewage disposal, the object in view being to bring the student, by immediate contact with actual problems, into vital relations with the most recent state of the art. Reports submitted by students will be subjected to rigid criticism both as to substance and form, the design being first to inform the student as to current problems and their solution; second, to give him practice in dealing with similar cases; and third, to supply him with searching, friendly criticism as to his methods and results and as to the form which his reports should take.

During the year the student will be expected to make a detailed sanitary study of some one existing or proposed system of water or sewage purification and to report upon this *in extenso* precisely as he should do this if he were actually employed by a corporation, a city or a town. This report will then be critically considered in conference, more exacting requirements being applied to the later studies of the same sort.

[ELECTIVE IN COURSES I., VII., XI., GRADUATE YEAR.]

762. SANITARY LAW.

Professors Sedgwick, Gunn, Weston.

PREPARATION: 750; 753; 754.

One lecture weekly upon the status of sanitary procedures under the common and the statute law. Consideration will be paid to the police power as allotted under the Constitution, to federal, state and municipal powers, legal procedures in times of epidemic, the law of quarantine, water supply, sewerage and drainage, nuisances, vaccination, and the like. The case method will be followed to a considerable extent, illustrations being drawn as far as possible from notable instances, contemporary litigations, and the personal experiences of the Lecturers.

[ELECTIVE IN COURSES VII., XI., GRADUATE YEARS.]

763. PUBLIC HEALTH ADMINISTRATION.

Professor Gunn; Mr. Hoyt.

A course of fifteen lectures given in the second term. Particular attention is paid to the organization of State and Municipal Health Departments. The administrative duties of executive health officers and other health officials are taken up and considered at length. The course is supplemented by careful consideration of the existing organization of State and Municipal Departments of Health.

[ELECTIVE IN COURSES VII., XI., GRADUATE YEARS.]

770. JOURNALS.

The Department Staff.

PREPARATION: 710; 730.

A semi-weekly meeting of the officers and fourth-year and graduate students of the Biological Department at which each member is expected to report

from time to time upon his own investigations or those of others as found in current periodicals, and is subjected to friendly criticism as to his conclusions, or his methods of presentation, or both. The meetings extend throughout the year.

[Required in Course VII.]

771. THESIS CONFERENCES.

Professors Sedgwick, Bigelow; Drs. Stiles, Howe.

Preparation: 722.

A meeting of the instructors and advanced students in the second term of the fourth year of the Course in Biology (Option 1) for the discussion of recent progress in Physiology, Zoölogy and Bacteriology, and for the presentation of original and critical papers in these subjects.

[Required in Course VII., Option 1.]

772. THESIS CONFERENCES.

Professors Sedgwick, Prescott, Gunn, Weston.

Preparation: 750.

A meeting of the instructors and advanced students in the second term of the fourth year of the Course in Biology (Option 2) for the discussion of recent progress in Sanitary Science and Public Health topics, and for the presentation of original and critical papers in these subjects.

[Required in Course VII., Option 2.]

780. THEORETICAL BIOLOGY.

Mr. Turner.

Preparation: 704; 710.

An advanced course in General Biology of thirty lectures and recitations in both terms of the fourth year, designed to acquaint the student with the principal theories and hypotheses which have played an important part in the history of the subject, and particularly of those which underlie the more fruitful research work of the present day. The first term is devoted largely to the individual organism, the subjects discussed including the physical and chemical explanation of vital phenomena, the responses of organisms to their environment, the development of living organisms, including regeneration and regulation, and the kinds of variability exhib-

ited by living things. In the second term the evidences of evolution, Darwinism and the post-Darwinian theories in regard to the mechanism of evolution are discussed, consideration being given to the recent experimenta advances in the study of biometrics, heredity and eugenics.

[REQUIRED IN COURSE VII.]

781. ADVANCED PHYSIOLOGICAL LABORATORY.

Dr. Howe.

PREPARATION: 712; 722.

Three hours a week in the second term, fourth year, of laboratory work upon the more recent aspects of the subject as now treated in Europe and America.

[REQUIRED IN COURSE VII., OPTION I.]

790. HISTORY OF SCIENCE.

Professors Sedgwick, Tyler.

A course of forty-five lectures, one hour a week throughout the first term of the third year and two hours a week during the second term, of which either term's work may be taken without the other. The course consists of a survey of the beginnings of science, especially in Greece and the Greek colonies; its development at Alexandria, its decline and virtual eclipse in Europe in the dark ages; its rejuvenation in the Renaissance, and its growth and progress in modern times. Brief biographical sketches are given of some of the greater workers—such as Pythagoras, Archimedes, Aristotle, Euclid, Roger Bacon, Leonardo, Copernicus, Kepler, Galileo, Descartes, Newton, Laplace, Dalton, Liebig, Faraday, Lyell, Darwin, and Pasteur—in connection with the discussion of their work. The aim of the course is to acquaint those who follow it with the sources of the broad stream of scientific knowledge as it exists today. The instruction consists of lectures and assigned reading and considerable illustrative material is used.

[ELECTIVE.]

791. PUBLIC HEALTH METHODS.

Mr. Brown.

A course of lectures, recitations and laboratory exercises in public health methods, with visits, inspections and reports.

[ELECTIVE. REQUIRED IN THE SCHOOL FOR HEALTH OFFICERS.]

DEPARTMENT OF PHYSICS.

CHARLES R. CROSS, S.B.
Thayer Professor of Physics and Director of the Rogers Laboratory.

HARRY M. GOODWIN, PH.D.
Professor of Physics and Electrochemistry.

LOUIS DERR, M.A., S.B.
Professor of Physics.

CHARLES L. NORTON, S.B.
Professor of Heat Measurements.

WILLIAM J. DRISKO, S.B.
Associate Professor of Physics.

MAURICE DEK. THOMPSON, PH.D.
Associate Professor of Electrochemistry.

DANIEL F. COMSTOCK, PH.D.
Assistant Professor of Theoretical Physics.

NEWELL C. PAGE, S.B.
Assistant Professor of Physics.

Instructors.

HERBERT P. HOLLNAGEL, PH.D.
GORDON B. WILKES, S.B.
WILLIAM R. BARSS, A.B., PH.D.
GEORGE E. WASHBURN, PH.D.
FRANKLIN L. HUNT, S.B., A.M.
ROYAL M. FRYE, A.B.

Assistants.

OLIVER E. CONKLIN, S.B.
JOSEPH W. HORTON, S.B.
GERALD W. BLAKELEY, B.A., S.B.
CHARLES H. CALDER, S.B.
HORATIO W. LAMSON, S.B.
JOSEPH C. MACKINNON, S.B.
ALLEN R. GREENLEAF, S.B.

The instruction in General Physics extends through the second year, and is common to all Courses. The fundamental principles of the subject are developed in an extended course of fully illustrated lectures, supplemented by recitations.

Parallel with the lecture course is the laboratory course in General Physical Measurements in which the work performed

is, from the beginning, exclusively quantitative. It is laid out primarily to teach the student to make accurate measurements, to impart training in the manipulation of instruments employed in physical investigation, and to give practice in properly recording, interpreting, and reducing experimental data. At the same time it leads to a better understanding of the principles of Physics, with which the student has already become acquainted in the lecture-room. In a number of Courses, such as Physics, Chemistry, Electrochemistry, and Electrical, Mechanical, Chemical and Mining Engineering, study of a more advanced scientific or technical nature is undertaken. In such work, laboratory and lecture instruction are usually combined.

Opportunity is offered for physical and electro-chemical research in special laboratories, which are very extensively equipped. Original investigation is encouraged, and the result has been a considerable number of published memoirs.

For the special benefit of students who are candidates for a degree in Physics, further instruction in pure and applied Physics beyond that given in the general course is provided. It is intended that students pursuing such work shall gain a familiarity with standard works on the various branches of Physics in both their own and foreign languages. In connection with the advanced courses a colloquium is held, for which the students prepare and present before the class for discussion, reviews of current articles appearing in the various physical journals. More advanced instruction in mathematical and experimental Physics is offered to graduate students or others who are competent to pursue such courses.

801. PHYSICS (Mechanics, Electricity, Light, Heat).

Professors Cross, Derr, Norton, Drisko, Page;
Messrs. Hollnagel, Barss, Washburn, Hunt, Frye.

PREPARATION: M12.

The course consists of three lectures per week throughout the second year accompanied by three recitations in each week during the first term and two in each week during the second term. The subjects considered are

general mechanics, molecular mechanics, wave-motion, electricity, light and heat which topics are discussed both mathematically and experimentally. It is the purpose of the course to lay a thorough foundation for subsequent study of theoretical, experimental, and technical Physics. Hence it is planned with immediate reference to familiarizing the pupil with the fundamental principles of the science. The lectures are very fully illustrated by suitable experiments.

[REQUIRED IN ALL COURSES.]

802. PHYSICS (Heat).

Professor Norton.

PREPARATION: 801.

A course of experimental lectures, two hours per week during the first eight weeks of the third year, devoted in part to a consideration of the principles and phenomena of heat, and in part to a discussion of the application of those principles to practical engineering problems and to a discussion of the thermal properties of some of the materials most frequently used in technical and engineering work.

[REQUIRED IN ALL COURSES EXCEPT IV.]

803. PRECISION OF MEASUREMENTS.

Professors Goodwin, Drisko, Page; Messrs. Hollnagel, Barss, Washburn, Hunt, Frye.

PREPARATION: M21 or M23; 807, taken simultaneously.

A course of ten class-room exercises in the second term in connection with the laboratory course in General Physical Measurements. The aim of the course is to teach the student how to attack problems involving measurements of any kind in an efficient manner. The work includes a discussion of the nature of errors and methods for their elimination and the application of the Calculus to the solution of precision problems in direct and indirect measurements. Graphical methods of treating observations are also discussed. Text-book, Goodwin's Elements of the Precision of Measurements and Graphical Methods.

[REQUIRED IN ALL COURSES EXCEPT IV.]

806. PHYSICAL LABORATORY (Recitations).

Professor Page.

PREPARATION: 803, 807, taken simultaneously.

Fifteen class-room exercises on Electricity in connection with the laboratory course 807 in that subject.

[REQUIRED IN COURSES VI., VIII.]

807. PHYSICAL LABORATORY (General Physical Measurements, Mechanics, Electricity, Light, Heat).

Professors Goodwin, Drisko, Page; Messrs. Hollnagel, Barss, Washburn, Hunt, Frye, and assistants.

PREPARATION: 801, 806 and 803, completed or taken simultaneously.

A series of two-hour exercises extending throughout the year, laid out individually for each student, according to the Course he is pursuing. The experiments are correlated, so far as practical, with the lecture and class-room work. The use of the various instruments of precision is taught, as far as may be, in connection with experiments each of which illustrates some different method or principle. The earlier experiments relate to the mechanics of solids, liquids, and gases; these are followed by exercises in electricity, including the measurements of currents, resistances, potentials, capacities and inductances. The experiments in light include the use of the compound microscope, the determination of the focal length of lenses, gas photometry, indices of refraction, and elementary spectrum analysis. Those in heat include exact measurements in mercurial and air thermometry and calorimetry, the determination of the mechanical equivalent of heat by electrical methods, continuous calorimetry, coefficients of expansion, and vapor pressure. All work is strictly quantitative, and the attention of the student is especially directed to the precision discussion of his results. The laboratory manuals used are: Physical Laboratory Experiments, Part I., Mechanics, Part II., Optics, Part III., Heat, prepared by Professor Goodwin; Notes on Electrical Measurements by Professor Page.

Courses I. and XI., omit electricity and seven exercises in the first term.

[REQUIRED IN ALL COURSES EXCEPT IV.]

808. PHYSICAL LABORATORY (Heat).

Professors Goodwin, Drisko; Messrs. Hollnagel, Barss, Washburn, Hunt, Frye, and assistants.

PREPARRTION: 807; 802, completed or taken simultaneously.

This course is a continuation of the preceding, and consists of seven two-hour exercises in heat measurements in the first term of the third year. It

includes exact measurements in mercurial and air thermometry and calorimetry, the determination of the mechanical equivalent of heat by electrical methods, continuous calorimetry, coefficients of expansion, and vapor pressure. Particular attention is directed to the elimination and correction of errors peculiar to heat measurements and to the precision discussion of the results. More advanced instruction in heat measurements is given in course 813. The laboratory manual used is: Physical Laboratory Experiments, Part III., Heat, prepared by Professor Goodwin. After 1915–1916 this course will be included in course 807.

[Required in All Courses except IV.]

810. PHYSICAL LABORATORY (Advanced).

Professor Goodwin.

Preparation: 803; 807; 808.

A course of five hours a week in the second term of the third year, open to students who have completed the general laboratory courses in Physics. The work is laid out for each student individually, and involves collateral reading of references in French and German. The experiments assigned are in the nature of short researches devoted to the exact determination of various physical constants. An extensive collection of apparatus of the highest grade is provided for the work of this course.

[Optional in Course VIII., Option I.]

813. HEAT MEASUREMENTS.

Professor Norton; Mr. Wilkes and assistants.

Preparation: 808.

A course of lectures and laboratory exercises in the measurement of high temperatures, precise thermometry, the efficiency of fuels, and determinations of thermal properties of engineering materials. Especial attention is given to the study of such temperature and heat measurements as are of technical importance,—for instance, the calorific efficiency of coal and the determination of the temperature of kilns and furnaces. The preparation and study of thermometers of the highest precision is required of students in Physics. The time devoted to the work varies in different Courses.

[Required in Courses III., Options 1, 2, V., Options 2, 3, VIII., XII., XIV.]

814. HEAT MEASUREMENTS.

Professor Norton and assistants.

PREPARATION: 808.

A course given in the second term of the fourth year in connection with course 261. It consists of eight or more laboratory exercises of the same character as those of course 813, but more limited in scope.

[REQUIRED IN COURSES II., VI., X., XIII., XIII.A., XIII.B.]

815. ADVANCED HEAT MEASUREMENTS.

Professor Norton.

PREPARATION: 813.

A course of forty-five hours, lectures and laboratory, devoted to the study of methods of measurement of the thermal properties of materials, with the greatest practicable precision, and with apparatus and methods as highly developed as possible. Because of the great lack of accurate data relating to the thermal properties of materials of engineering, this work will be in part of the nature of original research and the laboratory is equipped and will be operated with this point in view. The precise measurement of coefficients of expansion, and of the coefficient of thermal conductivity at high temperatures may be mentioned as examples.

[REQUIRED IN COURSE VIII., OPTION 3.]

816. HEAT MEASUREMENTS.

Professor Norton.

PREPARATION: 813.

This course of forty-five hours lecture and laboratory in the second term is an extension of the undergraduate work in Heat Measurements, especially in the line of application to the study of furnaces and other metallurgical apparatus where the maintenance of fixed high temperatures, the supply of the necessary heat for reactions, and the minimizing of heat loss by radiation, etc., are of prime importance. A thermal study of a metallurgical furnace, or some similar investigation, will occupy a considerable part of the time in the laboratory.

[ELECTIVE IN COURSE III., GRADUATE YEAR.]

822. ELECTRICAL LABORATORY.

Professor Page and assistants.

PREPARATION: 803; 806; 807; 808.

An extension of the second year course (807) of laboratory practice. Application of the general methods studied in the earlier course is made to special problems, such as the measurement of low resistances, the determination of temperature coefficients, the measurement of small capacities and inductances, exact comparisons of electromotive forces, currents, etc. Instruments of the moving coil type are critically studied, and their laws verified by experiment. Opportunity is also offered for the determination of resistance and of current in absolute measure. A series of experiments relating to high frequency currents is also provided.

[REQUIRED IN COURSE VIII.]

824. ELECTRICITY.

Professor Page.

PREPARATION: M22; 801; 807.

A course of thirty exercises in the first term of the third year intermediate in character between the second year course in Electricity and the distinctly mathematical course on the Theory of Electricity given in the fourth year. It includes a discussion of such topics as Kirchhoff's laws, the magnetic circuit, capacity and inductance measurements and methods of determining the ohm, "v," and other fundamental electrical and magnetic constants.

[REQUIRED IN COURSE VIII., OPTION 3, AND ELECTIVE.]

825. THEORETICAL ELECTRICITY.

Professor Comstock.

PREPARATION: 824.

Forty-five exercises in the second term of the third year, devoted to a consideration of the mathematical theory of electrical phenomena, based upon course (824) and of less extent than course (842).

[REQUIRED IN COURSE VIII., OPTION 3.]

828. ACOUSTICS.

Professor Cross.

PREPARATION: 801, taken simultaneously.

A course of fifteen lectures given in the first term of the second year devoted to a consideration of the general phenomena and laws of sound, and in particular to those portions of the subject which relate to speech and hearing.

[REQUIRED IN COURSE VIII.]

829. ACOUSTICS.

Professor Cross.

PREPARATION: 801.

A course of five lectures given in the first term of the fourth year and intended to impart to the student a knowledge of such acoustic principles as are of importance in Architecture.

[REQUIRED IN COURSE IV., OPTION 1.]

831. COLOR.

Professor Cross.

PREPARATION: 801.

A course of five lectures given in the first term of the fourth year. In these lectures are discussed the principles of color sensation, color mixture, successive and simultaneous contrast, and their relations to phenomena in nature and art.

[REQUIRED IN COURSE IV., OPTION 1.]

833. DESCRIPTIVE ASTRONOMY.

Professor Drisko.

PREPARATION: M12; 801.

A course of thirty lectures and recitations in the second term of the third year on the main facts and principles of Descriptive Astronomy, accompanied by a discussion of astronomical instruments and their uses. The scope of the course is substantially that covered in Young's General Astronomy. The lectures are illustrated by numerous lantern slides.

[REQUIRED IN COURSE VIII., OPTIONS 1 AND 2.]

841. THEORETICAL PHYSICS I.,—DYNAMICS.

Professor Comstock.

PREPARATION: M22; 801; M36 or M38, taken simultaneously.

A course of three exercises per week throughout both terms of the third year, designed to give the student a thorough training in theoretical dynamics as a basis for his subsequent work in Theoretical Physics. Independent effort on the part of the student is considered essential to a proper understanding of so fundamental and important a subject and hence much time is devoted to solution of problems. The work begins with the elements of the subject, *i. e.*, with the motion of a point and the mathematical

statement of Newton's Laws, and considers further the dynamics of a particle and the dynamics of rigid and deformable bodies. This includes a consideration of some of the general dynamical methods and principles, such as Lagrange's equations and Hamilton's principle.

[REQUIRED IN COURSE VIII., FIRST TERM; OPTIONS 1 AND 2 SECOND TERM.]

842. THEORETICAL PHYSICS II.,—ELECTROSTATICS AND ELECTROKINETICS.

Professor Comstock.

PREPARATION: 841.

A course of three lectures per week in the first term and two in the second term of the fourth year, designed as an introduction to graduate work in the mathematical theory of electricity. The course opens with a short historical review of the development of the physical theory of electricity and magnetism and this is followed by a general discussion of modern physical theory. The properties of the potential function are then taken up with its application to various problems in attraction, together with a discussion of the theorems of Poisson, Laplace, Gauss, and Green. The modern theory of electrodynamics is then considered and applied to such problems as the dynamics of moving charges, radiation, etc. In this connection a short introduction to the "Principle of Relativity" is given. The purpose of this course is to give the student a general insight into the fundamental principles and methods of attack underlying the most recent investigations in theoretical electricity.

[REQUIRED IN COURSE VIII., OPTIONS 1 AND 2.]

843. THEORETICAL PHYSICS III.,—OPTICS.

Professor Comstock.

PREPARATION: 841.

A course of three lectures and recitations per week during the first term of the fourth year. It is of a general rather than a distinctly analytic nature. It pre-supposes a knowledge of the fundamental principles of Optics, and, while sufficient time is devoted to geometrical Optics to give the student a clear insight into the methods of attacking problems from the standpoint of ray propagation, stress is laid mainly on the theory and phenomena of physical Optics. Wood's Physical Optics is used as a text-book.

[REQUIRED IN COURSE VIII., OPTIONS 1 AND 2.]

844. THEORETICAL PHYSICS IV.,—ENERGETICS AND KINETIC THEORY.

Professor Goodwin.

PREPARATION: 565; 841.

A course of forty-five lectures in the second term of the fourth year devoted to the general mathematical theory of heat and concluding the undergraduate instruction in Theoretical Physics. About thirty exercises are devoted to a general treatment of Thermodynamics with applications to gases, vapors, dilute solutions, and chemical equilibrium. The treatment is based on the properties of the entropy and thermodynamic potential functions and is intended to prepare students to take up as graduate work the study of such works as those of Duhem and Gibbs. This is followed by a treatment of the kinetic theory of gases, including a discussion of the recent work of Planck and Nernst, Van der Waal's equation, and the theory of corresponding states.

[REQUIRED IN COURSE VIII., OPTIONS 1 AND 2.]

848. THEORETICAL AND APPLIED OPTICS.

Professor Derr.

PREPARATION: 841.

Forty-five hours of lecture and laboratory work in the first term of the fourth year, chiefly devoted to the study of lenses and lens combinations, and their applications in photography and microscopy.

[REQUIRED IN COURSE VIII., OPTION 3.]

849. OPTICAL LABORATORY.

Professor Goodwin.

PREPARATION: 807; 808; 843 or 848, taken simultaneously.

A course of four hours a week in the first term of the fourth year devoted to advanced optical measurements. The work includes special methods in photometry, spectrophotometry, spectroscopy, including work with plane grating, concave grating and Littrow-Echelon spectroscopes, and measurements with interferometers, refractrometers and polariscopes. For this work the laboratory is equipped with the best apparatus obtainable. The experiments are in the nature of short investigations in which the student is thrown so far as possible on his own resources. The work assigned varies according to the option the student is pursuing. In Option 3 the application of the work to technical problems is particularly kept in mind.

[REQUIRED IN COURSE VIII.]

851. PHOTOGRAPHIC LABORATORY.

Professor Derr.

PREPARATION: 808; 861.

Laboratory practice in photographic manipulations, sixty hours in the first term of the fourth year, devoted to the testing of lenses and shutters, the making and testing of safe lights, the general and color sensitometry of plates, the preparation and use of color filters, spectrum photography and the use of dyes for regional sensitiveness. A part of the work of course (867) may be included if desired, and some additional freedom of choice of work is allowed.

[REQUIRED IN COURSE VIII., OPTION 3.]

852. ELECTRICAL DISCHARGES IN VACUA.

Dr. Hollnagel.

PREPARATION: 822.

A laboratory course of forty-five hours, first term, fourth year, in which practice will be given in the use of vacuum apparatus, including the manipulation of different types of the mercury pump the measurement of low pressures and the preparation of vacuum tubes for spectroscopic and other purposes. The course will also include such experiments as the determination of $\frac{e}{m}$ and the electronic charge.

[REQUIRED IN COURSE VIII., OPTION 3. ELECTIVE FOR GRADUATE STUDENTS.]

855. PHYSICAL COLLOQUIUM.

Professor Goodwin.

These exercises are prefaced by a lecture on physical and electrochemical periodical literature and reference books, and on the use of a reference library. During the first term each student is required to compile the literature of one physical or electro-chemical subject and of the subject he expects to select for his thesis. At the weekly colloquium meetings held during the second term of the fourth year the students present before the class for informal discussion reviews of assigned articles appearing in English, French, and German scientific journals. The reviews are submitted to the Department of English for criticism as to their literary character.

[REQUIRED IN COURSES VIII., XIV.]

860. CALCULATING MACHINES.

Professor Derr.

An elective course, in the first term, of seven exercises devoted chiefly to practice with the slide rule in solving arithmetical problems taken from Engineering and Physics. The precision attainable with slide rules is carefully studied, and other forms of calculating machines are discussed. To avoid interference with other studies, the exercises are held at 4 P.M.

[ELECTIVE.]

861. PHOTOGRAPHY.

Professor Derr.

PREPARATION: 501; 801.

Fifteen lectures in the second term, very fully illustrated by experiments, on the principles and processes of photography with dry plates. An outline of photographic optics, including the testing of lenses, is followed by a study of the theories of the latent image and its development and the general treatment of dry plates. Orthochromatism and the various processes of color photography are explained in detail. Attention is also given to the use of the copying camera and the projection lantern; and the more important printing processes are illustrated. To avoid interference with other exercises, the lectures are given at 4 P.M. The text-book is Derr's Photography for Students of Physics and Chemistry.

[REQUIRED IN COURSE VIII., OPTION 3; ELECTIVE IN THE SECOND, THIRD AND FOURTH YEARS.]

ELECTIVE COURSES.

862. THE ELECTRICAL DISCHARGE IN GASES; RADIO-ACTIVITY.

Professor Cross.

A course consisting of fifteen lectures in the second term, given in alternate years with course 863. It is devoted to an elementary but rather full discussion of the various phenomena of the electrical discharge in gases and allied subjects, including the low-vacuum discharge, cathode rays, Röntgen rays, and radio-activity. The lectures are illustrated very fully by experiments.

The course is intended to supplement that in General Physics. It is entirely elective and no examination is required. The lectures are given at a late hour in the afternoon so that all students desiring to do so can attend without interference with other studies.

[ELECTIVE. NOT GIVEN IN 1915–1916.]

863. HERTZ WAVES; RADIO-TELEGRAPHY.

Professor Cross.

In this course are discussed the phenomena of electrical oscillations and Hertz waves with their application to wireless telegraphy and allied subjects. The lectures are of the same general character as those in course 862, and will be given in alternate years with the latter.

[ELECTIVE. OFFERED IN 1915–1916.]

864. POLARIZED LIGHT AND ITS APPLICATIONS.

Professor Cross.

PREPARATION: 801.

A course of fifteen experimental lectures given in the first term of alternate years, on polarized light and its applications. The phenomena of plane, circular and elliptical polarization, rotary polarization and the electromagnetic relations of light are discussed, and fully illustrated by experiments. The principles of different forms of polarimeter and saccharimeter are also considered.

[ELECTIVE. OFFERED IN 1915–1916.]

865. PRINCIPLES AND APPLICATIONS OF ELECTROLYSIS.

Professor Goodwin.

A course of six experimental lectures in the second term illustrating the principles underlying electrolysis and the voltaic cell together with some of their more important applications. This course is intended to supplement that in General Physics. It is elective and no examination is required. The lectures are given at four o'clock in the afternoon so as not to conflict with other work.

[ELECTIVE FOR SECOND, THIRD AND FOURTH YEAR STUDENTS.]

866. GENERAL PHYSICAL MEASUREMENTS.

Professors Goodwin, Norton, Page.

PREPARATION: Course in College Physics and 803, completed or taken simultaneously.

This is a course in exact physical measurements of a somewhat advanced character laid out primarily to meet the needs of graduate students who are taking physics as a minor for the degree of Doctor of Philosophy. It

is intended to familiarize students with the best methods for determining various physical constants in light, heat, and electricity, special emphasis being placed on the elimination of sources of error and a precision discussion of the results.

[ELECTIVE IN GRADUATE YEAR.]

867. MICROSCOPE THEORY AND PHOTOMICROGRAPHY.

Professor Derr.

PREPARATION: M22; 801.

A theoretical and experimental study of the principles of vision with the compound microscope, according to the diffraction theory of Abbé, with practice in photomicrography in black and white and natural colors, and in the use of the ultra-violet microscope. For this work there are provided a fine Zeiss compound microscope, with all the accessories required for a study of the theory of the instrument, an Abbé focometer and the Zeiss ultra-violet apparatus operated by a high-power induction coil. Four hours per week throughout the first or second term.

[ELECTIVE IN COURSE VIII., GRADUATE YEAR.]

868. RADIATION.

Professor Goodwin.

This course of fifteen lectures in the first term is devoted to a discussion of the fundamental laws of radiant energy and the phenomena resulting from its transformations. The course begins with a consideration of the laws of Kirchhoff, Stefan-Boltzmann, Wien, Planck and others on black body radiation and their experimental verification and application to high temperature measurements. The radiation of gases is then taken up and includes a discussion of the effect of pressure, temperature, and magnetic field on spectra, and the recent work on "series." The course concludes with a consideration of the application of these matters to problems in astrophysics. Offered in alternate years with 869.

[ELECTIVE IN GRADUATE YEAR. NOT GIVEN IN 1915–1916.]

869. THEORY OF RADIATION AND ITS APPLICATION TO MODERN PHYSICS.

Dr. Hollnagel.

A course of fifteen lectures in each term in which the modern views of Radiant Energy are treated from a mathematical standpoint. The first fifteen lectures are devoted entirely to the development of the more general theory of Radiation and its necessary consequences, while the latter half of the course is devoted to a treatment of the properties of a perfect radiator, and Planck's theory of "quanta." Offered in alternate years with 868.

[ELECTIVE IN GRADUATE YEAR. OFFERED IN 1915–1916.]

870. WAVE-THEORY AND POLARIZATION.

Professor Comstock.

PREPARATION: M22; 801.

A course of fifteen lectures during the first term in which the theory of wave motion in isotropic and nonisotropic media is developed, first according to the general and then the electromagnetic theory. This involves a consideration of plane polarization, double refraction, circular, elliptical and rotary polarization, as well as the more important phenomena of magneto-optics. Course 864 and the present one may be taken advantageously in successive years. Offered in alternate years.

[ELECTIVE IN COURSE VIII., GRADUATE YEAR. NOT GIVEN IN 1915–1916.]

871. THE CONSTITUTION OF MATTER IN THE LIGHT OF RECENT DISCOVERY.

Professor Comstock.

A course of fifteen lectures during the second term in which an account is given of the present state of knowledge and hypothesis respecting the constitution of matter. The nature of negative electricity, and the structure of the atom and molecule are considered as fully as time allows and where possible the problems pressing for solution are discussed so far as is necessary to indicate the probable direction of future investigation. This course is given in alternate years.

[ELECTIVE IN COURSES VIII., XIV., GRADUATE YEAR. OFFERED IN 1915–1916.]

872. RADIOACTIVE MEASUREMENTS.

Dr. Barss.

PREPARATION: 808.

A series of laboratory exercises two hours per week during the second term for the purpose of studying the methods employed in measuring the radiations emitted by radioactive substances. In addition to the experimental work, the main points in the development of the subject of radioactivity will be discussed, as well as so much of the theory as is necessary for an adequate working knowledge of each experiment. Detailed theoretical discussions however, will be avoided as much as possible. The lectures on Radioactivity 862, furnish a suitable though not essential introduction to the present course.

[ELECTIVE TO STUDENTS IN THIRD AND FOURTH YEARS, AND TO GRADUATE STUDENTS.]

ELECTROCHEMICAL COURSES.

881. ELEMENTS OF ELECTROCHEMISTRY.

Professor Thompson.

PREPARATION: 502; 802; 245.

A course of thirty exercises, given in the first term, adapted to the needs of electrical engineering students who have had no chemistry beyond that given in the first year. The principles of this subject essential to the understanding of the modern views of electrochemistry are discussed in connection with the theory of electrolytic conduction, the osmotic theory of primary cells, and electrolysis. The more important electrothermal and electrochemical industries are also described as fully as time permits.

[ELECTIVE IN COURSE VI.]

882. ELECTROCHEMISTRY.

Professor Goodwin.

PREPARATION: 565, or its equivalent.

A course of thirty lectures in the first term, in which the subject is very fully discussed from the theoretical side. An adequate knowledge of theoretical chemistry is assumed. The principal topics treated are the theories of electrolytic conduction, polarization and electrolysis, the osmotic theory of the voltaic cell, the principles involved in the corrosion, electro-deposition, and refining of metals, and the energy principles underlying the transformation of chemical and electrical energy.

[REQUIRED IN COURSES VIII., XIV. ELECTIVE IN GRADUATE YEAR.]

885. APPLIED ELECTROCHEMISTRY.

Professor Thompson.

PREPARATION: 882.

A series of thirty lectures in the second term of the fourth year on the industrial applications of Electrochemistry. The subjects discussed include electric furnaces and their products, electro-metallurgy, accumulators, primary cells, electro-analysis and electrolytic processes for the production of various compounds.

[REQUIRED IN COURSE XIV. ELECTIVE IN GRADUATE YEAR.]

886. ELECTROCHEMICAL LABORATORY.

Professors Goodwin, Thompson, and assistant.

PREPARATION: 882, taken simultaneously.

This course, given in the first term, is carried on in conjunction with the lecture course on Theoretical Electrochemistry. This work is devoted to exact electrochemical measurements of all kinds, such as measurements of electrical conductivity, transference numbers and ionic velocities, single potentials, decomposition voltages, polarization, etc. Each student is given a desk completely equipped with electrochemical apparatus and is thus enabled to calibrate his own set of instruments which he retains for his use throughout the whole course.

[REQUIRED IN COURSE XIV. ELECTIVE IN GRADUATE YEAR AS FAR AS THE CAPACITY OF THE LABORATORY PERMITS.]

887. ELECTROCHEMICAL LABORATORY.

Professor Thompson and assistant.

PREPARATION: 883, taken simultaneously.

A course given in the second term of the fourth year in conjunction with course 883 on Applied Electrochemistry. The work consists in efficiency tests in the production in the electric furnace of carborundum, calcium carbide, aluminum, silicon and iron, a test of an induction furnace and efficiency tests in the production of chemicals in aqueous solutions. A storage battery run to illustrate points brought out in course 883 is included.

[REQUIRED IN COURSE XIV.]

888. ELECTRIC FURNACES.

Professor Thompson and assistant.

PREPARATION: Heat Measurements and Electrical Engineering Laboratory.

A course of thirty-five hours of laboratory practice given in the first term, consisting of the electric furnace work of course 887. This is intended for fourth year and graduate students, in other courses than Course XIV., who have had the requisite preparation and who wish to become familiar with electric furnace methods. It includes, besides the laboratory work, five lectures on the industrial application of the experiments performed.

[ELECTIVE FOR FOURTH YEAR AND GRADUATE STUDENTS.]

889. ELECTRIC FURNACES.

Professor Thompson and assistant.

PREPARATION: 687 or 689; 813.

A course given in the second term consisting of those electric furnace experiments described under course 887, which are the best suited to the needs of students in Mining Engineering and in Industrial Physics respectively.

[REQUIRED IN COURSES III., OPTION 2; VIII., OPTION 3.]

890. ELECTROCHEMISTRY.

Professor Thompson and assistant.

PREPARATION: 567.

A course given in the second term consisting of lectures and laboratory work. The lectures will take up the fundamental principles of electrochemistry and their more important applications. The laboratory work will consist in electric furnace experiments.

[REQUIRED IN COURSE III., OPTION 2. NOT GIVEN IN 1915–1916.]

893. PHYSICO-CHEMICAL LABORATORY.

Professor Goodwin.

PREPARATION: 565, completed or taken simultaneously.

This course of five hours a week in the second term is designed to give practice in the more precise methods for the determination of physico-chemical constants. A special laboratory is provided of which the equip-

ment includes instruments of high grade for the measurement of optical electro-chemical, and thermo-chemical constants. The student is given some latitude in the choice of the particular line of work he desires to pursue. Each experiment is in the nature of a short investigation in which the student is encouraged to develop his own initiative as much as possible.

[OPTIONAL IN COURSE VIII., OPTION I.]

896. ELECTROCHEMICAL SEMINAR.

Professor Goodwin.

PREPARATION: 882; 883.

A weekly seminar in the first term in which assigned topics and current publications dealing with the more advanced phases of theoretical Electrochemistry are discussed.

[ELECTIVE FOR GRADUATE STUDENTS ONLY.]

897. APPLIED ELECTROCHEMISTRY (Seminar).

Professor Thompson.

PREPARATION: 883; 887.

A weekly seminar in the second term in which topics and current publications dealing with the industrial applications of electrochemistry are discussed.

[ELECTIVE FOR GRADUATE STUDENTS ONLY.]

898. GLASS BLOWING.

Professor Thompson.

Six two-hour laboratory exercises in the first term in which the student is taught how to manipulate glass and make such simple apparatus, electrodes, vacuum tubes, etc., as are likely to be needed in physical and electrochemical research.

[ELECTIVE FOR FOURTH YEAR STUDENTS IN COURSES VIII. and XIV.]

DEPARTMENT OF GEOLOGY.

WALDEMAR LINDGREN, M.E.
William Barton Rogers Professor of Economic Geology.

THOMAS A. JAGGAR, PH.D.
Professor of Geology and Director of the Hawaiian Volcano Observatory.

CHARLES H. WARREN, PH.D.
Professor of Mineralogy.

HERVEY W. SHIMER, PH.D.
Associate Professor of Paleontology.

FREDERIC H. LAHEE, PH.D.
Assistant Professor of Geology.

Instructor.

JOHN D. MACKENZIE, S.B.

The courses of the Department of Geology may be considered in five groups.

1. Those for students of Mining Engineering (Course III., Options 1 and 3) consisting of Mineralogy, Petrology, Dynamical and Stratigraphic Geology, Geological Surveying and Economic Geology.

2. Those for students of Metallurgical Engineering (Course III., Option 2) consisting of Mineralogy, Dynamical Geology and Economic Geology.

3. Those for students of Civil and Sanitary Engineering (Courses I. and XI.) consisting of Dynamical Geology, Field Geology, Stratigraphic Geology and Lithology. In addition the course in Dynamical Geology is given to students in Chemistry (Course V., Option 2) and a course in Geology of Materials is given to students of Option 2 in Architecture.

4. Those for students of Geology (Course XII.) which include the same subjects as enumerated under 1, and besides

other more specialized subjects, such as Geology of North America, Geology of Europe, Index Fossils, Physiography and Glacial Geology. In this course some of the subjects mentioned under 1 will be given in somewhat extended form.

In addition to these undergraduate studies, a course in General Geology is given which is listed among the "Options in General Studies" (p. 130).

5. The last section includes graduate studies and research along several lines, which are offered to candidates for the S.M. and Ph.D. degrees, and to special advanced students. The subjects include Optical Crystallography, Advanced Mineralogy and Crystallography, Chemical Mineralogy, Advanced Petrography, Advanced Economic Geology, Geology of Coal and Petroleum, Geology of Igneous Rocks, Introductory Paleontology, Organic Evolution and Volcanology and Seismology. This list may be modified or extended at any time.

A beneficial coöperation in graduate studies has been established with the Department of Geology of Harvard University by which advanced students are allowed to attend Harvard courses in subjects not regularly given at the Institute and vice versa. Among such Harvard courses open to advanced students are Geometrical Crystallography, Geology of Igneous Rocks, Physiography and Climatology offered respectively by Professors Charles Palache, Reginald A. Daly, Wallace W. Atwood and R. DeC. Ward.

1201. MINERALOGY.

Mr. MacKenzie.

PREPARATION: 502.

This course now given in the third year, includes Elementary Crystallography. The instruction in the latter consists of a short series of lectures, supplemented by laboratory practice, with models and natural crystals. In mineralogy the time is largely devoted to laboratory work, supplemented by informal lectures or recitations. The work occupies seven hours per week in the first term. For the Classes of 1918 and the following years, this course will occupy five hours per week during the first term of the second year.

[REQUIRED IN COURSES III., XII.]

1202. MINERALOGY.

Professor Warren.

PREPARATION: 502.

This course, which is similar in plan to 1201, is given during the second term of the second year.

[REQUIRED IN COURSE V., OPTIONS 2, 3.]

1208. MINERALOGY AND PETROLOGY.

Mr. MacKenzie.

PREPARATION: 1201; 1231; 1264.

This course now given during the second term of the third year, consists of one lecture or recitation, and three laboratory hours per week. A portion of these laboratory hours is used for field excursions. The first part of the course is a continuation of course 1201, taking up particularly the important silicate minerals after which the more common rock types are studied. While the latter subject is treated primarily from the megascopic viewpoint, the microscope is used for the purpose of explaining more effectively characteristics and relationships not readily apparent from megascopic study alone. For the Class of 1918 and thereafter, this course will occupy six hours per week instead of four.

[REQUIRED IN COURSES III., XII.]

1209. MINERALOGY AND PETROLOGY.

Professor Warren.

PREPARATION: 1201; 1208.

This course, beginning with the Class of 1918 will be a continuation and amplification of courses 1201 and 1208, and will occupy two hours per week in the first and four hours per week in the second term of the third year. Particular attention will be paid to the application of the polarizing microscope to the study of minerals and rocks.

[REQUIRED IN COURSES III., OPTION 3, XII.]

1211. LITHOLOGY.

Mr. MacKenzie.

PREPARATION: 502; 1231, which may be taken simultaneously.

Fifteen hours in the first term of the third year. The work consists of a systematic laboratory study of the common rocks and rock-forming minerals.

[REQUIRED IN COURSES I., XI.]

1215. PETROGRAPHY.

Professor Warren and assistants.

PREPARATION: 801; 1208.

This course, consisting of three hours a week (five hours for Course XII.) in each term of the fourth year, is designed to train the student in the important methods of petrographic study, particularly those involving the use of the polarizing microscope, and to further familiarize him with the characteristics of the principal rock types and with the fundamental principals of petrographic science. The hours devoted to this course may be considerably extended by those specializing in geology.

[REQUIRED IN COURSES III., OPTION 3., XII.]

1220. ELEMENTARY CRYSTALLOGRAPHY.

Professor Warren.

This course consists of one lecture per week throughout the second term, and aims to consider briefly the more important characteristics of the crystalline state of matter. The course forms a part of, and is given with course 1202, and is open to students of chemistry, physics and biology. Additional laboratory hours are optional to such as may wish to study the geometrical properties of crystals somewhat more in detail.

[ELECTIVE.]

1221. PHYSICAL AND CHEMICAL CRYSTALLOGRAPHY.

Professor Warren.

This course, which takes the form of a seminar of three hours per week in the first term, is offered in alternate years only, to graduate students who are candidates for the higher degrees. In connection with that part of the course dealing with the optical properties of crystals, a considerable amount of additional laboratory work is required. It is necessary that those taking this course should have a thorough preparation in geometrical crystallography and the elementary work in optical crystallography.

[GRADUATE YEAR ONLY.]

1223. OPTICAL CRYSTALLOGRAPHY AND APPLICATIONS.

Professor Warren.

This course given during the first term is designed primarily to give instruction in the practical application of the polarizing microscope to

problems involving the investigation of crystalline material (both minerals and laboratory preparations). It consists almost entirely of laboratory work with the microscope, and is open particularly to graduates, students in Chemistry, Chemical Engineering, and Physics. The polarizing microscope is one of the most powerful and precise tools of scientific research yet invented and its value is rapidly being widely recognized in chemistry as it has long been in mineralogy and petrology. The time devoted to the work will usually occupy five hours per week.

[Elective in Courses V., VIII., X., Graduate Year.]

1225. ADVANCED PETROGRAPHY.

Professor Warren.

Preparation: 1215.

The work in this course consists of a thorough petrographic study of selected suites of rocks, and in general, of the preparation of a written report on some portion of the rocks studied. The work naturally involves a full discussion with the instructor of the problems involved, as well as frequent reference to the literature of the science.

[Graduate Course in Geology.]

1226. CHEMICAL MINERALOGY AND PETROLOGY.

Professor Warren.

Preparation: 1225.

This course of forty-five hours, usually given in the second term of alternate years, aims to familiarize the student with the applications of chemistry, particularly of physical chemistry, to mineralogy and petrology. It is conducted largely as a seminar and involves a considerable amount of outside reading and study. It is open only to graduate students who have had adequate preparation in physics and chemistry as well as in geological subjects.

[Required in Course XII., Graduate Year.]

1231. DYNAMICAL GEOLOGY.

Professor Lahee.

Preparation: 502; 801.

This course of forty-five hours in the first term is offered to students of Civil Engineering and related subjects in the third year and to students of Mining and Geology in the second year. The greater geological processes

—erosion, sedimentation, deformation, intrusion, and vulcanism—are discussed by means of lectures illustrated by maps, diagrams, specimens, and stereopticon. While the theoretical principles of geology are necessarily emphasized, considerable attention is also given to the practical application of the science.

[REQUIRED IN COURSES I., III., V., OPTION 2, XI., XII.]

1233. GENERAL GEOLOGY. (Dynamical, Structural and Historical Geology, Evolution.)

Professors Shimer, Lahee.

PREPARATION: 501; 801.

Forty-five hours during the second term of the third year. This course gives a general view of the history of the earth, showing how its present form, structure and life have been developed. The lectures devoted to Dynamical and Structural Geology will be given by Professor Lahee, those on Historical Geology and Evolution by Professor Shimer. Attention will be given to the geological work of atmosphere, rivers, sea, and underground water, to the phenomena of earthquakes and volcanoes, to the formation of mountains, to the effects of the earth's internal heat, and to the gradual change of the life during the geologic periods. Emphasis will be placed on the modern conception of evolution as interpreted by paleontology and the distribution of life. The lectures will be illustrated by specimens, charts, and stereopticon.

[ELECTIVE IN ALL COURSES EXCEPT I., III., OPTIONS 1 AND 3, XI., XII.]

1234. STRUCTURAL AND FIELD GEOLOGY.

Professor Lahee; Mr. MacKenzie.

PREPARATION: 1211; 1231.

Two hours a week throughout the second term of the third year. The object of this course is to teach the student the principles of Structural Geology and their application to practical engineering problems, and to train his powers of observation and reasoning. The work consists essentially of laboratory and field exercises in the study of the more common rocks, structures, and topographic forms. Since the field excursions require more than the allotted two hours a week, because of the time consumed in travelling, six trips only are taken during the last eight weeks of the term.

[REQUIRED IN COURSES I., XI.]

1237. STRATIGRAPHIC GEOLOGY.

Professor Shimer.

PREPARATION: 1201, taken simultaneously; 1231.

This course of thirty hours in the second term of the second year for Courses III. and XII. aims to give a general view of the past history of the earth. The fifteen lectures are supplemented by assigned readings in geologic text-books. In the laboratory periods a general knowledge is obtained of the main groups of plants and animals found fossil. These fossils are studied through a comparison with their nearest living representatives, and in connection with their use in the determination of the earth's past history. For the Class of 1917 this course is given in the first term of the third year.

[REQUIRED IN COURSES III., OPTIONS 1, 3, XII.]

1238. STRATIGRAPHIC GEOLOGY.

Professor Shimer.

PREPARATION: 1231.

This course of fifteen hours in the second term of the third year is designed to give the student a general view of the past history of the earth as interpreted by the sedimentary rocks and their enclosed fossils.

[REQUIRED IN COURSES I., XI.]

1251. ORE DEPOSITS.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1201; 1231.

An elementary course of thirty hours in the second term of the second year, giving the most important features of the occurrence and origin of metallic ores.

[REQUIRED IN COURSE III., OPTION 2.]

1252. ELEMENTARY ECONOMIC GEOLOGY.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1201; 1237.

A course of fifteen hours in the second term of the third year. This course is designed as a preparation for the more special course in the first term of the fourth year. The student will be given a general view of the most important principles of mineral deposits and of the most important classes of deposits.

[REQUIRED IN COURSES III., OPTIONS 1, 3, XII. OMITTED AFTER 1915–1916.]

1253. ECONOMIC GEOLOGY.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1201; 1208; 1237; 1262.

A course of forty-five hours in the first term of the fourth year, illustrated by specimens and lantern views, presenting such general considerations as are of importance in connection with mineral deposits. The structural features, theories as to origin, and the classification of ore deposits, are discussed, and particular attention is given to the modes of occurrence, geological relations and origin of the type deposits in this country.

[REQUIRED IN COURSES III., OPTIONS 1, 3, XII. OMITTED AFTER 1916–1917.]

1254. ECONOMIC GEOLOGY.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1215; 1253.

A course of thirty hours in the laboratory study of ores, by petrographic and metallographic methods, supplemented by lectures on geological field examinations of mineral deposits.

[REQUIRED IN COURSES III., OPTION 3, XII. OMITTED AFTER 1916–1917.]

1255. ECONOMIC GEOLOGY.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1201; 1208; 1237; 1262.

A course of seventy-five hours in the first term and forty-five hours in the second term of the fourth year, fully illustrated by specimens and views, will present the occurrence, geological relations, and origin of mineral deposits, both metallic and non-metallic. It is supplemented by laboratory study of ores by petrographic and metallographic methods. In connection with this course a number of lectures are also given on geological field examinations of mineral deposits. This course will be given to the Class of 1918, and thereafter.

[REQUIRED IN COURSES III., OPTION 3, XII.]

1256. ECONOMIC GEOLOGY.

Professor Lindgren; Mr. MacKenzie.

PREPARATION: 1201; 1208; 1237; 1262.

A course of forty-five hours in the first term of the fourth year, giving a brief account of the occurrence, geological relations and origin of mineral

deposits, both metallic and non-metallic. This course will be given to the Class of 1918, and thereafter.

[Required in Course III., Option 1.]

1257. GEOLOGY OF THE MATERIALS OF CONSTRUCTION.

Mr. MacKenzie.

Preparation: 501.

One hour a week, throughout the first term of the third year. A short course in geology for students of architecture and engineering, who have done no previous work in geology. The lectures treat of the rudiments of dynamical geology, its bearing on the origin and sources of stone, brick, cement, iron, and coal, and the weathering and quarrying of building stone.

[Required in Course IV., Option 2. Elective in Courses II., VI., X.]

1259. ADVANCED ECONOMIC GEOLOGY.

Professor Lindgren.

Preparation: 1254.

One hour a week consultation or seminar; five hours a week preparation. This course is designed to give the student experience in practical work along economic lines. Specific problems in field or laboratory are selected by each student and the progress checked by the weekly consultations. This course will lead to a thesis. Suitable topics for theses are the genesis or enrichment of ores, the geological structure and extent of ore-bodies, or questions concerning coal, water-supply or other products. Abundant laboratory material for chemical or mineralogical topics may be furnished from the Crosby Collection, but a thesis drawn from the student's summer field work is preferable.

[Elective in Course III., Graduate Year.]

1260. GEOLOGY OF COAL AND PETROLEUM.

Mr. MacKenzie.

Preparation: 1253; 1255.

This course of thirty hours in the second term is designed to present in more detail the mode of occurrence, geological relations and origin of deposits of fuels and oils. It will be supplemented by lectures on special features by prominent geologists.

[Elective in Course XII., Graduate Year.]

1262. FIELD GEOLOGY.

Mr. MacKenzie and assistant.

PREPARATION: 108; 1264; 1208, taken simultaneously.

This course of fifteen hours in the last eight weeks of the second term of the third year is designed to introduce the student to practical methods of mapping in the field. There will be lectures and field exercises. The work will be arranged to teach the use of the compass, the barometer, and other instruments, in reconnaissance and detailed traverses and in the construction of large and small scale geologic maps. Emphasis will be placed upon methods of note-taking and collecting of specimens. This course will be given only to Classes of 1916 and 1917. For the Class of 1918 and thereafter, this course will consist of forty-five hours of field work and lectures during the last eight weeks, in the second term of the third year.

[REQUIRED IN COURSE III., OPTIONS 1, 3.]

1264. STRUCTURAL AND FIELD GEOLOGY.

Professor Lahee and assistant.

PREPARATION: 1231.

There will be one lecture and one laboratory or field exercise each week throughout the second term of the second year. It is the object of this course to teach the student the methods of interpretation of topographic and geologic maps, the fundamental principles of the field study of rocks, geologic structures, and topographic forms, and the construction of simple geologic sections. For the Class of 1918 and thereafter, this course will be given in the first term of the third year.

[REQUIRED IN COURSE III., OPTIONS 1, 3.]

1265. GEOLOGICAL SURVEYING.

Professor Lahee and assistant.

PREPARATION: 1208; 1237; 1262; 1264.

This comprehensive course of sixty hours in the first term of the fourth year affords systematic training in the methods and practice of Geological Surveying by the use of the plane table and other instruments and in the construction of geologic sections.

One full day is required in the field each week for seven weeks. The class will make a detailed investigation of two areas, one illustrating complex structure in sedimentary rocks, and the other illustrating many types and problems of igneous phenomena. In the last two weeks each student

will be assigned to a third area which he will investigate by himself. A report accompanied by geologic maps and sections will be required for each of the three localities examined. This course will be given only to the Classes of 1916 and 1917. For the Class of 1918 and after, this course will consist of thirty-five hours of field work during the first eight weeks in the first term of the fourth year.

[REQUIRED IN COURSES III., OPTIONS 1, 3, XII.]

1267. FIELD GEOLOGY (Advanced).

Professors Lindgren, Warren, Lahee.

PREPARATION: 1265.

This is a course of research demanding six hours work a week throughout a year of graduate study (or fourth year of Course XII.). Structural, petrographic, stratigraphic or glacial problems are assigned. The student investigates in detail the topic selected, and may publish his results.

[ELECTIVE IN COURSES III., GRADUATE YEAR, XII.]

1271. INTRODUCTORY PALEONTOLOGY.

Professor Shimer.

PREPARATION: 1237 or 1238.

This course of sixty hours in each term of the third year aims to give a knowledge of ancient life through a comparison with living forms, the main purpose being to make the student acquainted with the structure (anatomy) and relationships of the principal types of fossil animals and plants. The instruction consists of laboratory work with specimens, supplemented by lectures.

[ELECTIVE IN COURSE XII., GRADUATE YEAR.]

1273. INDEX FOSSILS.

Professor Shimer.

PREPARATION: 1237 or 1238.

A course of one lecture and three hours of laboratory work per week for one term. This is a continuation of the second part of course 1237. It includes a study of those fossils which are most abundant and the most characteristic indices of the age of the different rocks, the identification of unknown material directly from the field, the working out of practical problems through the aid of fossils.

[REQUIRED IN COURSES III., OPTION 3, XII. ELECTIVE IN GRADUATE YEAR.]

1275. ORGANIC EVOLUTION.

Professor Shimer.

PREPARATION: 1237 or 1238.

This course consists of lectures, reading and laboratory work on the philosophy of organic evolution. It gives the modern conception of evolution as interpreted by paleontology, comparative anatomy, embryology, distribution of life, pathology, heredity, etc. It likewise treats of the development of the different forms of animal and plant life, the life history of the individual, and of the group to which it belongs, and the problems of faunas, including their rise, culmination and decadence, the relations of fossils to sediments and to shore, deep sea, and abyssal conditions, the cause of the varying stability and persistence of types, and their relative stratigraphic values.

[ELECTIVE.]

1277. ADVANCED PALEONTOLOGY.

Professor Shimer.

PREPARATION: 1273.

This is a seminar course of at least one hundred and twenty hours, arranged to meet the needs of the individual student. Topics are: advanced North American Index Fossils of the Paleozoic, Mesozoic, or Cenozoic; Index Fossils of Europe; work on some stratigraphic area with making of exact correlations through identification of the fossils; correlation of an era or a portion of one throughout North America; migration of fossil or recent faunas; biological problems on the evolution of fossil or recent species. Laboratory material for thesis work is stored in the collections of the Department.

[ELECTIVE.]

1291. GEOLOGY OF NORTH AMERICA.

Professors Lindgren, Shimer, Lahee.

PREPARATION: 1237, or 1238.

This course of sixty hours in the second term of the fourth year embraces the Stratigraphy, the general geologic structure, and the general Physiography of North America. In the first part of the course the general structure and areal geology of the country are considered. The second part is devoted to the succession and character of the sedimentary formations in the various geologic provinces of the continent. The third part is devoted to a discussion of the igneous bodies of the continent, and of the structure and physiography of the Cordillera.

[REQUIRED IN COURSES III., OPTION 3, XII.]

1294. GEOLOGY OF EUROPE.

Professors Lindgren, Shimer.

PREPARATION: 1253; 1237.

A course dealing with the stratigraphy, the geologic structure, and the igneous rocks of the continent, and with the relation of these to the present surface features.

[ELECTIVE IN COURSE XII., GRADUATE YEAR.]

1296. VOLCANOLOGY AND SEISMOLOGY.

Professor Jaggar.

PREPARATION: 1234 or 1262.

A course of field and laboratory work to be given at the Volcano Observatory at Hawaii to advanced students of geology. The course includes conferences, observations, and thesis problems, dealing with the phenomena of volcanoes and the instruments and methods of seismology.

DEPARTMENT OF NAVAL ARCHITECTURE AND MARINE ENGINEERING.

CECIL H. PEABODY, S.B.
Professor of Naval Architecture and Marine Engineering.

WILLIAM HOVGAARD.
Professor of Naval Design and Construction.

HENRY H. W. KEITH, S.B.
Assistant Professor of Naval Architecture.

GEORGE OWEN, S.B.
Assistant Professor of Naval Architecture.

Instructor.

JEROME C. HUNSAKER, U.S.N., S.M.

Assistants.

EVERS BURTNER, S.B. THOMAS W. HUFF, S.B.

The instruction in Naval Architecture and Marine Engineering is intended for those who expect to be ship-designers, ship-builders, ship-managers, or marine engine builders or who desire to enter allied industries. The special work of the regular Course is given in the form of lectures and recitations, and drawing and computation, during the second, third and fourth years of the Course.

The advantageous location of the Institute at an important seaport enables students to see ship and engine-construction (including marine steam turbines) at the Navy Yard, at the yard of the Fore River Ship Building Company, and at several other ship and engine-works, and to visit ships of all types. This location has made it possible to arrange for power and speed trials and progressive speed trials of ships, including turbine steamers; experiments to determine the turning moments of rudders; and tests on the economy of boilers and engines.

For information regarding graduate work and the admission of graduates of the Department of Mechanical Engineering to professional work of the Department of Naval Architecture and Marine Engineering, see pages 47, 122 and 141 to 145.

For details regarding the Course for Naval Constructors, arranged by request of the United States Navy Department to give advanced instruction to graduates of the Naval Academy, see page 120.

A circular of the Department of Naval Architecture and Marine Engineering will be sent on application to the Secretary of the Faculty.

For description of Graduate Course in Aeronautical Engineering, see page 158.

1301. NAVAL ARCHITECTURE.

Professor Peabody.

PREPARATION: M22; 215, 1342; taken simultaneously.

A continuous series of lectures and recitations, thirty each term of the third year, on the statics and dynamics of Naval Architecture. The course opens with methods of computation and use of integrating instruments, and proceeds with the methods of computing displacement and stability of ships, and includes a discussion of surface of buoyancy and of water-lines, also a consideration of the effects of adding weights, flooding compartments, grounding, docking and landing. A simple form of modern hydrodynamics is developed and applied to the study of waves and their influence on the rolling of ships, and also to the investigation of stream lines about ships.

[REQUIRED IN COURSES XIII., XIII.A., XIII.B.]

1302. NAVAL ARCHITECTURE.

Professor Peabody.

PREPARATION: 1301; 1343, taken simultaneously.

This course of forty-five lectures, thirty in the first term of the fourth year and fifteen in the second term, is a continuation of the course of the preceding year. A discussion is given of the resistance of ships and of propulsion by paddle wheels, screw propeller, and by sails; also methods of making power and speed trials, and of steering and manœuvering. Methods

are given of determining the strength of ships in quiet water and among waves; also in consideration of the strength of bulkheads. Instruction is given in compass adjustment.

[REQUIRED IN COURSES XIII., XIII.A., XIII.B.]

1305. MEMOIRS.

Professor Peabody.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1311. THEORY OF WAR-SHIP DESIGN.

Professor Hovgaard.

PREPARATION: 1301, taken simultaneously.

A series of sixty lectures, thirty in each term of the junior year. The work of the first term gives a historical account of the development of war-ships, dealing separately with each of the more important classes: sea-going battleships, coast defence ships, cruisers, gunboats, torpedo vessels and submarine boats.

The attention of the student is particularly directed to an appreciation of the causes which have led to the various steps in the development, the chief object of these lectures being to broaden the view of the students and to afford a basis for the full understanding of the following lectures of this course.

The lectures during the second term are the first part of a course of practical and theoretical nature relating directly to the design and construction of war-ships. The course of this term comprises a discussion of the principles which govern the choice of the elements of the design of the hull and the general arrangements of its main features: principal dimensions, distribution of weights, stability, seaworthiness, watertight subdivision and strength. It contains also practical rules for working out a preliminary design and for the performance of weight calculations.

These lectures as well as the following lectures on this subject are accompanied by numerous compilations, directly useful in naval design work.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1312. THEORY OF WAR-SHIP DESIGN.

Professors Hovgaard, Keith.

PREPARATION: 1311; 1302, taken simultaneously.

A course of sixty lectures extending throughout the senior year. The work of this year is a continuation of the lectures described under 1311 and

comprises a discussion of the structural arrangements of war-ships, including strength calculations and the theory of riveted joints as applied to shipbuilding. Special attention is given to methods of construction used in the United States Navy and comparisons are made with methods used in other navies.

The lectures during the second term comprise the design and installation of boilers, engines, and propellers as far as these problems concern the naval architect; coaling and coal stowage; liquid fuel; rudders and steering gear.

[Required in Courses XIII.a., XIII.b.]

1313. THEORY OF WAR-SHIP DESIGN.

Professor Hovgaard.

Preparation: 1311; 1312.

A course of sixty lectures extending throughout the graduate year comprising the following subjects: drainage, ventilation, heating and anchor gear; disposition and installation of artillery; ammunition, ammunition transport and stowage; design of ammunition rooms; torpedo installations; effects of gunfire, resistance of armor, principles of armor protection; protection against submarine attack; conning towers.

The lectures during the entire three years are accompanied by descriptions of methods and installations used in the United States Navy and other navies, together with explanations and study of plans and working drawings, by which the students are also made familiar with the interpretation of such drawings.

[Required in Courses XIII.a., XIII.b.]

1321. WAR-SHIP DESIGN.

Professors Hovgaard, Keith.

Preparation: 1301; 1311, taken simultaneously.

The time allotted to the subject of war-ship design is seven hours per week during the first term of the junior year, eight hours per week during the second term, and this is followed by two three-hour exercises per week throughout the senior and graduate years. The first term of the junior year is occupied by introductory work consisting of fairing of lines, tracing, and ship calculations. The object of this work is to provide exercises for the students in drawing and calculation, and to make them acquainted with various methods of calculation. In the second term of the junior year the students commence the design of a warship. In working out the general arrangement plan, particular attention is given to the dis-

position of ordnance, ammunition, and armor; and the problems of ammunition transport, coal stowage and transport, drainage, and ventilation are studied. Special plans are worked out, showing structural arrangements, drainage and ventilation and sketches of structural details are prepared. Detailed calculations are performed for the determination of displacement, weight distribution, stability, and strength, and the usual diagrams accompanying such calculations are prepared. The methods of calculations are those used by the Bureau of Construction and Repair.

The horse-power and coal capacity are determined, the principal dimensions of boilers, engines, and propellers are fixed, and the general arrangement of the machinery is studied.

A half-block model of the design is made by each student, and on this model the plating, longitudinals, etc., are laid off.

[Required in Courses XIII.A., XIII.B.]

1322. WAR-SHIP DESIGN.

Professors Hovgaard, Keith.

Preparation: 1311; 1312; 1322; 1313, taken simultaneously.

This course is given in the senior year, and is a continuation of the subject described under course 1321.

[Required in Courses XIII.A., XIII.B.]

1323. WAR-SHIP DESIGN.

Professors Hovgaard, Keith.

Preparation: 1311; 1312; 1322; 1313, taken simultaneously.

This course is given throughout the graduate year and forms a continuation of course 1322.

[Required in Courses XIII.A., XIII.B.]

1331. SHIP CONSTRUCTION.

Professor Owen.

Preparation: D21; 206.

This is a course of twenty lectures in the second term of the second year beginning with descriptions of types of ships, plans and materials, and continuing with an elementary discussion of stresses. A general conception of steel ship construction is given, including structural details, machine tools and wooden ship construction. The layout, equipment and methods

of operation of modern shipyards are described, together with various types of crane service. The aim is to familiarize the student with shipyards and shipyard methods before the work on constructional details is begun. Students are recommended to obtain practical experience by spending part of their summer vacation in some shipyard.

[Required in Courses XIII., XIII.B.]

1332. SHIP CONSTRUCTION.

Professor Owen.

Preparation: 1331; 1342; 1302, 1343, taken simultaneously.

This is a course of twenty lectures in the second term of the third year and is a continuation of course 1331. The subjects treated embrace the various ship-registration societies and their requirements as to the details of construction necessary to withstand the stresses a ship experiences. The transverse framing layout of shell-plating and plating model, decks, bulkheads, double-bottoms, tanks, machinery space, etc., and the maintenance in service of the finished hull. Simultaneously with the lectures on structural details the student is required to make specific application to his own design.

[Required in Course XIII.]

1333. VENTILATION AND DRAINAGE OF SHIPS.

Professor Owen.

Preparation: 1332; 1342; 1343, taken simultaneously.

A course of thirty lectures, given in the first term of the fourth year, dealing with the problems encountered in the ventilation and drainage of ships and application is made to the problem in ship design. Each student makes a calculation for the amount of air discharged from a complex ventilating system and designs proper ventilating systems for his ship, both for natural and forced ventilation. Such special features as ventilation of stokeholds, engine rooms, cargo spaces, and shaft tunnels are discussed as well as ventilation of passenger accommodations.

The drainage and pumping of the many isolated compartments existing in a ship is considered and each student designs a suitable installation for his case.

[Required in Courses XIII., XIII.B.]

1341. SHIP DRAWING.

Professor Owen.

PREPARATION: M23; D21; 206, taken simultaneously.

This course in drawing of two hours a week in the second term of the second year consists of the fairing of a set of lines of a steamship from offsets, working to a scale of $\frac{1}{4}''$ to $1'$.

[REQUIRED IN COURSES XIII., XIII.B.]

1342. SHIP DRAWING AND DESIGN.

Professor Owen.

PREPARATION: 1331; 1301, taken simultaneously.

The time allotted to this work in the third year is five hours per week in the first term and six hours per week in the second term. In the first term the design of a sailing yacht is undertaken by each student. The lines, sail plan, and construction plan are drawn and the attendant calculations of weight, trim and stability made. In the second term each student individually takes up the design of a steamship for a specific purpose, determines the dimensions, form, scantlings, displacement, and stability, and designs and draws the lines, midship-section and general arrangement plans.

[REQUIRED IN COURSE XIII.]

1343. SHIP DESIGN.

Professor Owen.

PREPARATION: 1301; 1342; 1302, taken simultaneously.

This is a continuation to completion through the fourth year of the design begun in the third year and requires five hours per week through the first term and eight hours per week through the second term. Each student completes the plans for the essential details of construction for his design such as sections, bulkheads, decks, shell plating (expansion and model) and specifications together with calculations of weight, trim, and methods of determining costs.

Calculations are made for launching and for the stress in the hull when the ship is in still water and when among waves.

[REQUIRED IN COURSE XIII.]

1351. MARINE ENGINEERING.

Professor Peabody.

PREPARATION: 245 or 246; 229; 243.

A course of thirty hours in the second term of the fourth year.

It gives a description of marine engines and their adjuncts, together with methods of determining dimensions and proportions of parts and strain in them due to steam pressure and dynamical actions. A discussion is given of vibrations of ships and balancing engines. Each student makes a preliminary design of a marine engine adapted to the ship which he is designing in course 1342, 1343 or 1321.

[REQUIRED IN COURSE XIII.]

1352. MARINE ENGINE DESIGN.

Professor Peabody.

PREPARATION: 1351, taken simultaneously.

This is a course of ninety hours, in the second term of the fourth year, in computation and drawing in which the student embodies the design of a marine engine as discussed under course 1351.

[REQUIRED IN COURSE XIII.]

1355. MARINE ENGINEERING.

Professor Peabody.

PREPARATION: 229; 245 or 246.

A course of thirty lectures in the first term of the graduate year, similar to that described under 1351, but giving attention especially to naval engines.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1361. MARINE ENGINE DESIGN.

Professors Peabody, Owen.

PREPARATION: 1351, taken simultaneously.

A course of ninety hours in the first term of the graduate year in the design and drawing of a reciprocating naval engine, including the determination of power, proportion of parts, and stresses. Detailed drawings are made and the construction and assemblage of a naval engine and auxiliary machinery, including the propeller, are discussed.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1365. MARINE STEAM TURBINES.

Professor Peabody.

PREPARATION: 1351, taken simultaneously.

A course of thirty lectures in the second term of the fourth year giving a discussion of arrangements and construction of various types of steam turbines, and methods of determining sizes and proportions required for the development and distribution of power especially as applied to marine propulsion.

[REQUIRED IN COURSES XIII., XIII.A., XIII.B.]

1371. AERONAUTICS.

Mr. Hunsaker.

PREPARATION: 215; 245; 246 or 247, taken simultaneously.

A course of fifteen exercises, lectures and problems, given during the second term, discussing the development of dynamic flight, description of present day aeroplanes, results of experimental model research, general principles of aeroplane design, control, equilibrium and stability.

[ELECTIVE: MAY BE SUBSTITUTED BY FOURTH YEAR STUDENTS IN COURSE II. FOR GENERAL ENGINEERING LECTURES 275.]

1372. AERONAUTICS.

Mr. Hunsaker.

PREPARATION: M57.

A course of thirty lectures in the second term giving the essential principles of experimental and theoretical aerodynamics, theory of aeroplane design, theory of dirigible design, history of flight and description of modern air craft.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1373. AERONAUTICS.

Mr. Hunsaker.

PREPARATION: 1372.

A course of ninety hours drawing-room work in the second term in which the student will carry through the computation and drawing for an aeroplane or dirigible to meet given specifications. Special attention will be given to naval requirements. Classified plans, photographs and weights are available for comparison.

[REQUIRED IN COURSES XIII.A., XIII.B.]

1374. FLUID DYNAMICS, EXPERIMENTAL.

Mr. Hunsaker.

PREPARATION: M38.

Two lectures per week throughout the first term. A discussion of the experimental methods of aerodynamic laboratories together with an analysis of the results of modern research. This work will include the study of the force of the wind on aeroplane wings, bodies, etc.; resistance and stability of airship hulls; law of comparison; use of aero-dynamic constants.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1375. THEORY OF AEROPLANE DESIGN.

Mr. Hunsaker.

Three lectures per week throughout the first term. The theory of the aeroplane will be developed to include the conditions of straight flight, turning, equilibrium and stability, resistance and propulsion. The following topics will also be considered:—technical history of dynamic flight with technical description of modern aeroplanes; general procedure in design, use of aerodynamic constants, design of wings, chassis and body, motor foundations, staying, etc; strength and stability calculations for hydroaeroplane floats and flying boats.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1376. AEROPLANE DESIGN.

Mr. Hunsaker.

Drawing-room work six hours per week throughout the first and second terms.

The student will design a complete aeroplane to meet given specifications. This design work will include all necessary calculations for stability and equilibrium, and upon completion, the student will make a scale model of his designed aeroplane to test in the wind tunnel to determine its compliance with his original specifications.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1377. THEORY OF AIRSHIP DESIGN.

Mr. Hunsaker.

Three lectures per week throughout the second term. The theory of ballooning and physics of the atmosphere are first developed as a foundation for the study of the equilibrium and stability of airships. This is followed by history of airships and description of the modern French, German, and Italian types; general procedure in design; design of envelope, valves, suspension, car, etc.; resistance and propulsion; operation and preservation; calculation of longitudinal strength of a non rigid envelope.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1378. AIRSHIP DESIGN.

Mr. Hunsaker.

Drawing room work for six hours per week throughout the second term. A design for a semi rigid or non rigid airship will be undertaken to meet given specifications. The weight, buoyancy, and strength calculations will be completed and the power to drive estimated by tests in the wind tunnel of a scale model. The design will be carried through the general arrangement plans and such details as are necessary for the above calculations.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1379. AERIAL PROPELLERS.

Mr. Hunsaker.

Lectures and drawing room work on aerial propellers, two hours per week for the last ten weeks of the first term. Discussion of results of tests and application of same to design. Empirical and theoretical methods of design. The student will design a propeller on the Drzwiecki system for his aeroplane or airship design.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1380. AERODYNAMIC LABORATORY.

Mr. Hunsaker.

The wind tunnel of the Department of Naval Architecture will be used by the student to investigate the forces and couples produced by a stream of air of known velocity upon models of aeroplane wings, rudders or complete aeroplanes, and upon dirigible hulls, etc. The laboratory work will be arranged to fit in with the student's work in design of air craft, so that doubtful points in design may be investigated by wind tunnel testing as well as by calculation.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1381. METEOROLOGY.

Two lectures per week for ten weeks in the second term covering the meteorology of aeronautics. Physics of the atmosphere, distribution of heat and pressure, permanent and periodic winds, cyclones and tornadoes, thunder storms, clouds, forecasting, wind structure and gusts, atmospheric electricity, motion of the upper atmosphere.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

1391. MOLD-LOFT WORK.

Professor Owen and assistant.

PREPARATION: 1331; 1342.

An optional course in Mold-loft Work is offered to students in Naval Architecture at the close of the spring term, and lasting about ten days. The method is one developed and used by some of the leading ship-yards in America and Great Britain. The Department has four glass topped tables, two 14 feet by 2½ feet and two 3½ feet by 2½ feet. The glass is ground to a surface that takes pencil and ink lines excellently, and can be readily cleaned.

The lines of a ship are drawn and faired to a large scale (an inch to the foot), and the difference or intervals between lines are measured and enlarged to full size. These full-sized differences are faired by the contracted system, care being taken that the sum of differences shall give the proper over-all dimension. By this method errors in excess of an eighth of an inch full size can be detected and eliminated. The body-plan is then laid down on the floor to the full size in the usual manner and faired and completed. Frames, floors, margin plates, longitudinals, and shell plating are located and bevels determined are cut as is customary in preparing to get out and bend the materials for framing the ship.

[ELECTIVE IN COURSES XIII., XIII.A., XIII.B.]

1395. MODEL MAKING.

Professor Owen.

PREPARATION: 1342.

Each student in Naval Architecture after having designed a set of lines for a ship is given twenty-five hours instruction in cutting a model to those lines, in order that a proper conception of the form of the ship may be had.

To aid in shaping the model two sets of lines are transferred to the model. In the first place the lifts or boards from which the model is made, are sawed to the form water lines. These lifts are then glued together to form a block, which is profiled to the forms of transverse sections or stations, in a special machine. The student then proceeds to cut away redundant material and to fair and smooth up the model guided by the double system of lines which were transferred from his design. The model is afterward used for laying off shell plating. This course is given in the first term of the fourth year to Courses XIII. and XIII.B. and in June at the end of the second term to Course XIII.A.

[REQUIRED IN COURSES XIII., XIII.A., XIII.B.]

DEPARTMENT OF DRAWING AND DESCRIPTIVE GEOMETRY.

ALFRED E. BURTON, S.B., SC.D.
Professor of Topographical Engineering.

ERVIN KENISON, S.B.
Associate Professor of Drawing and Descriptive Geometry.

W. FELTON BROWN.
Associate Professor of Freehand Drawing.

HARRY C. BRADLEY, S.B.
Assistant Professor of Drawing and Descriptive Geometry.

ARTHUR E. NORTON, PH.B.
Assistant Professor of Engineering Drawing.

Instructors.

ARTHUR L. GOODRICH, S.B. FRANK M. GRACEY.
STEPHEN A. BREED, S.B. RALPH G. OVERLAND.
JOHN E. BIRD.

Assistants.

WALTER J. HAUSER, S.M. HERBERT H. WHITCOMB, S.B.

The work of this Department includes (I) preparatory Courses in Mechanical Drawing, Descriptive Geometry, and Freehand Drawing, given throughout the first year, and Descriptive Geometry given in the first term of the second year; (II) Courses in Freehand Drawing, extending through all years of the Department of Architecture and a course in Applied Decorative Design given in the graduate year.

The preparatory instruction leads to the various courses in applied drawing, given in the professional departments of the Institute. The instruction therefore largely concerns the technique and principles of representation in general, or pure drawing.

The courses in Mechanical Drawing include the precise penciling and finished inking of instrumental constructions and irregular curves. Most of the drawings are first laid out in pencil and then traced. Drawings of machine details,

made from given measurements, are required, and all lettering and dimensioning is done freehand. Special stress is laid upon workmanlike and time-saving methods in drafting, including the supplementary use of freehand drawing. The standing in Mechanical Drawing is partly determined by means of a six-hour drawing given, at the end of the first year, as a test of the student's manual facility, knowledge of working methods, and speed.[1]

Special importance is attached to the study of Descriptive Geometry, both as embracing the principles of geometrical representation, and as a means for cultivating the imagination. Training in the practical use of its principles is afforded by the solution of problems taken from engineering and architectural practice.

The Courses in Freehand Drawing begin with the drawing of letters, in which are presented the first principles and fundamental processes of freehand drawing in general. This work merges into practical lettering and later into object drawing.

The instruction in the Courses in Freehand Drawing given in the Department of Architecture is an extension of the methods begun in the first year to drawing from the cast and from life. Instruction in Art anatomy and the principles of decorative design, together with criticism along æsthetic lines, is given in connection with the exercises in drawing. Some of these exercises are held in the galleries of the Museum of Fine Arts. The wealth of examples afforded by the collection of casts, and the Art atmosphere of the Museum, are considered important influences.

The work in Decorative Design includes drawing from life, the study of principles, and the making of preliminary sketches in figure composition. The students of each graduate class coöperate in designing and executing a large mural decoration, introducing the human figure.

[1] A similar test in drawing is required of applicants for advanced standing in Mechanical Drawing, and of first-year students wishing to omit this subject.

D11. MECHANICAL DRAWING.[1]

D15. DESCRIPTIVE GEOMETRY.[1]

Professors Kenison, Bradley, Norton; Messrs. Goodrich, Breed, Overland.

PREPARATION: 2, 5.

Courses of forty-five hours each extending through the first term of the first year. The work consists of lectures and drawing, supplemented by text-books. The time given to lectures is about one hour for each four hours of drawing.

The instruction in Mechanical Drawing relates to the drawing instruments and materials, instrumental constructions and the drawing of irregular curves, tracing in ink, conventions, lettering and dimensioning, and working methods.

The course in Descriptive Geometry covers the simpler problems on the point, line, and plane, and various constructions in the projection of solids, including sections and developments.

[REQUIRED IN ALL COURSES.]

D12. MECHANICAL DRAWING.[1]

D16. DESCRIPTIVE GEOMETRY.[1]

Professors Kenison, Bradley, Norton; Messrs. Goodrich, Breed, Overland.

PREPARATION: D11; D15.

Courses of forty-five hours each in the second term of the first year. These courses are continuations of Mechanical Drawing D11 and Descriptive Geometry D15, respectively, and the teaching methods are essentially the same.

The instruction in Mechanical Drawing is continued in the directions indicated for course D11, and includes several drawings of machine details.

In Descriptive Geometry the problems on the line and plane that are given at the Institute are completed, and the projection of solids including the intersection of solids bounded by plane faces is continued. Isometric drawings and several practical applications are given.

[REQUIRED IN COURSES I., II., V., VI., VIII., XI., XIII., XV.]

[1] This subject may be taken separately. Applicants for advanced standing should present themselves for examination (except in the case of those offering certified records from other colleges in this subject), and all applicants should submit drawings covering the above ground as fully as possible. In case these drawings are not satisfactory, further work and examination may be required.

D12a. MECHANICAL DRAWING.[1]

D16a. DESCRIPTIVE GEOMETRY.[1]

Professor Kenison; Mr. Goodrich.

PREPARATION: D11; D15.

These courses are arranged for students taking Courses III., X. or XIV., and extend through the second term of the first year. The first, a course of twenty hours, is a continuation of Mechanical Drawing D11. The second, a course of seventy hours, is an abridgment of the work given in courses D16 and D21.

[REQUIRED IN COURSES III., X., XII, XIV.]

D14. MECHANICAL DRAWING.[1]

D18. DESCRIPTIVE GEOMETRY.[1]

Professors Kenison, Bradley.

PREPARATION: D11; D15.

These courses are arranged for students taking Architecture, and extend through the second term of the first year. The first, a course of forty-five hours, is a continuation of Mechanical Drawing D11. The second, a course of ninety hours, with one hour additional per week for preparation, covers the work of Descriptive Geometry D16 and D21.

The courses are open to students not in Course IV. only by special arrangement with Professor Kenison.

[REQUIRED IN COURSE IV.]

D21. DESCRIPTIVE GEOMETRY.[2]

Professors Kenison, Bradley; Mr. Goodrich.

PREPARATION: D12; D16.

A course of three hours per week throughout the first half of the second year, consisting of lectures and drawing. The course is a continuation of Descriptive Geometry D16 and deals with single and double curved sur-

[1] This subject may be taken separately. Applicants for advanced standing should present themselves for examination (except in the case of those offering certified records in this subject from other colleges) and all applicants should submit drawings covering the above ground as fully as possible. In case these drawings are not satisfactory, further work and examination may be required.

[2] Applicants for advanced standing should present themselves for examination (except in the case of those offering certified records in this subject from other colleges) and all applicants should submit drawings covering the above ground as fully as possible. In case these drawings are not satisfactory, further work and examination may be required.

faces; their tangent planes, intersection by oblique planes, penetrations, developments, etc. The time given to lectures is about one hour for each two hours of drawing.

[REQUIRED IN COURSES II., VI., XI., XIII., XV., OPTIONS 1 and 2.]

D23. DESCRIPTIVE GEOMETRY.[1]

Professors Kenison, Bradley; Mr. Goodrich.

PREPARATION; D12; D16.

A course of four hours per week in the first term of the second year. The course includes Descriptive Geometry D21 with additional problems, and the subject of warped surfaces.

[REQUIRED IN COURSE I.]

D26. DESCRIPTIVE GEOMETRY (College Class).

Professors Kenison, Bradley; Mr. Goodrich.

A course of five hours per week, with four hours of outside preparation, given during the first term of each school year. The class is intended for students from other colleges entering with advanced standing, but who are deficient in Descriptive Geometry. Satisfactory completion of the work in this class is accepted as covering the complete requirements in descriptive Geometry in any Institute Course except Course I. Members of Course I must take, in addition to the work of the College Class, ten hours of class room work and twenty hours outside preparation with the regular second year class.

The College Class is open to graduates from other colleges, without restriction: also to students from other colleges, not graduates, who are entering the Institute with advanced standing, and who obtain permission from Professor Burton. The Class is not intended for students who have failures to make up, and a student who has previously taken any course in Descriptive Geometry at the Institute will not be admitted.

[1] Applicants for advanced standing should present themselves for examination (except in the case of those offering certified records in this subject from other colleges) and all applicants should submit drawings covering the above ground as fully as possible. In case these drawings are not satisfactory, further work and examination may be required.

D31. FREEHAND DRAWING.[1]

Mr. Gracey.

No Preparation is Required.

A course of two hours per week throughout the first half of the first year. The work consists of letter drawing, and stroke lettering for working drawings. The instruction is given by short lectures on the principles and processes of freehand drawing, and individual criticism.

[Required in all Courses.]

D32. FREEHAND DRAWING.[2]

Mr. Gracey.

Preparation: D31.

A course of one hour per week throughout the second term of the first year. The exercises include further work in letter drawing and stroke rendering, dimensioning, the construction of titles, title designing, and object drawing. Drawings either in projection or in perspective may be required.

[Required in all Courses except IV.]

D41. FREEHAND DRAWING.

Mr. Bird.

Preparation: D31.

A course of four hours per week in the second term of the first year. It is the same as course D32, except that cast drawing of ornament and of details of the human figure is included.

[Required in Course IV.]

D42. FREEHAND DRAWING.[3]

Professor Brown.

Preparation: D41.

A course of four hours per week throughout the second year. The course is a continuation of Freehand Drawing D41. The work consists of draw-

[1] All applicants for advanced standing should present themselves for examination and should submit examples of their lettering and object drawing.
[2] Applicants for advanced standing should present themselves for examination and should submit examples of their object drawing, lettering, and dimensioning.
[3] Applicants for advanced standing should present themselves for examination.

ing from casts of architectural ornament and details of the human figure, memory drawing, and, occasionally, drawing from life.

[REQUIRED IN COURSE IV.]

D43. FREEHAND DRAWING.[1]

Professor Brown.

PREPARATION: D42.

A course of two two-hour periods per week throughout the third year. The course is a continuation of Freehand Drawing D42. The work includes drawing from casts of architectural ornament and the human figure, life drawing, memory drawing, and time sketching in pencil, and pen and ink.

[REQUIRED IN COURSE IV., OPTION 1.]

D44. LIFE CLASS.[1]

Professor Brown.

PREPARATION: D43.

A course of six hours per week throughout the fourth year. The course is a continuation of Freehand Drawing D43. The work consists of drawing from the nude, memory drawing, time sketching, and preliminary practice in figure composition.

[REQUIRED IN COURSE IV., OPTION 1.]

D45. LIFE CLASS AND DECORATIVE DESIGN.[1]

Professor Brown.

PREPARATION: D44.

A course of six hours per week throughout the year. The course includes drawing from the nude, principles of composition, and applied decorative figure design.

[ELECTIVE IN COURSE IV., GRADUATE YEAR.]

[1] Candidates for advanced standing should present themselves for examination.

DEPARTMENT OF ENGLISH.

HENRY G. PEARSON, A.B.
Professor of English.
ARCHER T. ROBINSON, A.M.
Professor of English.
FRANK AYDELOTTE, A.M., B.LITT.
Professor of English.
HENRY L. SEAVER, A.M.
Assistant Professor of English.

Instructors.

CHAUNCY C. BATCHELOR, A.M.
CLINTON H. COLLESTER, A.M.
HERBERT W. SMITH, A.M.
ROBERT E. ROGERS, M.A.
THOMAS G. GOODWIN, A.M.
WILLIAM GREEN, S.M.
PERCY MARKS, A.M.

English Composition at the Institute is taught as an essential part of the training of every educated man, but special emphasis is laid upon its importance in technical work. While attention is given to its place in general cultivation and to its æsthetic side, the greater stress is placed upon the absolute necessity that every professional man shall be able to express his thought with clearness and accuracy. In the first year is given a systematic course in Composition; in the second year themes are written in connection with the study of Literature; in the third and fourth years, whenever possible, written work is arranged in professional Courses in connection with regular technical work. At any time in the four years, if a student shows marked deficiencies in English, he is given special work in Composition to be done with consultation and criticism.

English Literature is required throughout the second year of all students. It is designed not only to give the history of Literature, but so far as is practicable to cultivate an understanding and appreciation of what is best. As much stress

as possible is laid on the enjoyment and comprehension of masterpieces; and the assigned readings are treated as not only illustrative, but essential. The same principle is observed in the higher courses of Literature which belong to the third and fourth year.

E10. ELEMENTARY ENGLISH.

Professor Seaver.

This course of thirty hours in the first term and fifteen hours in the second term is arranged for foreign students. All students bred to speak any language other than English are required, unless they pass the Entrance Examination, or unless special arrangement is made to the contrary, to take this course in their first year in place of E11. The work is intended to develop vocabulary and, by frequent written work and conference, to correct the individual student's errors of idiom, grammar, and spelling.

E11. RHETORIC AND ENGLISH COMPOSITION.

Professors Pearson, Robinson, Aydelotte, Seaver; Messrs. Batchelor, Collester, Smith, Rogers, Goodwin, Marks.

PREPARATION: 3, 4.

The first-year English Composition is conducted by means of class-room exercises, written work, and consultations; it occupies two class-room hours and two hours of preparation per week in the first term and two class-room hours, or one hour each of class-room work and preparation, in the second term. The chief object is to enable the student to write correct, lucid, and easy business English; to express himself with accuracy and precision; and to realize that the secret of clear writing is clear thinking.

[REQUIRED IN ALL COURSES.]

E15. SPECIAL COMPOSITION.

Mr. Smith.

This course is supplementary to course E11, and may be required at any time after the first year of any student who shows inability to write clear and correct English. It consists wholly of theme work and consultation, and is continued in each case as long as the needs of the student require.

E20. ENGLISH READING AND COMPOSITION.

Professor Seaver.

PREPARATION: E10.

This course of thirty hours in the first term and thirty hours in the second term is required in place of E11, in the second year, of foreign students who took Elementary English (E10) in the first year. The course aims, by means of recitations, themes, conferences, and assigned readings, to acquaint the student with the vocabulary of modern discussion. Magazine articles, essays, and books, on topics of contemporary history, politics, etc., are read carefully, to train the student in thorough, retentive, appreciative reading, and are made the basis of written exercises, to develop the student's capacity for orderly, intelligible expression.

E21. ENGLISH LITERATURE.

Professors Pearson, Robinson, Aydelotte, Seaver; Messrs. Batchelor, Collester, Smith, Rogers, Goodwin.

PREPARATION: E11.

In the English Literature of the second year thirty exercises are held in each term. (In the first term Courses VI. and XII. have only fifteen exercises). Readings are assigned in the more important authors, and written work with personal consultation is required in each term. The year's work is designed to give an outline of the rise and development of Literature in England to the close of the Nineteenth Century. This survey is necessarily general, but the effort is to make it sufficiently definite to serve as a reliable framework for any later and more detailed study.

[REQUIRED IN ALL COURSES.]

E31. SHAKESPEARE'S PLAYS.

Professor Pearson.

PREPARATION: E21.

This course is given two hours a week during the first term of the third year. It consists of the reading and discussion of three or four plays by Shakespeare, the plays being chosen to illustrate various aspects of his genius.

[ELECTIVE.]

E32. ENGLISH LITERATURE OF THE NINETEENTH CENTURY.

Professor Pearson.

PREPARATION: E21.

This course, given in the second term of the third year, consists of a study of some of the masterpieces of Nineteenth Century Literature with discussion of the ways in which these works are representative of their authors and expressive of the spirit of the age.

[ELECTIVE.]

E33. THE ENGLISH BIBLE.

Professor Seaver.

PREPARATION: E21.

The course in the English Bible is given two hours a week during the first term of the third year. The assigned readings, confined to the text of the Bible, should acquaint the student with the more significant parts of the Old and, especially, of the New Testament. The purpose of the lectures is to show the historical origin and influence of the religious thought of the Jews, and the literary structure and excellence of the Biblical writings; also to give the student, as basis for his subsequent reading and interpretation, knowledge of the conditions under which the books of the Bible were written.

[ELECTIVE.]

E34. ENGLISH COMPOSITION AND LITERATURE.

Professor Aydelotte.

PREPARATION: E21.

This course consists of readings in English essayists of the nineteenth century (Newman, Arnold, Ruskin, Huxley, and Carlyle). Its purpose is to give students training in the careful reading of thoughtful English prose, and practice in oral and written discussion of the ideas suggested by the reading. The course meets three times a week in the second term of the third year.

[REQUIRED IN COURSE XV.]

E35. REPORT WRITING.

Messrs. Green, Goodwin.

PREPARATION: E21, Ec50.

This course, of two exercises a week in the first term of the third year, acquaints the student with the various kinds of writing incidental to an

engineer's work, and gives practice in the writing of business letters, inter-departmental memoranda, and reports. The reports will embody the results of actual investigations made by the student.

[REQUIRED IN COURSE XV.]

E36. ADVANCED ENGLISH COMPOSITION.

Professor Robinson.

PREPARATION: E11.

This course, of thirty exercises and forty-five hours of preparation, is given in the second term of the third year. The work covers, first, logical analysis and logical composition. Later, specimens of contemporary prose are studied, and students who show literary ability in any direction are given a chance to develop it. Among the practical exercises is practice in the dictation of letters, in extemporaneous speaking from outlines, and in the oral presentation of papers.

[ELECTIVE.]

E38. ARGUMENTATION AND DEBATE.

Mr. Collester.

The purpose of the course in Argumentation and Debate is to give training in the preparation and the oral delivery of formal arguments. It is given in the second term of the third year.

[ELECTIVE.]

E39. PUBLIC SPEAKING.

Professors Robinson, Seaver.

The course in Public Speaking is given in the first term of the third year, and consists of thirty exercises and fifteen hours of preparation. It takes the form of both class drill and individual training, and gives an introduction to the study of gesture, enunciation, tone, and expression. At least one informal speech and one prepared address are delivered by each student. The number that can be admitted to the course is limited, and applicants are required to consult the instructor before final registration.

[ELECTIVE; REQUIRED IN COURSE XIII.A.]

DEPARTMENT OF ECONOMICS AND STATISTICS.

DAVIS R. DEWEY, PH.D., LL.D.
Professor of Economics and Statistics.

CARROLL W. DOTEN, A.M.
Associate Professor of Economics.

Instructors.

MARTIN J. SHUGRUE, A.B. HARRY R. TOSDAL, PH.D.

Ec31. POLITICAL ECONOMY.

Professors Dewey, Doten; Messrs. Shugrue, Tosdal.

PREPARATION: H31, taken simultaneously.

A course of three hours a week in the first term of the third year involving lectures, discussions, and written work. The course is elementary, with special emphasis upon descriptive economics.

[REQUIRED IN ALL COURSES EXCEPT XV.]

Ec32. POLITICAL ECONOMY.

Professor Doten.

PREPARATION: H12.

This is a course of three hours a week in the first term of the second year. It is not so general in its scope as Ec31. More emphasis is placed upon fundamental principles.

[REQUIRED IN COURSE XV.]

Ec33. ECONOMIC HISTORY.

Professor Doten.

PREPARATION: H31, taken simultaneously.

A course of one hour a week in the first term of the third year. This is designed for students who wish to secure a broader course in Economics than is provided by course Ec31. The industrial history of England and the United States is reviewed, showing the historical origins of present economic conditions.

[ELECTIVE.]

Ec34. RAILROAD ECONOMICS.

Professor Doten.

PREPARATION: Ec31.

This is a course of three hours a week in the second term of the third year. Two hours are devoted to lectures and recitations and the third hour to special investigations under the supervision of the instructor. The method employed is both historical and comparative, and each question is discussed, so far as practicable, in the light of European as well as American experience. The following are some of the topics covered: the history of railroad development in the United States, methods of financing new roads, character and cost of construction in different countries, competition and combinations, public service, rates and fares, freight classification, methods of accounting, reports and statistics. Special attention is given to the relation of the railroads to the State, and students are encouraged to investigate problems connected with government regulation and control.

[ELECTIVE.]

Ec35. TRANSPORTATION.

PREPARATION: Ec56.

This course consists of two hours a week in the second term of the third year. Lectures will deal with the making of railroad rates, classification of freight, handling of freight, terminal facilities, warehousing, powers of the Interstate Commmerce Commission in relation to the shipper, ocean rates, customs and port regulations, tonnage duties, port and inland differentials, and special transit privileges.

[REQUIRED IN COURSE XV.]

Ec36. BANKING AND FINANCE.

Professor Dewey.

PREPARATION: Ec31.

A course of three hours a week in the second term of the third year. The following topics will be considered: national banks, State banks, trust companies, savings banks, different kinds of loans, securities for loans, the bank statement, the money market, relation of the treasury and crop movement to money market, clearing house, domestic and foreign exchange and foreign systems of banking, particularly those of Canada, England and Germany. One hour of the three will be devoted to individual investigation and the use of banking reports under the immediate supervision of the instructor.

[ELECTIVE.]

Ec37. BANKING.

Professor Dewey.

PREPARATION: Ec31 or Ec32.

Similar to Ec36, but more extended, particularly in exercises in banking problems.

[REQUIRED IN COURSE XV.]

Ec38. SECURITIES AND INVESTMENTS.

PREPARATION: Ec37; Ec56.

A course of three hours a week in the second term of the third year. This treats of (1) different kinds of securities: government, railroad, industrial, public utility, etc.; (2) the construction of bond tables, interest formulas, sinking fund calculation, serial bonds, amortization, and the mathematical theory of investment; (3) stock and produce exchanges, brokerage, and speculation.

[REQUIRED IN COURSE XV.]

Ec45. LABOR PROBLEMS.

Professor Doten.

PREPARATION: Ec31.

This course consists of two hours a week in the second term of the third year, occupied with lectures and discussions and a third hour to be used at the option of the instructor in special investigation work. The ground covered consists of a brief résumé of modern Industrial History, showing the laborer's place in the industrial world; a study of the history, purposes and achievements of trade unions; and the general condition of labor as regards wages, hours of labor, sanitary and safety regulations, and workman's insurance. The following special topics are discussed: arbitration; coöperation; profit-sharing; employers' liability; strikes and lockouts; injunctions; factory legislation; railroad relief associations and welfare schemes in manufacturing establishments.

[ELECTIVE.]

Ec50. ACCOUNTING.

Mr. Shugrue.

PREPARATION: Ec31 or Ec32.

A course of three hours a week in the second term of the second year. This course is not designed to make bookkeepers, auditors, or accountants

in any professional sense, but deals rather with the analysis of financial reports. Instruction will deal with bookkeeping terminology, the significance of assets and liabilities, good-will, franchises, the construction of the balance sheet and of the profit and loss statement.

[REQUIRED IN COURSE XV.]

Ec51. COST ACCOUNTING.

PREPARATION: Ec50; Ec56.

A course of three hours a week in the first term of the fourth year. The following topics will be considered: methods of determining costs of materials, processes of labor and machines; the distribution of indirect costs and overhead expenses; cost data to secure efficiency; shipping orders; inventories; recording and payment of wages.

[REQUIRED IN COURSE XV. NOT GIVEN IN 1915–1916.]

Ec55. ECONOMICS OF CORPORATIONS.

Professor Dewey.

PREPARATION: Ec31.

A course of two lectures a week in the first term of the fourth year. It treats of the nature of corporations and their legal development, accounting, valuation of bonds, holding companies, lighting companies, street railway franchises, and the taxation of corporations.

[REQUIRED IN COURSE VI.]

Ec56. INDUSTRIAL ORGANIZATION.

Mr. Tosdal.

PREPARATION: Ec42; Ec50.

A course of two hours a week in the first term and three hours a week in the second term of the third year. This course gives an extended survey of the forms of organization under which business is carried on at the present time, treating more particularly of corporations. Consideration is given to the differences in state corporation laws affecting choice of state for securing a charter, methods of promoting, underwriting, and financing a corporation, reorganization methods, and the state supervision of corporations.

[REQUIRED IN COURSE XV.]

Ec58. BUSINESS MANAGEMENT.

PREPARATION: Ec56.

This course is given twice a week in the first term and four times a week in the second term of the fourth year. It includes a survey of the methods of carrying on an individual business. The following topics are considered: the organization of the executive force, departmental functions, office systems, factory efficiency, standardization of goods, stock keeping, routing of orders, management of labor, selection of employees, systems of wage payments, bonuses, efficiency methods, welfare inducements, marketing of goods, organization of the sales department, advertising and publicity, credit department, and insurance.

[REQUIRED IN COURSE XV. NOT GIVEN IN 1915–1916.]

Ec60. BUSINESS LAW.

Mr. Albers.

Fifteen lectures, given in the second term of the third year. The course consists of a general treatment of the subject of business law, such topics as the definition of law, its sources, the distinction between law and equity, and the application of law to business contracts being considered. To the last of these topics the most thorough treatment is given, that being the form of business law with which the students will have most to do in their professional life.

[REQUIRED IN ALL COURSES.]

Ec61. BUSINESS LAW.

PREPARATION: Ec56; Ec58, taken simultaneously.

A course of two hours a week given throughout the fourth year. Deals with contracts, agency, negotiable instruments, patent law and trademarks.

[REQUIRED IN COURSE XV. NOT GIVEN IN 1915–1916.]

Ec65. STATISTICS.

Professor Dewey; Mr. Shugrue.

PREPARATION: Ec50.

A course of thirty two-hour exercises given in the first term of the third year. Elementary instruction is given in the construction of statistical tables and charts, official sources of commercial and financial statistics of the United States, and the interpretation of such material.

[REQUIRED IN COURSE XV.]

Ec70. TAXATION.

PREPARATION: Ec31.

A course of elementary lectures one hour a week in the first term of the fourth year.

[REQUIRED IN COURSE XV. NOT GIVEN IN 1915–1916.]

DEPARTMENT OF HISTORY AND POLITICAL SCIENCE.

CHARLES F. A. CURRIER, A.M.
Professor of History and Political Science.

JOHN O. SUMNER, A.B.
Professor of History.

Assistants.

WILLIAM H. J. KENNEDY, A.B. LACEY D. CASKEY, B.A., PH.D.

The courses in History naturally divide themselves into three groups: (1) those taken by all students pursuing regular courses; (2) those required in Course IV.; and (3) elective courses.

The courses taken by all students pursuing regular courses have for their main objects, first, to familiarize students with the history of the nineteenth century, a century of the highest historical as well as scientific importance, and second, to study the present governments and politics of the United States and of the principal European nations; in other words, to acquaint the student with contemporary history and political institutions, to stimulate and broaden his interest in the world of today, and to lay the foundations of good citizenship. The second group is designed to meet the special needs of students in the Course in Architecture. The elective courses are those offered as options in General Studies in the third year. (See page 130.)

H12. HISTORY I: AMERICAN NATIONAL DEVELOPMENT.

Professor Currier.

PREPARATION: 4.

This course comprises two lectures a week in the second term of the first year. The subject consists of two parts, History and Government. (1) About one half of the time is devoted to a consideration of selected

advanced topics in the history of the United States, with more than usual reference to the history of the last forty years and to contemporary problems. (2) National Government and Municipal Government occupy most of the other half of the time, and only slight opportunity is afforded for studying the government of the States.

[REQUIRED IN ALL COURSES.]

H31. HISTORY II: EUROPEAN NATIONAL DEVELOPMENT.

Professor Currier.

PREPARATION: H12.

This course, of two lectures a week, given in the first term of the third year (second year in Course IV.) is largely a study of contemporary European governments and politics, with historical introductions to explain the origin and meaning of existing systems and conditions. The principal stress is laid on the leading nations, with as much attention to the minor countries as time permits. International relations, colonial possessions, and non-European interests, especially in Asia and Africa, are also studied.

[REQUIRED IN ALL COURSES.]

H33. HISTORY OF EUROPEAN CIVILIZATION AND ART. (First Course.)

Professor Sumner.

PREPARATION: 4.

Three hours a week during the first, and two hours during the second term of the second year for Option 1, and of the fourth year for Option 2. Classes after the Class of 1916 take this subject in the second year.

This course treats of the rise of civilization and of its westward expansion through the Mediterranean basin. The racial, economic, religious, and political elements in this development are carefully traced, and upon the background thus gained the art of each successive epoch is studied and general æsthetic principles are discussed. The greater part of the time is devoted to Hellenic civilization and art, but as the students in Course IV. have already had a specialized course in the History of Architecture, attention is here particularly concentrated upon sculpture. The lectures are very fully illustrated by lantern slides, supplemented by collections of photographs and by reference to the original works and casts contained in the Boston Museum of Fine Arts.

[REQUIRED IN COURSE IV.]

H34. EUROPEAN CIVILIZATION AND ART. (Second Course.)

Professor Sumner.

PREPARATION: H33.

Two hours a week, throughout the third year. This course continues course H33 through the later Greek and the Roman period.

[REQUIRED IN COURSE IV.]

H34a. HISTORY OF EUROPEAN CIVILIZATION AND ART. (Second Course.)

Dr. Caskey (First Term); *Professor Sumner* (Second Term).

PREPARATION: H33.

Three hours a week, throughout the fourth year.

This course, which will be discontinued after the year 1915–1916, covers the same ground as course H34 with the addition of some survey of the art of later periods.

[REQUIRED IN COURSE IV., OPTION 1.]

H35. EUROPEAN CIVILIZATION AND ART. (Third Course: Special Topics.)

Professor Sumner.

PREPARATION: H34.

Three hours a week during the first term.

The work of this course will be concentrated upon the history and art of Florence, Venice, and Rome in the Renaissance age, with special attention to their sculpture and painting.

[ELECTIVE IN COURSE IV., GRADUATE YEAR.]

H37. CURRENT PUBLIC PROBLEMS.

Professor Currier.

PREPARATION: H31, taken simultaneously.

A course of one exercise a week, lectures and recitations, during the first term of the third year. An intensive study of contemporary constitutional and political questions, chiefly in the United States, England, France and Germany.

[ELECTIVE.]

H38. MUNICIPAL GOVERNMENT.

Professor Currier.

PREPARATION: H31.

A course of two exercises a week, with assigned reading, during the second term of the third year. The ground covered is chiefly Municipal Government in the United States; but European, and especially English, municipal systems are studied for comparison and illustration.

[ELECTIVE.]

H39. INTERNATIONAL LAW.

Professor Currier.

PREPARATION: H31, taken simultaneously.

A course of one exercise a week during the first term of the third year, including the study of a text-book, together with references to current international relations and to the history of diplomacy.

[ELECTIVE.]

DEPARTMENT OF MODERN LANGUAGES.

FRANK VOGEL, A.M.
Professor of German.

ERNEST F. LANGLEY, PH.D.
Professor of French.

HERMAN R. KURRELMEYER, PH.D.
Associate Professor of German.

Instructors.

JOSEPH BLACHSTEIN. GEORGE R. B. MEISTER.
JUSTUS ERHARDT. CHARLES G. COOK, A.M.
OTTO E. PLATH, A.M.

The study of Modern Languages at the Institute has two objects: that of enabling the student to make use of the languages as instruments in scientific research, and that of giving him general training and culture. It aims to give him sufficient facility with modern texts to use them without the necessity of translating, and as much familiarity with the spoken language as his individual aptitude and the time available permit. From the beginning as much of the class-room work as possible is carried on in the language taught. Occasional talks therein are also given, and writing from dictation is frequently practiced.

A sound knowledge of Grammar is attained by the careful analysis of parts of the texts read, and by oral and written illustrative exercises. To make these of value a good pronunciation is essential, and this is striven for through constant practice in the class room. In addition to a deeper knowledge of the language and literature, the advanced courses aim to impart succinctly through these, familiarity with the character, customs, traditions, spirit, history and development of the peoples and countries whose language is studied.

In the designation of courses the grade of Elementary and Intermediate correspond, respectively, to the definitions of the Modern Language Association of America.[1] All other courses are of advanced grade.

[1] Report of the Committee of Twelve.

L11. GERMAN (Elementary).

Professor Vogel; Messrs. Blachstein, Meister, Cook, Plath.

This course consists of three exercises a week throughout the year, and is intended to prepare students to fulfill the entrance requirement in German. The work is based on the following books[1]:

Raabe. Else von der Tanne.
Rosegger. Das Holzknechthaus.
Storm. Geschichten aus der Tonne.
Vos. Essentials of German.

[ELECTIVE.]

L21. GERMAN (Intermediate).

Professors Vogel, Kurrelmeyer; Messrs. Blachstein, Erhardt, Meister, Cook, Plath.

PREPARATION: 7 or L11.

This course consists of three exercises a week throughout the year. The Grammar is reviewed, and the study of it completed. The reading, scientific as well as literary, gradually becomes more difficult, and the syntax, idioms and synonyms of the language are carefully studied. By the end of the course students should be able to read understandingly any ordinary newspaper or magazine article of a literary or popular scientific nature, to understand simple spoken German, and to express simple thoughts in German. As far as practicable the exercises are conducted in German. The work is based on the following books[1]:

Bierwirth. An Abstract of German Grammar.
Haltenhoff. Science German Course.
Hauff. Lichtenstein.
Loening and Arndt. Deutsche Wirtschaft.
Bacon. German Composition.
Prehn. Guide to German Vocabulary.
Schiller. Gustav Adolf in Deutschland.

[REQUIRED IN ALL COURSES EXCEPT IV.]

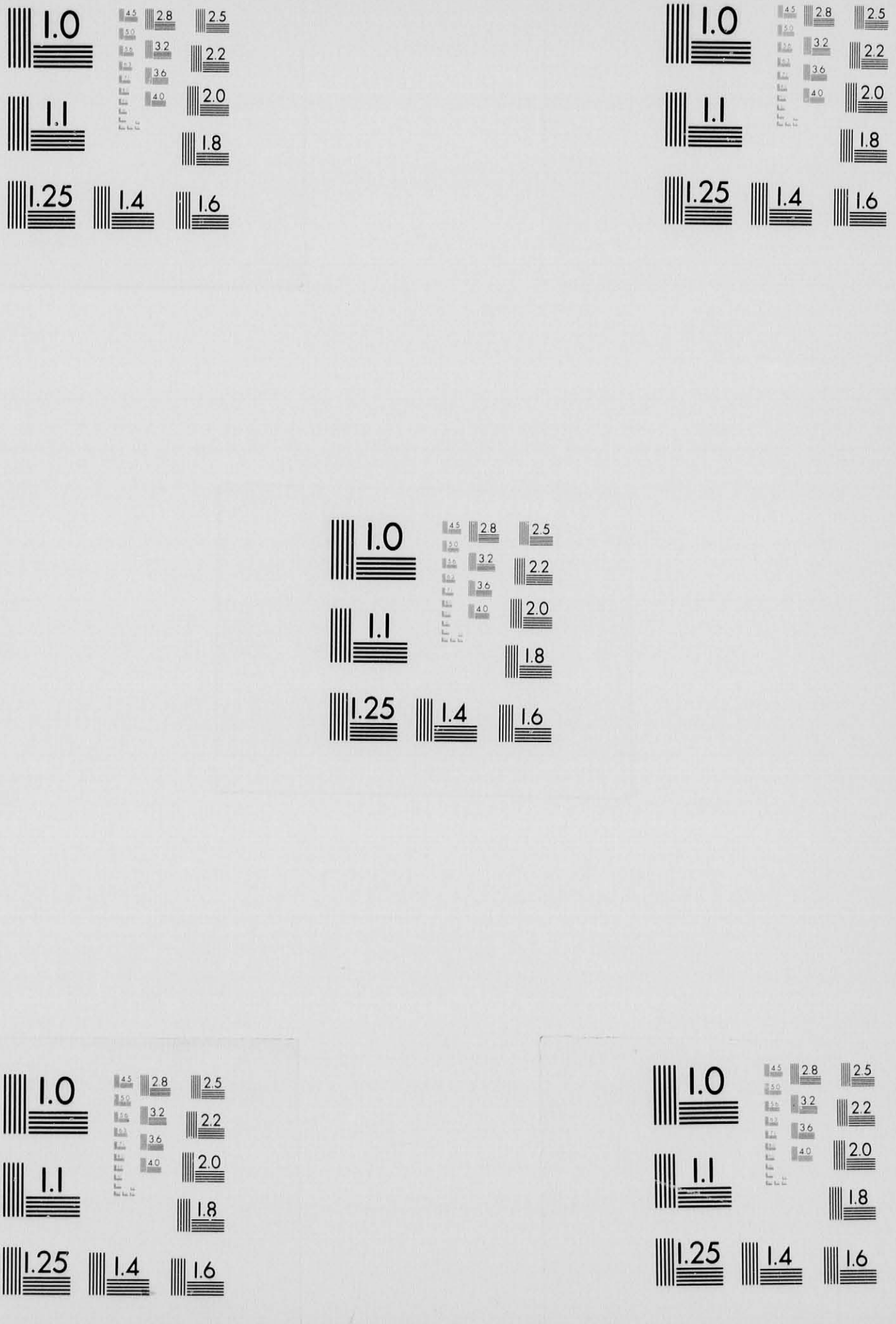
L31. GERMAN (Advanced).

Professors Vogel, Kurrelmeyer.

PREPARATION: L21.

This course, given three times a week during both terms, consists wholly of exercises in Scientific German. The work is based on the following books[1]:

[1] In all courses the list of books is subject to modification.


1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8
4.5
5.0
5.6
6.3
7.1

Du Bois-Reymond. Wissenschaftliche Vorträge.
Lassar-Cohn. Die Chemie im täglichen Leben.
Rauter. Allgemeine chemische Technologie.
Kauffmann. Allgemeine und physikalische Chemie.

[REQUIRED IN COURSES V., VII., VIII., OPTIONS 1, 2, XII.]

L32. GERMAN (Advanced).

Professors Vogel, Kurrelmeyer.

PREPARATION: L21.

This course, given three times a week during the first term, is wholly devoted to exercises in Scientific German. The work is based on the following books in addition to selections from current scientific journals.

Kayser. Die Elektronentheorie.
DuBois-Reymond. Wissenschaftliche Vorträge.
Kauffmann. Allgemeine und Physicalische Chemie.

[REQUIRED IN COURSES VIII., OPTION 3, XIV.]

L33. GERMAN (Advanced).

Professors Vogel, Kurrelmeyer; Mr. Erhardt.

PREPARATION: L21.

This course is given twice a week during the first term only, and is wholly devoted to exercises in Scientific German. The work is based on the following books:

Kayser. Die Elektronentheorie.
Müller. Die elektrischen Maschinen.
Rauter. Allgemeine chemische Technologie.

[REQUIRED IN COURSES VI., X., XV.]

L34. GERMAN (Advanced).

Professor Vogel; Messrs. Blachstein, Meister, Cook, Plath.

PREPARATION: L21.

This course, given twice a week during the first term, is wholly devoted to readings and exercises in Scientific German. The work is based on selected passages from current foreign scientific periodicals and books in addition to Schöpfungen der Ingenieur-technik der Neuzeit. Not given in Course III. in 1915–1916.

[REQUIRED IN COURSES I., III., OPTIONS 2, 3, XI.]

L35. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given once a week during the first term, and is wholly devoted to readings and exercises in Scientific German. Selected passages from current foreign scientific periodicals and books form the basis of the work, also Lüdicke, Mechanische Technologie.

[REQUIRED IN COURSE II.]

L41. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course forms a brief introduction to the German Literature of the Eighteenth and Nineteenth Centuries and consists of one exercise a week during the first term and two a week during the second term. It is given in brief lectures in German with readings from the following books:

Biedermann. Deutsche Bildungszustände.

Keller. Bilder aus der deutschen Litteratur.

Nichols. Modern German Prose.

Paszkowski. Einführung in die Kenntnis Deutschlands und seines geistigen Lebens.

Tombo. Deutsche Reden.

This course alternates with L42 below.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L42. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given once a week during the first term and twice a week during the second term. It consists of lectures on the German drama with a considerable amount of reading from characteristic plays, beginning with Schiller's Don Karlos.

[ELECTIVE: OPTION IN GENERAL STUDIES. OMITTED IN 1915–1916.]

L43. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given twice a week during the first term and it comprises composition, dictation, reading, lectures, and conversation. The work is

based on current newspaper and magazine articles and on the following books:

Bacon. Im Vaterland.
Kron. German Daily Life.
Kron. Der kleine Deutsche.
Leopold. Im Deutschen Reich.
Savory. Drei Wochen in Deutschland.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L44. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given twice a week during the second term. The work consists wholly of exercises without preparation. It is distinctively a sight reading course for practice in rapid reading.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L45. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given twice a week during the second term. It consists of lectures and readings on the life and work of the most important German men of science.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L46. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This course is given twice a week during the second term. It consists of lectures and readings with a study of the development of the Faust legend.

Goebel. Goethe's Faust will be used.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L47. GERMAN (Advanced).

Professor Vogel.

PREPARATION: L21.

This is a practical course in commercial correspondence and is given once a week during the second term. A foreign correspondent will be provided for each member of the class.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L61. FRENCH (Elementary).

Professor Langley.

This course consists of three exercises a week throughout the year and is designed to enable students to fulfill the entrance requirement in French. The work will be based on the following books [1]:

Thieme and Effinger. French Grammar.
François. Introductory French Prose Composition.
Moffett. Récits Historiques.
Daudet. Neuf Contes Choisis.
Labiche. La Grammaire.

[ELECTIVE.]

L62. FRENCH (Intermediate).

Professor Langley.

PREPARATION: 6.

This course, given three times a week throughout the year, consists of recitations partly conducted in French. It comprises a continuation of the study of grammar, translation into French of connected passages, letter writing, dictation, reading and translation of some standard modern authors. At the end of the course the student should be able to understand easy spoken French, express simple ideas in French, read works of ordinary difficulty without having to go through the process of translation, and, finally, have a real appreciation of the authors read. The work will be based on the following books [1]:

Olmstead. French Grammar.
Koren. French Composition.
Dow and Skinner. Contes des Romanciers Naturalistes.
Balzac. Gobseck.
Bowen. First Scientific French Reader.
Augier. Le Gendre de Monsieur Poirier.
Hugo. Travailleurs de la Mer.
Michelet. Histoire de France (Selections).

[REQUIRED IN COURSE IV.]

L71. FRENCH (Advanced).

Professor Langley.

PREPARATION: L62.

This course is offered in alternate years. It is given once a week throughout the year and consists of a general survey of the French drama from the seventeenth century to the present time, with the reading of eight or nine representative plays selected from the list below, and brief lectures in French. Either term's work may be elected independently. The work will be based on the following books [1]:

[1] In all courses the list of books is subject to modification.

Corneille. Le Cid.
Molière. Tartuffe.
Molière. Le Malade imaginaire.
Racine. Andromaque.
Beaumarchais. Le Barbier de Séville.
A. Dumas. Henri III.
Hugo. Hernani or Ruy Blas.
De Musset. On ne badine pas avec l'amour.
Dumas fils. La Question d'Argent.
Augier. Le Gendre de Monsieur Poirier.
Pailleron. Le Monde où l'on s'ennuie.
Rostand. Cyrano de Bergerac.

[ELECTIVE: OPTION IN GENERAL STUDIES. OMITTED IN 1915–1916.]

L72. FRENCH (Advanced).

Professor Langley.

PREPARATION: L62.

This course is offered in alternate years. It is given once a week throughout the year and consists of a brief survey of the history of French Literature. Such topics as the following will be discussed in outline; the literature of the middle ages; the Renaissance; classicism; romantic movement; realism; naturalism; art for art's sake; impressionism and symbolism. Most of the work will be concentrated upon the reading of nineteenth century authors. The work of either term may be elected independently.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L73. FRENCH (Advanced).

Professor Langley.

PREPARATION: L62.

This course is given twice a week during the first term. It comprises conversation, reading and a small amount of composition and letter-writing. Part of the work will consist of the sight reading of matter of special interest to students of architecture, selected from histories of art, periodicals and monographs. The class work will be carried on in French as much as possible. Among other things the following books will be used:

Pichon. Leçons pratiques.
Besnard. Le Mont-Saint-Michel.
Gebhart. Florence (Les Villes d'Art Célèbres).

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L74. FRENCH (Advanced).

Professor Langley.

PREPARATION: L62.

This course is given twice a week during the second term. The work will consist of letter-writing, composition, conversation, and the sight reading of modern French. Part of the latter will deal with subjects, which although of special value to students in architecture, will be of general interest and profit. No preparation is required for the exercises. The class work will be conducted in French as much as possible. Among other things the following books will be used:

Pichon. Leçons pratiques.
De Foville. Pise et Lucques.

[ELECTIVE: OPTION IN GENERAL STUDIES.]

L81. SPANISH (Elementary).

Professor Langley.

This course is given twice a week throughout the year. The work includes the study of the elements of Spanish Grammar; regular verbs and all common irregular verbs; composition exercises, and the reading of easy Spanish texts. In 1917–18 and thereafter, Course III., Option 1, may take this subject three times per week in the second term. The work is based upon the following books:

De Vitis. Spanish Grammar.
Umphrey. Spanish Composition.
Alarcón. Novelas Cortas.
Morrison. Tres Comedias Modernas.

[ELECTIVE.]

L91. ITALIAN (Elementary).

Professor Langley.

This course is offered in alternate years. It is given twice a week throughout the year, includes the study of the elements of Italian Grammar, regular verbs, and all common irregular verbs, composition exercises, reading of Italian texts, and some practice in conversation. The work is based on the following books:

Marinoni. Elementary Grammar of the Italian Language.
Bergen and Weston. Italian Reader.
Wilkins and Altrochi. Italian Short Stories.

[ELECTIVE. OMITTED IN 1915–1916.]

DEPARTMENT OF MATHEMATICS.

HARRY W. TYLER, PH.D.
Walker Professor of Mathematics.

DANA P. BARTLETT, S.B.
Professor of Mathematics.

FREDERICK S. WOODS, PH.D.
Professor of Mathematics.

FREDERICK H. BAILEY, A.M.
Professor of Mathematics.

EDWIN B. WILSON, PH.D.
Professor of Mathematics.

NATHAN R. GEORGE, JR., A.M.
Associate Professor of Mathematics.

LEONARD M. PASSANO, A.B.
Associate Professor of Mathematics.

CLARENCE L. E. MOORE, PH.D.
Assistant Professor of Mathematics.

HENRY B. PHILLIPS, PH.D
Assistant Professor of Mathematics.

Instructors.

JOSEPH LIPKA, PH.D.
FRANK L. HITCHCOCK, PH.D.
BARNEM B. LIBBY, M.A.
GEORGE RUTLEDGE, PH.D.

Great importance is attached to the study of Mathematics, both as a means of general education and as a necessary basis for further instruction in the engineering and other Courses. Nearly all students pursuing regular courses study Mathematics throughout their first two years, beginning with a course in Plane Trigonometry, and a general course in Algebra, Analytic Geometry, and Calculus which begins in the first term of the first year and continues to the middle or end of the second year, or in some Courses to the middle of the third year. This consecutive coursein Mathematics includes work formerly divided somewhat arbitrarily into Algebra, Analytic Geometry, Differential Calculus, Integral Calculus, and Differ-

ential Equations. The sub-titles retained in parentheses indicate merely the approximate distribution under the present plan. Care is taken to present both underlying principles and a great variety of concrete applications, the latter connecting the mathematical instruction closely with the professional studies. The instruction is given mainly by recitations in small sections, the number of the students in a section being generally limited to about twenty. Students having time and interest for the study of Mathematics beyond the prescribed limits are offered opportunity for more advanced work.

M10. PLANE TRIGONOMETRY.

Professors Bartlett, George,[1] *Passano, Moore, Phillips; Messrs. Lipka, Hitchcock, Libby, Rutledge.*

PREPARATION: 1; 2; 5.

A course of two exercises a week during the first term of the first year, covering the following subjects: definitions of the trigonometric functions as ratios; proofs of principal formulas; trigonometric transformations; circular measure of angles; solution of trigonometric equations; inverse trigonometric functions; proofs of formulas of right and of oblique triangles; theory and use of logarithms; and areas and solutions of right and of oblique triangles. The course is fully illustrated by practical problems.

[REQUIRED IN ALL COURSES.]

M11. MATHEMATICS. (Algebra, Elements of Analytic Geometry.)

Professors Tyler,[1] *Bartlett, Woods, Bailey, Wilson, George, Passano, Moore, Phillips; Messrs. Lipka, Hitchcock, Libby, Rutledge.*

PREPARATION: 1; 2; 5; M10, taken simultaneously.

A course of two recitations a week during the first term of the first year covering the following subjects: graphical representation; the polynomial of the first degree in one variable, including the analytic geometry of the straight line; the polynomial of the nth degree in one variable, including the fundamental theorems of the theory of equations; the plotting of certain algebraic functions expressed by surds or fractions; differentiation of the polynomial in one variable, including problems on tangents, normals, max-

[1] In charge.

ima and minima, and points of inflection. The division of topics between M11 and M12 varies from year to year.

[REQUIRED IN ALL COURSES.]

M12. MATHEMATICS. (Analytic Geometry, Elements of Calculus.)

Professors Tyler, Bartlett, Woods, Bailey,[1] Wilson, George, Passano, Moore, Phillips; Messrs. Lipka, Hitchcock, Libby, Rutledge.

PREPARATION: M10; M11.

A course of four exercises a week in the second term of the first year in continuation of the preceding and covering the following subjects: the derivation of the equations of curves defined by geometric properties; intersection of curves; differentiation of algebraic functions with applications to geometrical and physical problems; inverse differentiation applied to problems; change of co-ordinate axes; the analytic geometry of curves of the second degree; graphs and derivatives of elementary transcendental functions, and problems; parametric representation; polar co-ordinates; and curvature. Throughout the course special attention is given to the solution of problems, which are introduced as soon as the requisite theory has been developed.

[REQUIRED IN ALL COURSES.]

M20. SPHERICAL TRIGONOMETRY.

Professor Passano;[1] Dr. Hitchcock.

PREPARATION: M10.

This course of ten exercises during the first term of the second year covers the proofs of formulas of right and of oblique spherical triangles, and dependent problems.

[REQUIRED IN COURSE I.]

M21. MATHEMATICS. (Integral Calculus.)

Professors Tyler, Bartlett, Woods,[1] Bailey, Wilson, George, Passano, Moore, Phillips; Messrs. Lipka, Hitchcock, Libby, Rutledge.

PREPARATION: M12.

A course of three hours a week during the first term of the second year,

[1] In charge.

devoted mainly to the integral calculus of functions of one variable and covering the following subjects: infinitesimals and differentials; methods of integration; definite integrals; geometrical applications to areas and lengths of plane curves, volumes of solids of revolution, and other volumes which can be found by a single integration; and mechanical applications to work, attraction, pressure, and centers of gravity and pressure. The division of topics between M21 and M22 varies from year to year.

[REQUIRED IN ALL COURSES.]

M22. MATHEMATICS. (Solid Analytic Geometry, Calculus.)

Professors Tyler, Bartlett,[1] *Woods, Bailey, Wilson, George, Passano, Moore, Phillips; Messrs. Lipka, Hitchcock, Libby, Rutledge.*

PREPARATION: M21.

A course of three exercises a week during the second term of the second year, in continuation of course M21, mainly devoted to the study of functions of two variables and covering the following subjects: the elements of solid analytic geometry including a discussion of the plane, the straight line and simple surfaces; partial differentiation; multiple integration, with geometrical applications to areas and volumes, and with mechanical applications to attraction, moments of inertia, and centers of gravity; line integrals and exact differential equations.

[REQUIRED IN ALL COURSES EXCEPT V., OPTIONS 2, 3, VII., XV., OPTION 3.]

M26. THE THEORY OF PROBABILITY AND METHOD OF LEAST SQUARES.

Professor Bartlett.

PREPARATION: M22 taken simultaneously.

This course consists of twenty exercises in the second term, partly lectures and partly recitations, in which, after the fundamental principles that govern the application of the method to the adjustment of observations have been developed, numerous problems are solved illustrating the process of computing the most probable values of the unknown quantities, the determination of the precision measures of the results, and the discussion of the accuracy necessary to be attained in the component measurements of a series in order that the final result may be secured with a prescribed degree of accuracy. The use of the method in the development of empirical equations, the question of the rejection of discordant observations, and the occasional occurrence of special laws of distribution of the errors of

[1] In charge.

observation are also considered. The text-book used is Bartlett, General Principles of the Method of Least Squares.

[REQUIRED IN COURSE VIII., OPTIONS 1, 2.]

M31. MATHEMATICS. (Differential Equations.)

Professors Bailey,[1] *Wilson, Phillips.*

PREPARATION: M22.

A course of three exercises a week during the first term of the third year in continuation of course M22, and covering the following subjects: differential equations of the first order; singular solutions; linear differential equations; and geometrical and mechanical applications.

Course M36 is recommended in place of this to any who expect to take graduate work.

[REQUIRED IN COURSES II., XIII., XIII.B.]

M32. MATHEMATICS. Advanced Calculus, Differential Equations.)

Professor Phillips.

PREPARATION: M22.

An abridgment of course M36 occupying two hours a week in the second term of the third year.

[REQUIRED IN COURSE XIV.]

M35. MATHEMATICS. (Advanced Calculus, Differential Equations.)

Professors Wilson,[1] *Moore.*

PREPARATION: M22.

An abridgment of Course M36 occupying three hours a week in the second term of the third year.

[REQUIRED IN COURSES VI., VIII., OPTION 1.]

[1] In charge.

M36. MATHEMATICS. (Advanced Calculus and Differential Equations.)

Professor Woods.

PREPARATION: M22.

A course of four exercises a week during the first term of the third year, covering the following subjects: Taylor's Formula with applications to approximations in calculation and analysis, partial differentiation, complex numbers, vectors, differential equations of the first order, linear differential equations, total and partial differential equations, with numerous applications to geometry and physics.

[REQUIRED IN COURSES VIII., OPTION 2, XIII.A.]

M38. MATHEMATICS. (Advanced Calculus and Differential Equations.)

Professor Woods.

PREPARATION: M36.

This course of thirty exercises in the second term treats the following subjects: line and surface integrals, vectors, functions defined by integrals, the elements of the calculus of variations, differential equations of physics.

[REQUIRED IN COURSE XIII.A.]

M39. MATHEMATICS. (Advanced Calculus and Differential Equations.)

Professor Woods.

PREPARATION: M36.

This course consists of forty-five exercises during the second term, and is an amplification of course M38.

[REQUIRED IN COURSE VIII., OPTION 2.]

M45. FOURIER'S SERIES; LAPLACE'S COEFFICIENTS.

Professor Bailey.

PREPARATION: M31 or M35.

This course consists of a series of lectures and recitations twice a week extending throughout the fourth year. The theory of Fourier's series, Bessel's functions, zonal and spherical harmonics, and their application to the solution of such problems in Physics as can be expressed by certain partial differential equations, are discussed.

[REQUIRED IN COURSE VIII.]

HISTORY OF THE MATHEMATICAL SCIENCES.

Professor Tyler.

This course consists of about ten lectures during each term and forms a part of course 790 on the History of Science, under which title a more detailed description may be found.

[ELECTIVE.]

ELECTIVE ADVANCED COURSES.

In addition to the above subjects, which are required in certain Courses, opportunity for further elective work is given, the topics varying from year to year.

Graduates of the Institute, or of other colleges, desiring to prepare themselves under the conditions of a scientific school for the teaching of Mathematics may advantageously include some or all of these subjects, as well as any of the above not previously taken, in programs for the degree of Master of Science.

The Department will also endeavor in particular to meet the needs of graduate students desiring to engage in mathematical investigation of problems of engineering or applied science.

It is highly desirable that students who intend to take any of the following courses should have previously completed courses M36 and M39.

M51. CURVE TRACING.

Dr. Hitchcock.

PREPARATION: M22.

A course of two exercises a week during the second term, covering the more important facts in regard to plane curves. A large variety of curves are plotted from their equations. Enough time is given to invariants, both scalar and vector, to show the meaning and use of these quantities.

[ELECTIVE.]

M52. ELEMENTARY THEORY OF THE POTENTIAL FUNCTION.

Dr. Hitchcock.

PREPARATION: M22.

An elementary course during the first term, introducing the student to some of the conceptions underlying modern mathematical physics: electrostatic and gravitational potential, vector fields, and vector potential. The intent of the course is to develop a point of view, rather than to study any part of the subject in detail. The exercises will consist of lectures, problem work, and the study of passages from modern writers.

[ELECTIVE.]

M53. THERMODYNAMICS.

Professor Phillips.

PREPARATION: M31 or M35.

This course consists of two hours per week during the first term and covers the general theory of thermodynamics based either on statistical mechanics or on the two fundamental laws.

[ELECTIVE.]

M54. MATHEMATICAL LABORATORY.

Dr. Lipka.

PREPARATION: M22.

A course of two exercises a week throughout the year (either term's work may be taken without the other) for practical instruction in numerical, graphical and mechanical calculation and analysis as required in the engineering or applied mathematical sciences. The course will include: methods for checking the accuracy of arithmetic and logarithmic computations; numerical solution of algebraic, transcendental and differential equations; graphical methods in the processes of arithmetic, algebra and the calculus; nomography and the construction of graphical charts; curve fitting to empirical data; approximate methods of integration, differentiation and interpolation; the use and principles of construction of instruments employed in calculation, such as slide-rules, arithmometers, planimeters and integraphs; and many kindred topics.

[ELECTIVE.]

M56. ELEMENTS OF THE THEORY OF FUNCTIONS OF A COMPLEX VARIABLE.

Professor Tyler or Professor Woods.

PREPARATION: M31 OR M35.

This course will consist of two exercises a week during either term.

Emphasis will be placed on the general bearings of the subject in its relation to special branches of Mathematics and their applications, with which the students may be already familiar, and on its significance as an introduction to more advanced subjects.

[ELECTIVE.]

M57. HYDRODYNAMICS.

Professor Wilson.

PREPARATION: M38.

This course consists of twenty lectures during the first or second term in which the fundamental equations of Hydrodynamics are developed and applied to the solution of particular problems.

[NOT GIVEN IN 1915–1916.]

M58. ADVANCED GEOMETRY.

Professor Woods.

PREPARATION: M31 or M35.

This course of two hours a week during the second term is intended to extend the knowledge of analytic geometry acquired in the required mathematical courses. Among other subjects, those of Projective Geometry and Non-Euclidean Geometry will be handled.

[ELECTIVE.]

M59. FLUID DYNAMICS, THEORETICAL.

Professor Wilson.

Two hours per week in the first and second terms. The classical mathematical treatment of the motion of fluids, Kirchhoff-Helmholtz discontinuity, cyclic and vortex motion, effect of viscosity and elasticity.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

M63. MATHEMATICS OF WIRELESS TELEGRAPHY.

Professor Wilson.

PREPARATION: M39.

This course consists of two hours per week during the second term, and includes a treatment of the simpler and of some of the more difficult theories of the transmission and reception of electromagnetic energy by ether waves.

[ELECTIVE. NOT GIVEN IN 1915–1916.]

M65. ANALYTICAL MECHANICS.

Professor Moore.

PREPARATION: M35.

This course of two hours a week throughout the year is mainly a problem course in the kinetics of particles and of rigid bodies in the plane. With the consent of the instructor the course may be taken in either half year alone.

[ELECTIVE.]

M66. DYNAMICS OF RIGID BODIES.

Professor Wilson.

Three hours per week throughout the first and second terms. A complete course of lectures and problems in theoretical mechanics with especial reference to the control of aeroplanes, their oscillations in flight, and gyroscopic effects in turning.

[REQUIRED IN GRADUATE COURSE IN AERONAUTICAL ENGINEERING.]

M67. STATISTICAL METHODS IN THEORETICAL PHYSICS.

Professor Wilson.

PREPARATION: M39.

A course of one lecture per week for the whole year, dealing with general aspects and particular applications of the use in physics of statistical methods, which, beginning with the kinetic theory of gases, have gradually extended over a wide range of phenomena, especially those connected with the second law of thermodynamics.

[ELECTIVE.]

M69. PARTIAL DIFFERENTIAL EQUATIONS.

Professor Woods.

PREPARATION: M35 or M31.

This course of two hours a week in the first term is an introduction to the theory of partial differential equations, especially of the types which appear in applied mathematics. Particular attention is paid to the solution of equations under given boundary conditions.

[ELECTIVE.]

M71. THE TEACHING OF ELEMENTARY MATHEMATICS.

This course will consist of fifteen or more exercises conducted by various members of the Department and devoted to the discussion of selected questions with special reference to the history and literature of the subject. No specific requirement as to preparation will be made, but the course will be open only to graduate students.

[ELECTIVE.]

Laboratories.

The most marked characteristic of the Institute from the material point of view consists of its numerous large and well-equipped laboratories.

Recognition of the value of laboratory instruction as a fundamental element in general education and of the proper function of such instruction are of comparatively recent origin, dating only from the latter half of the last century. Such instruction has formed a very important department of the work at the Institute from the beginning, the Institute having taken the initiative in the establishment of laboratory work along various lines.

In the first Annual Catalogue it was stated that "The Laboratory arrangements of the School are designed, when complete, to embrace the following departments: (1) Laboratory of Physics and Mechanics; (2) Laboratories for Chemical Analysis; (3) Laboratory for Metallurgy; and (4) Laboratory for Industrial Chemistry." "A high value is set upon the educational effect of laboratory practice, in the belief that such practice trains the senses to observe with accuracy, and the judgment to rely with confidence on the proof of actual experiment."

The system of laboratory instruction thus inaugurated has since been greatly extended, and now includes the following:

The Engineering Laboratories, including the Laboratory of Applied Mechanics, the Steam Laboratory, the Laboratory for Testing Highway Materials, and the Hydraulic Laboratory.

The John Cummings Laboratory of Mining Engineering and Metallurgy.

The Kidder Chemical Laboratories.

The Research Laboratory of Physical Chemistry.

The Research Laboratory of Applied Chemistry.

The Augustus Lowell Laboratories of Electrical Engineering.
The Research Laboratory of Electrical Engineering.
The Biological Laboratories.
The Sanitary Research Laboratory and Sewage Experiment Station.
The Rogers Laboratory of Physics, including Laboratories of General Physics and the special Laboratories of Heat Measurements, Physico-Chemical Measurements, and Electro-Chemistry.
The Geological and Mineralogical Laboratories.
The Hawaiian Volcano Observatory.
The Mechanical Laboratories.

The Laboratory of General Chemistry was opened in 1866, and is believed to have been the first laboratory for instruction in General Chemistry to classes of considerable size. The Physical Laboratory was established in 1869, and was the first laboratory of the kind in the world to offer class instruction. Previous to 1871 metallurgical work was done in the Chemical Laboratories; but in that year a distinct Mining and Metallurgical Laboratory was put in operation, the first in the world for the treatment of ore in large quantities for purposes of instruction. An Engineering Laboratory was established on a small scale in 1874, was much enlarged in 1882, and has steadily increased in efficiency since that time. The Mechanical Laboratories were a result of President Runkle's study of the Russian exhibit at the Centennial Exhibition of 1876 in Philadelphia. The Geological Laboratory was established in 1880; the Biological Laboratories in 1883; the Research Laboratory of Physical Chemistry and the Sanitary Research Laboratory and Sewage Experiment Station in 1903; the Research Laboratory of Applied Chemistry in 1908; the Hawaiian Volcano Observatory in 1912; and the Research Laboratory of Electrical Engineering in 1913.

The Institute laboratory work is effectively supplemented by visits to engineering and industrial establishments, and by excursions directed by members of the Faculty.

The Engineering Laboratories.—These laboratories are situated in the building on Trinity Place, and occupy a floor area of about 23,500 square feet. The very extensive equipment of these laboratories has been chosen with the following objects in view: first, to give the students practice in such

experimental work as engineers in the pursuit of their profession are called upon to perform; and, second, to provide ample facilities for the carrying on of original investigations in engineering subjects. The result has been the publication of a large amount of important engineering data. The various special laboratories, together with their equipment, are described below.

The Applied Mechanics Laboratory is furnished with the following apparatus: three testing-machines of one hundred thousand pounds capacity, one of fifty thousand pounds and one of twenty thousand pounds capacity for determining tensile strength, elasticity, and compressive strength; a testing-machine of one hundred thousand pounds capacity for determining the transverse strength and stiffness of beams up to twenty-five feet in length, of framing-joints used in practice, and of other structures subjected to a transverse load; a rope and chain testing-machine of one hundred and fifty thousand pounds capacity; apparatus of thirty thousand pounds capacity for making time-tests of full-sized timber beams; a kiln for drying lumber; apparatus for testing the strength of full-sized masonry arches; a machine for testing the torsional strength and stiffness of shafting up to three inches in diameter and to fifteen feet in length; a torsion machine of sixty thousand inch-pounds capacity; a small torsion machine of six thousand inch-pounds capacity, for very delicate work; machinery for the measurement of the twist of shafting; for testing the tensile strength of mortars and cements, and of ropes; for testing the effect of repeated stresses upon the elasticity and strength of iron and steel; for determining the strength and elasticity of wire; for determining the strength and elasticity of cloth; for testing the strength of pipe and pipe-fittings under hydraulic pressure; and also accessory apparatus for measuring stretch, deflection, and twist. Besides the above-stated apparatus, a horizontal Emery testing-machine of three hundred thousand pounds capacity forms a part of the equipment of this laboratory. It contains all the essential features of the eight hundred thousand pound testing-

machines built by Lieutenant Albert H. Emery at the Watertown arsenal, and is suitable for testing a compression specimen eighteen feet long, and a tension specimen twelve feet long. A hydraulic accumulator weighted to 1,700 pounds per square inch has been connected with the testing machine and is also available for general pressure work.

The Laboratory for the Testing of Highway Materials contains the following apparatus: one Page Impact Cementation Machine, one Page Impact Toughness Machine, one Improved Dorry Hardness Testing Machine with Sifter, one Page Hydraulic Briquette Molding Machine, one 25 mm. Core Drill with Drain Table, one Page Ball Mill, one Combined Diamond Saw and Lap Grinder.

Besides the above apparatus for making physical tests upon highway materials, the equipment of the Chemical Laboratory is available for chemical tests.

The Hydraulic Laboratory contains a closed steel tank five feet in diameter and over twenty-seven feet high, arranged for the insertion of orifices, mouth-pieces, and other special pieces of apparatus, with gates for controlling the discharge, and with connections for supplying water, in experiments upon pipes and motors. This tank is connected with a ten-inch stand-pipe over seventy feet high, so arranged that a constant head may be maintained at any desired level. Two steel tanks, each about two hundred and eighty cubic feet capacity, give opportunity for the accurate measurement of larger quantities of water than can be weighed directly during experiments. A system of pipes connected both with the main tank and with the pumps is arranged for the insertion of diaphragms, branches, and other apparatus for studying loss of head and the laws of discharge. An attachment has been fitted to the main tank, containing a Pitot tube for studying the laws of velocity in jets, and adjustable points for accurate measurement of the cross-section of jets.

The laboratory is further equipped with a forty-eight-inch Pelton wheel, of thirty horse-power; a three-foot American impulse wheel; a Venturi meter; an eight-inch, a twelve-inch, and two forty-eight-inch weirs, and an orifice tank for

measuring water; a centrifugal pump; two rotary pumps; a plunger pump; a pulsometer; an Emerson pump; a three-inch water meter and others of smaller size, and a variety of mercury gauges, standard orifices, mouth-pieces, diaphragms, branches, nozzles, etc., for experiments with flowing water under all conditions. A twelve-inch turbine is arranged to be run under various conditions of head and gate opening in tests for efficiency. There is also a hydraulic ram with a two-and-one-half-inch drive-pipe and a double-acting Rife hydraulic engine. The laboratory also contains a steel weir box, the weir having a standard crest adjustable as to length from zero to five feet, and a seconds pendulum, with chronograph for exact determination of time in experimental work. Water is directly supplied for experiment by the various pumps. The laboratory also contains apparatus by which the suitability of various materials for the construction of roads or pavements may be ascertained.

The Steam Laboratory contains a triple-expansion engine, with cylinders of nine inches, sixteen inches, and twenty-four inches diameter respectively, and thirty inches stroke, arranged in such a way as to be run single, compound, or triple, as desired for purposes of experiment. This engine is of the Corliss type, and has a capacity of about one hundred and fifty horse-power when running triple, with an initial pressure of one hundred and fifty pounds in the high-pressure cylinder. It is connected with a surface condenser and the other apparatus necessary to adapt it to the purposes of accurate experiment. A tandem compound, high-speed engine of about two hundred and twenty-five horse-power, having cylinders eleven and nineteen inches in diameter by fifteen inches stroke, is similarly provided with surface condenser, air pump, and other apparatus needed for testing. This engine transmits its power through a rope drive.

A Westinghouse Parsons Steam turbine of 500 K. W. capacity (2,300 volt 60 cycle A. C.) has been installed and is used for testing and experimental purposes.

This laboratory also contains a three-stage air compressor adapted to compress one hundred cubic feet of free air per

minute to twenty-five hundred pounds pressure per square inch, connected with storage tubes of about fifty-eight cubic feet capacity; a plant for making liquid air; a sixteen horse-power engine, and three small engines of eight, fifteen and thirty horse-power, used for giving instruction in valve setting, etc., also a thirty-six horse-power gas-engine, and a small gas-engine. It is equipped with several surface condensers, an eductor condenser, steam-pumps, injectors and ejectors, calorimeters, mercurial pressure and vacuum columns; apparatus for determining the quantity of steam or air issuing from a given orifice or through a short tube under a given difference of pressure; apparatus for testing steam-engine indicators; apparatus for testing injectors; and indicators, planimeters, gauges, thermometers, anemometers, and other accessory apparatus.

The Engineering Laboratories are provided with a number of friction brakes; with machinery for determining the tension required in a belt or rope to enable it to carry a given power at a given speed, with no more than a given amount of slip; with four transmission dynamometers; with a pendulum governor arranged for experimental purposes; with a complete set of Westinghouse air-brake apparatus, including the parts belonging to the car and to the locomotive, and with a complete brake outfit for an electric car; with the pump and engineer's valve of the New York air-brake; with a twelve-inch centrifugal machine and a thirty-six inch hydro-extractor; with a locomotive link model; with two hot-air engines; and with cotton machinery as follows: two cards, a drawing-frame, a speeder, a fly-frame, a ring spinning-frame, and a mule, as well as accessory apparatus.

There is also an independently fired superheater capable of superheating 10,000 lbs. of steam per hour, 250° F., at a pressure of 250 lbs. It is connected so that superheated steam may be supplied to the laboratory for various experiments on and with superheated steam. The superheater is so connected to the boiler that efficiency tests can be made upon it.

There are available for purposes of experiment in connec-

tion with the work of these laboratories four Babcock and Wilcox water tube boilers each of 250 H. P. capacity and one horizontal tubular boiler of 100 H. P. in a boiler house near the Engineering Building, with a wrought-iron stack, five feet in diameter and one hundred feet high; two large sectional boilers situated in the Rogers Building with a masonry stack three feet square and one hundred feet high; a 150-kilowatt direct current Curtis turbine and the engines and cooling tower in the power plant; also a 100 H. P. boiler, a forty horse-power engine, and other apparatus in the Mechanical Laboratories on Garrison Street.

The John Cummings Laboratories of Mining Engineering and Metallurgy.—These laboratories are designed to furnish students the means for experimental study of the various processes of ore-dressing, leaching and smelting, and at the same time to give them the mental training needful for professional practice. The apparatus has been chosen with a view to illustrating, as far as possible, the principles of the more important machines and furnaces actually used in mines, mills, and smelting works.

The crushing, concentration, leaching and smelting of ores of lead, copper, gold, and silver furnish the best field for this laboratory work. The production of iron and steel in quantity is precluded by the size of the plant required, and by the large amount of ores and fluxes needed; the microscopical study of the structural changes that occur under heat treatment takes its place.

The experimental work of the laboratory is carried on by students under the immediate charge of instructors. A sufficiently large quantity of ore is assigned to make the results quantitative. The work is divided into class and individual work. The former is typical for ore-dressing, smelting and electrolysis, the latter for leaching, amalgamating and assaying. In class work a lot of ore is treated in a series of connected ore-dressing machines or in one or more furnaces; each member of the class is given charge of every apparatus, or carries through the several manipulations connected with

a furnace, until he has become familiar with the duties and has made the required observations, measurements and records.

In individual work, each student is assigned an ore for treatment or for assay. The ores and methods are so chosen that the individual results when combined will form a consecutive series and thus bring out the correct method of working.

It is not considered that the instruction given in this laboratory is in any sense a substitute for the experience gained in large works. It is believed, however, that it prepares students to enter works and to be almost immediately useful in them. The spirit of investigation which is developed by the work, as well as the experience of comparing processes actually carried out with the same processes as described in books, is of great advantage.

The laboratories include five parts: concentration and plate amalgamation, lixiviation and pan amalgamation, roasting and smelting, assaying, and heat treatment and microscopical examination of metals and alloys.

In the Concentrating Laboratory the effects of different combinations and adjustments of machines upon the saving of losses in slimes and included grains, in order to produce the best scientific result or the greatest commercial profit, can be tested under the very best conditions. Among these combinations are graded crushing, graded sizing, graded jigging; hydraulic classifying as a preparation for jigging and the slime table; jigging with much or little suction; the variations of the slope, the quantity of water, and the roughness of the surfaces of slime tables; and the adjustments of the gravity stamps, the amalgamated plates, the belt vanners, Wilfley tables, and magnetic concentrators.

In the Lixiviating and Amalgamating Laboratory the effects of varying the sizes of grains, the strength of solution, and the time of treatment may be tried; suitable variations may be made in the cyanide process, the hyposulphite process, and, either by vat or by revolving barrel, in the chlorination process; in the amalgamating-pan the temperature, the

chemicals, and the time of exposure can all be studied for the production of the best results.

The Smelting Laboratory is provided with furnaces for roasting, smelting, converting and refining copper; for roasting, smelting, and desilverizing lead; and for chloridizing, roasting, preparatory to pan amalgamation or lixiviation; and for electro-deposition. The smelting of a ton or two of ore can not in the nature of things produce results which approach as nearly to the economy of practice on a large scale as is done in the other experimental lines, but the experience which the students gain throws more light upon the meaning of the lectures than any other work performed in these laboratories.

The Assaying Laboratory is provided with furnaces for crucible work, scorification, cupellation, and all the usual accompanying operations. Near-by are rooms for fine balances and for supplies. This laboratory not only provides for the regular course in Assaying which is taken by all the students in Mining Engineering and Electrochemistry, but it furnishes a means of testing and checking the work of the other three laboratories. A laboratory with chemical desks is provided for conducting small lixiviation tests and such wet work as is necessary in connection with the smelting and lixiviation of ores.

The Metallographical Laboratory is furnished with the necessary apparatus for heating, grinding, and polishing specimens of metals and alloys, for examining them microscopically, and for taking micrographs.

A museum of ores, products, and models of Mining Engineering and Metallurgy serves to illustrate the lectures.

The Kidder Laboratories of Chemistry afford accommodations for more than nine hundred students. The Chemical Department occupies twenty-five laboratories, four lecture-rooms, a reading-room and library, three balance-rooms, office, and supply-rooms,—in all forty-five rooms. The laboratory for Inorganic Chemistry has places for six hundred students, and is completely equipped for instruction in elementary Chemistry. The Analytical Laboratories can accom-

modate two hundred and seventy students, and possess every convenience for accurate and rapid analytical work. The Organic Laboratory is provided with appliances for vacuum, steam, and fractional distillation, with suction pumps for filtration, with electrolysis circuits, filter-presses, etc. Special laboratories are arranged for organic combustions, and on the roof is an enclosed room, in which chemical operations of a dangerous or noxious character can be performed. The Laboratory of Water and Air Analysis possesses an unusually complete outfit for the analysis of air and water, and for the investigations of sanitary problems and the Laboratory of Food Analysis is provided with all necessary modern appliances for the scientific examination of foods with respect to purity and nutritive value. The Laboratories of Industrial Chemistry accommodate forty-eight students. They comprise a series of rooms in the Pierce Building fitted with the needful apparatus for the preparation of chemicals on a considerable scale. The main laboratory contains kettles of various patterns, stills, presses, tanks, centrifugal dryers, crystal dryers, a filter-press, and a variety of other forms of apparatus. Two laboratories for undergraduate and graduate students respectively, adjoining the Research Laboratory of Physical Chemistry, are devoted to work in Theoretical Chemistry. These are equipped with electric circuits, thermostats, and standard physico-chemical instruments, as well as with all the facilities for ordinary chemical work. The Laboratory for Proximate Technical Analysis accommodates thirty-six students and is equipped, for the examination of gases, with numerous sets of gas-absorption and explosion apparatus, with sampling apparatus, flue thermometers, a photometer, and a gas calorimeter. For the analysis of oils, the laboratory is provided with viscosimeters, testing machines, different sorts of flashpoint apparatus, and other instruments employed in this special line of work, in addition to which are to be found the needful apparatus for the analytical examination of rubber, paper, tanning materials, and other substances of commercial importance. A special laboratory is equipped for the study of methods of optical

analysis of sugars, starches, and allied products. The main lecture hall has a seating capacity of three hundred, and is arranged with special reference to the delivery of lectures illustrated by experiment. In addition there are three lecture-rooms, seating respectively forty-eight, eighty, and one hundred and twenty-five students. The lecture-rooms contain valuable cabinets of specimens for purposes of illustration. The balance-rooms are supplied with thirty-five analytical balances.

The Research Laboratory of Physical Chemistry.—The Research Laboratory occupies two floors of the building Engineering C. It consists of ten small laboratories, most of which afford ample accommodation for two workers. A shop, well equipped with machine tools, including an engine lathe and a bench lathe, and containing a large variety of stock, forms part of the laboratory. In this shop a skilled instrument-maker is regularly employed in constructing apparatus for investigation. Adjoining the laboratories are rooms for special purposes,—weighing, photographic work, optical measurements, pure-water distillation, the storage of chemicals and apparatus, and the holding of lectures and seminar meetings. Each laboratory is connected with a 220-volt direct current circuit, and with systems for supplying ordinary and distilled water, gas, steam, and compressed air; and each is provided with a large thermostat. The equipment includes also a 120-volt storage battery. The laboratory has places for twenty research workers.

The Research Laboratory of Applied Chemistry.—The work of this laboratory is carried on in several rooms on the fifth floor of the Pierce Building, adjoining the Laboratory of Industrial Chemistry. The laboratory is fully provided with the necessary equipment for research purposes, including a well-appointed machine shop. Its close proximity to the Laboratory of Industrial Chemistry renders available the large scale apparatus with which the latter is furnished. The laboratory will accommodate ten research workers.

The Augustus Lowell Laboratories of Electrical Engineering.—These laboratories embrace the Standardizing Laboratory, the High Voltage Laboratory, the Laboratory of Dynamo-electric Machinery, the Transmission Laboratory, and various rooms devoted to photometric measurements and to special research.

The Standardizing Laboratory furnishes facilities for making tests and for giving instruction in electrical measurements. It is provided with circuits furnishing alternating current at 25 and 60 cycles, single-phase, three-phase, and quarter-phase, and also direct current. The equipment is of such a nature that any proposed scheme of measurement may be subjected to careful investigation. To this end the apparatus for standardization is very complete. For direct currents a storage battery giving 1,500 amperes is provided, together with a special set of high-voltage dynamos, giving potentials to 3,000 volts. To complete this set of apparatus, there are the necessary controlling devices, together with standard ammeters, voltmeters, and a potentiometer reading to 1,500 volts. By means of special transformers, alternating currents up to 4,000 amperes and potentials to 50,000 volts can be obtained. The necessary auxiliary apparatus for controlling and measuring these currents and potentials is provided. For the standardization of devices for power-measurement there is a set of two small machines so arranged that the instruments can be tested under various conditions of power-factor and frequency. Several oscillographs of different designs are provided for the examination of wave-forms. These are so arranged as to be readily portable, and are available for any tests carried on in the Department. Included in the equipment of this laboratory is a complete set of portable potential and current transformers together with the instruments which make it possible to perform measurements in circuits of any voltage up to 13,000 volts and of current capacity up to 3,000 amperes. This equipment much facilitates the study of various problems of electrical engineering as they occur in practice. The laboratory is provided with sets of standard

resistance coils, certified by the United States Bureau of Standards, all necessary apparatus for measuring both high and low resistance and for calibrating resistance boxes, and also with standards of capacity and inductance with the necessary auxiliary apparatus.

The High Voltage Laboratory is designed for the study of insulators and insulating materials as well as general high-voltage phenomena. Apparatus are provided for the determination of the insulation resistances of both large samples of insulated wire and small specimens of insulating materials under different conditions of temperature and voltage. For determining dielectric strengths there are two fifteen-kilowatt transformers, each capable of giving voltages up to 100,000 volts. These are provided with all necessary protective and controlling devices. The apparatus required for measuring high voltages and other electrical quantities are provided. Current for this laboratory is furnished by a dynamo which affords a wave form closely approximating to an exact sinusoid.

The Laboratory of Dynamo-electric Machinery has equipment which includes two similar 25-kilowatt generators belted to a 100-horse-power compound engine, this set being specially fitted with electrical instruments, engine-indicating apparatus, and surface-condenser for instruction in various methods of plant-testing; a motor-generator set, consisting of a 150-horse-power 230-volt, direct current motor, driving a 100-kilowatt, 230-volt, 60-cycle, three-phase generator and a 50-kilowatt, 230-volt, 25-cycle, three-phase generator; a motor-driven pair of series-boosters suitable for raising the potential of an 800 ampere, three-wire feeder 10 per cent.; a 100-kilowatt set of 60-cycle phasing transformers for change from three-phase to two-phase, or the reverse; a 150-horse-power, direct current motor; two 30-horse-power, and two 15-horse-power, 230-volt, direct current motors; and four 15-kilowatt, and two 7½-kilowatt, 60-cycle, three-phase machines, which can be operated at any frequency between 25 and 60 cycles per second, and can be used as generators or synchronous motors. A number of induction motors from 30-horse-power down; a two-kilowatt,

alternating current generator, capable of giving any frequency up to 10,000 cycles per second; a 12-kilowatt generator; a 13½-kilowatt, inclined-coil generator; a 20-kilowatt compound generator; an inter-pole variable speed motor; transformers of various patterns and designs; a 37-kilowatt inductor alternator; a single 55-kilowatt, three-phase transformer, with a 145-volt secondary; three 20-kilowatt, 60-cycle, and four 15-kilowatt, 60-cycle, transformers of standard voltages for general use about the laboratory; a pair of 60-cycle testing transformers, stepping up from 230 volts to 100,000 volts; and a 10-ton, electrically-driven, overhead crane, which traverses the entire length of the laboratory. There are also large numbers of direct current dynamos and motors, alternating current dynamos, transformers, rotary converters, motor-generator sets, and reactors of capacities less than 15 kilovolt-amperes each, together with inductances and condensers. The ventilating fans of the building and the fan for the cooling tower are driven by one 15-horse-power and two 10-horse-power motors, especially arranged for such work, and are available for instruction in connection with electrically-driven, variable-speed fans. The Institute power plant is also available for purposes of instruction.

Of the four dark rooms provided, one is equipped with a special photometer, designed by the department, for use in testing arc lights; one is used for special testing; and one as a photographic room, with ample accommodations for developing, printing, and washing. In connection with the photometric work there are various photometers of standard manufacture and a collection of primary and secondary light standards.

The laboratory possesses a representative collection of arc lamps, suitable for use on alternating and direct current circuits, both constant potential and constant current.

The Transmission Laboratory comprises a small building fitted up for high voltage testing and along side of it is a span 500 feet long which is a full size example of long-distance, high voltage power transmission lines. This is now being used for a variety of special investigations. An artificial line capable

of affording the phenomena of a power transmission line over 700 miles long is also provided.

The shop for the Department mechanician is well supplied with machine-tools, among which are two screw-cutting engine lathes, a milling machine, an emery grinder, two speed-lathes, a precision lathe with milling attachment, and an upright drill.

The highest importance is attached to work in the nature of scientific research, and special rooms, together with ample facilities in the nature of apparatus, are available.

Research Laboratory of Electrical Engineering.—The laboratory research work is being carried on in an organized way in association with the work of instruction of the Department and is conducted partly in several rooms associated with the Electrical Engineering Laboratories in the Lowell Building, partly in the Transmission Laboratory at the new Technology site in Cambridge, and partly in Pierce Hall at Harvard University. These research laboratories are equipped with a small mechanical workshop, a set of artificial conducting-lines for power transmission, telephony and telegraphy, and also with such special apparatus as may have been purchased, temporarily obtained from other laboratories, or constructed from time to time. The equipment is such that a number of electrotechnical researches are being conducted in these laboratories under the direction of the Research Committee of the Electrical Engineering Department.

The Laboratories of Biology and Public Health.—These laboratories which were opened in 1883 in the Rogers Building, are now located in the Henry L. Pierce Building. They comprise four well-equipped laboratories for undergraduates, with smaller rooms for special lines of work, and a laboratory devoted to more advanced or special investigation. In connection with these there is a well-appointed library and reading-room, centrally placed, and containing more than four thousand volumes and monographs.

A large Laboratory of Microscopy and General Biology supplies the needs of classes in these subjects, as well as of those in Elementary Zoölogy and Botany. It is furnished with microscopes, microscope lamps, suitable work-tables, and other appliances. The proximity of Boston to the sea offers exceptional facilities for work along these lines, as well as for the more advanced study of Zoölogy and Botany.

A second laboratory, somewhat smaller, furnishes opportunities for the practical work of the classes in Comparative Anatomy, Embryology, Parasitology, and Histology. It is equipped with freezing and other microtomes, paraffin baths, microscopes, and reagents for work on the gross and microscopic anatomy of plants and animals. Students of Biology have also valuable privileges in connection with the Boston Society of Natural History, of which the museum and library are freely accessible.

For experimental work in Physiology there is a special laboratory equipped with continuous roll and drum kymographs, induction coils, and other electrical apparatus, moist chambers, tambours, plethysmographs, etc., for physiological measurements.

The Laboratory of Bacteriology, Industrial Microbiology and Sanitary Biology is supplied with microscopes, incubating chambers, thermostats, and other special appliances necessary for the detailed and practical study of micro-organisms. In connection with it there is a special dark room and one for chemical work and the preparation of nutrient media.

Finally, there is a Research Laboratory for the use of graduate students and special investigators. This is fitted with incubators, autoclaves, and other apparatus for the study of problems connected especially with the sanitary and industrial applications of Biology, while near-by is the Sanitary Research Laboratory for investigations on water, sewage, disinfectants, etc.

This whole series of laboratories is organized for work directed chiefly towards the sanitary, hygienic, and industrial sides of Biology, and offers special opportunities for those desiring to fit themselves for teaching or for medical study

or for practical work in various branches of applied Biology or Public Health Science.

The Sanitary Research Laboratory and Sewage Experiment Station.—This laboratory was established in 1902, and has since been maintained by the generosity of an anonymous Donor. The work of the Station is at present chiefly at Brockton, but a Chemico-Bacteriological Laboratory is maintained for the special purposes of the Station in Room 24, Pierce Building. Here are conducted investigations bearing on water supply, sewage treatment and disposal, garbage disposal, sterilization by hypochlorites, chlorine, ultra-violet rays, etc., ventilation, food problems, and other subjects of sanitary interest. The work of this Laboratory is often associated with that of various commissions, research departments of manufacturing establishments, and with the public service.

The Sanitary Research Laboratory is available for graduate students or other properly qualified investigators in their research work upon problems in Sanitary Biology and Public Health, Micro-Biology, and Sanitary Engineering.

The Rogers Laboratory of Physics.—This laboratory is located in the Walker Building, and occupies sixteen rooms. Of these, two are lecture-rooms: the general physical lecture-room, seating three hundred students; and a smaller one seating two hundred and thirty. Both are fitted with appliances for physical experimentation and for the use of the lantern. The Rogers Laboratory has an exceedingly extensive equipment of apparatus for both demonstration and physical measurements, and large additions are made to it every year.

The several laboratories are as follows:—

The Laboratory of General Physics, which is devoted to instruction in general physical measurements, including mechanics of solids, liquids and gases, light and heat. The equipment consists entirely of instruments of a high grade and corresponding precision is required in the work of the student. Among the more novel pieces of apparatus in gen-

eral use may be mentioned a Zeiss comparator, spherometer, and thickness micrometer, a fine Zeiss spectrometer, and a comparator from the Société Genevoise.

For advanced work, provision is made in the following special laboratories:—

The Electrical Laboratory is provided with circuits for both direct and alternating currents. It contains an extensive collection of electrical measuring apparatus for the determination of current, potential, resistance, capacity, inductance, wave form, and the magnetic properties of iron.

The equipment includes a large number of sensitive galvanometers, Wheatstone bridge boxes of precision, rheostats, standard condensers, ammeters, and voltmeters of various ranges for use with direct current, and much accessory apparatus. It also contains several sets of alternating and direct current meters; a Carey Foster Bridge; a standard potentiometer, with Weston cells and standard resistances for use in calibrating the various meters; a set of storage cells capable of delivering 300 amperes at four volts, with switches for series-parallel connections; a compound oscillograph for the investigation of wave forms of current and potential; apparatus for the measurement of small capacities and small inductances; a portable electric wavemeter, with apparatus for its calibration; a small rotary converter; and a one kilowatt high tension transformer for high frequency work.

The Physico-chemical Laboratory is fully equipped to give instruction in physico-chemical methods and for research work in Chemical Physics. Among the special pieces of apparatus may be mentioned a Berthelot platinum calorimeter, a large Landolt-Lippich polarimeter, an Abbé dilatometer and heater, with complete quartz accessories, a Zeiss refractometer and comparison spectroscope, and Nernst's and Drude's apparatus for dielectric constants. A large electrically heated thermostat, the temperature of which can be maintained constant to within a few thousandths of a degree, is provided for work in chemical statistics and chemical dynamics.

The Electrochemical Laboratory provides for instruction both in Electrochemical Measurements and in Applied Electrochemistry. The laboratory for the former work has been equipped with every convenience and facility for carrying on electro-chemical experiments. Each student is given a large desk provided with four circuits of 2, 12½, 25 and 110 volts from each of which currents up to 10 amperes can be taken at all times. An adjustable rheostat of corresponding capacity is also provided and wired directly to terminals on the switchboard at the front of each desk. Water, gas, and suction are provided at one end of each desk, and a large electrically heated and regulated thermostat at the other. In addition to the usual apparatus required for chemical work, each student is given a very complete equipment of electrochemical apparatus. This includes a three-scale Weston portable voltmeter reading to 3, 15, and 150 volts, a Weston milli-voltmeter with adjustable shunt for reading amperes, a potential box, a Hartman and Braun resistance box, a Lippman electrometer, complete conductivity apparatus, transference apparatus, copper, silver, and gas voltmeters, normal and half electrodes, etc. At present sixteen desks have been thus equipped. The laboratory is also provided with a balance room, a special still for conductivity water, hoods, a drying closet, and special constant temperature closets, provided with circuits of variable voltage, for electro-chemical analysis.

The work in Applied Electrochemistry is intended to illustrate, on a fairly large scale, the more important industrial processes involving the mutual transformations of electrical and chemical energy. For this work a special laboratory adjoining the preceding has been equipped with a 25-kilowatt, double current motor generator, which may be connected to give 1,000 amperes at 25 volts or 2,000 amperes at 12½ volts. This generator supplies the students' desks with 12½ and 25 volts, and also the electric furnaces for electrolytic reductions on a large scale. The laboratory is also provided with direct current mains capable of furnishing 100 amperes at 110 volts, and 300 amperes at 320 volts. For

electric furnace work requiring heat alone the laboratory is also provided with alternating current from a 150-kilowatt generator in the power house. The energy is transmitted at 2,300 volts and transformed by especially designed transformers where needed; a special 50-kilowatt transformer designed in the department, provides for voltages from 160 volts to ten volts in steps of ten volts each. The secondary is wound in sections to permit a number of furnaces being run simultaneously, at voltages equal to any multiple of ten volts. A second similar 75-kilowatt transformer of variable voltage from 10 to 220 volts has also been installed.

Furnaces of a number of different types are provided, including those of Moissan, Borchers, Hoskins, Heroult, Arsem and others especially constructed at the Institute for electrometallurgical work. A complete induction furnace for the treatment of alloys and steel has also been recently installed. A storage battery of large capacity is available for processes requiring large currents at low constant voltage. Pyrometers of all types for measuring very high temperatures and direct current and alternating current ammeters, voltmeters, and wattmeters complete the equipment for technical work.

The Laboratory of Heat Measurements is devoted to the study of accurate thermometry, the measurement of high temperatures, the determination of the efficiency of fuels, and the study of intense sources of heat, such as the electric furnace. It is equipped with a large number of pyrometers, including electrical and optical instruments. Some of these instruments are fitted particularly for technical work while others are available for the precise measurement of temperatures. Among these instruments might be mentioned those of Siemens and Halske, Hartmann and Braun, Callendar, Whipple, Féry and Wanner. A very considerable number of standard mercury thermometers are available for the comparison of other laboratory instruments. Two specially designed transformers of 50-kilowatt capacity each are provided for work in connection with electric furnaces. These furnaces together with the standardized pyrometers make possible determinations of the melting point of refractory materials with great precision.

An extensive equipment is provided for the study of the thermal conductivity of substances used as heat insulators, especially in building construction. An air compressor, of sufficient capacity to supply the air liquefier, has recently been added to the laboratory equipment, and the liquefier has been rebuilt for use with this compressor. An Audiffren refrigerating machine has been recently added and permits of the study of the methods by which measurements may best be made of the heat interchanges in apparatus of this kind. A two-ton ammonia refrigerating machine is also available for cooling by direct expansion an insulated room in which temperatures as low as $-40°$ C. can be maintained.

The Laboratory of Acoustics is especially designed for experimentation and research on sound and its applications. It contains an excellent collection of standard forks and other acoustic apparatus.

The Optical Laboratory provides facilities for students to familiarize themselves with the more important optical methods and instruments now in use. The equipment includes an Abbé focometer, a Zeiss microscope with very complete accessories for the study of the optical theory of the microscope, a Pulfrich refractometer; and, for spectroscopic researches, a number of spectrometers, together with concave and plane Rowland gratings, an echelon spectroscope, and two Michelson interferometers. Facilities are also offered for advanced work in spectro-photometry, and for work in photography, for which special dark rooms are provided.

A photomicrographic camera and carefully selected apochromatic lenses supply the apparatus for photomicrographic work of high grade; and the equipment is supplemented by a Zeiss ultra-violet microscope operated by a high-power induction coil.

Provision is made for research in all the special laboratories. Connected with the Rogers Laboratory is a workshop equipped with two engine lathes, three speed lathes, a milling machine, an upright drill and other accessories for the construction of apparatus.

The Mineralogical and Geological Laboratories.—The laboratories for study and research in Mineralogy and Geology occupy a number of rooms on the first and second floors of the buildings on Trinity Place.

The Sections of Mineralogy and Petrography are equipped with extensive collections of minerals, rocks, and thin sections arranged for class and advanced work. For determinative mineralogy a large laboratory for blowpipe work is provided as well as a smaller laboratory for chemical analysis. All necessary apparatus for research work in Mineralogy and Crystallography is also provided.

For petrographic study of thin sections twelve microscopes of modern type are available as well as an instrument of particular precision for delicate optical measurements. Slicing and grinding machines, etc., complete the arrangement.

The Laboratory of Structural Geology contains collections of rocks, models and lantern slides fully illustrating geological phenomena. One electric light lantern and one reflectoscope are used for purposes of illustrating the lectures.

The Laboratory of Stratigraphic Geology and Paleontology contains in particular two extensive series of fossils, the one to illustrate their stratigraphic succession (Index Fossil set), the other their biologic relations. Besides these there is a reserve collection affording facilities for more extended work; and also a collection of modern shells for use in comparison with the fossil shells.

The Laboratory of Economic Geology contains exceptionally good collections of ores, non-metallic minerals, and of building stones. There are also collections of thin sections and polished sections of ores. All of these sets are arranged for study and available for the advanced student, while special parts of the collections are used for undergraduate work. A large room is provided with cases and desks for the use of advanced students; modern polarizing microscopes are used for study of thin sections. Two microscopes for reflected light are available for study of ores, and a large metallographic microscope with camera is used for advanced work in the same line. The laboratory is fully equipped with grinding and polishing machines.

Hawaiian Volcano Observatory.—The main building is near the hotel, known as "Volcano House," on the edge of the cliff that bounds the greater crater of Kilauea in Hawaii. The building is equipped with two laboratories, director's room, photographic dark room, and store-room on the main floor, with porch extending along two sides commanding views of the three volcanoes, Kilauea, Mauna Loa, and Mauna Kea. In front there is a concrete post for geodetic experiments.

The seismograph cellar, 18 feet square, is of concrete on the solid ledge of basalt. It is equipped with four instruments. These are horizontal pendulum tromometers, including one component of a heavy Omori type, made in Tokyo, one Omori three-component strong-motion seismograph, and two components of a 100 kg. Bosch-Omori tromometer with damping vanes, made in Strasburg. Besides these, there is a light Omori instrument with devices for recording local tremor in the vicinity of the active lavas. Other instruments are pyrometers, photographic and surveying apparatus, microphones, gas-meter, and several special thermometers.

The Observatory is supported by the Whitney fund and by the Hawaiian Volcano Research Association. A small station at the active lava pit of Kilauea was built by the Institute in 1911. This is now an instrument house, for routine measurements and experiments. The U. S. Weather Bureau has furnished the Observatory with a set of standard meteorological instruments, and the Territorial Government in coöperation with the U. S. Geological Survey, has prepared a detailed topographic map.

The plan of work of the Observatory involves two distinct aims. First, continuous registration and record of lava movements and effects, peculiar to the district and well known to be of fundamental geologic import. Second, experimentation on physical or chemical phenomena in their relation to these geologic pecularities. As an experiment station, the Observatory will welcome accomplished specialists, and some fellowship aid can occasionally be granted to such work. Not more

than one or two such investigators can be accommodated at one time, and it is desirable, owing to the expense of the journey and the field conditions, that such persons should remain for from six to eight months, in order to insure results of value.

Mechanical Laboratories.—Instruction in the Mechanic Arts was begun in the school year 1876–77, when laboratories for instruction in Chipping and Filing and in Forging were established. In the following year laboratories for teaching Carpentry, Wood-turning, Machine-tool Work and Foundry Work were added. These laboratories were the first established in this country to give instruction by the Russian method, which has the systematic instruction of the student as its aim rather than construction.

The Mechanical Laboratories, located on Garrison Street, offer practical instruction in the nature of the materials of construction and in the typical operations involved in the arts, and to this end are equipped with the more important hand and machine tools, so that the student may acquire a direct knowledge of the nature of metals and woods, some manual skill in the use of tools, and a thorough knowledge of what can be accomplished with them.

The Carpentry, Wood-turning, and Pattern-making Laboratories contain forty carpenter's benches, two circular-saw benches, a swing-saw, a band-saw, two jig-saws, a buzz-planer, thirty-five wood-lathes, a large pattern-maker's lathe, and thirty-five pattern-maker's benches. The Founding Laboratory contains a cupola furnace for melting iron, two brass furnaces, a core oven, four moulding machines, and thirty-two moulder's benches. The Forging Laboratory contains a power-hammer, thirty-three forges, seven blacksmith's vises, one blacksmith's hand-drill, and a power-shear. The Machine-tool Laboratory contains thirty-one engine-lathes and fifteen hand-lathes of approved patterns, a twenty-four-inch turret-lathe, three machine-drills, two centering-machines, four planers, a shaping-machine, two universal milling-machines furnished with spiral and gear-cutting attachments, a plain milling machine, two universal

grinding-machines, a cutter and reamer grinder, a twist-drill grinder, two tool grinders, a twenty-four-inch standard measuring machine, special apparatus for hardening and tempering equipped with pyrometers, a scleroscope for determination of hardness, and a fully equipped tool-room. The Filing Laboratory contains thirty-two vise benches arranged for instruction in vise work, a tool grinder, an air compressor, a set of pneumatic chipping, drilling and riveting tools and an equipment for autogenous welding.

Equipment for Civil Engineering.—The equipment of instruments and apparatus for instruction in Civil Engineering may be classified as follows: a full outfit of instruments used in surveying and in the drawing-room; a collection of hydraulic apparatus for work in the field, comprising single and double floats of various patterns, loaded tubes, and five current meters of different kinds; apparatus for comparing the wearing properties and other physical characteristics of the various road- and pavement-materials; and continuous-record instruments for measuring the strain in bridges and other structures of metal. The very complete hydraulic apparatus for the measurement of the flow of water through orifices and mouthpieces, over weirs, through pipes, etc., is described elsewhere, in connection with the Engineering Laboratories.

The Department has also a collection of models illustrating bridge-details, problems in stone-cutting, etc., and a set of full-sized models of various types of road- and pavement-construction, for use in connection with the work of instruction. It has also a large collection of blue-prints, drawings, and photographs, and a considerable number of lantern-slides.

For geodetic and astronomical instruction the Department possesses the following apparatus: a transit instrument of $2\frac{1}{2}$-inch aperture, 27-inch focus, with micrometer eye-piece for latitude observations; a sidereal chronometer, a chronograph, magnetometer, a dip circle, an altazimuth instrument, and various other smaller appliances, such as level triers, mercury horizons, etc.

By the kindness of many active members of the profession, the classes are frequently enabled to inspect engineering works of interest, and to carry on field operations in favorable localities.

The Lowell Observatory.—Dr. Percival Lowell, the Director of this Observatory, is non-resident Professor of Astronomy in the Massachusetts Institute of Technology, and although there is no official connection between the two institutions, the Director is glad to extend to members of the Institute every facility for inspecting the work of the Observatory.

The Lowell Observatory is situated at Flagstaff, Arizona, 7,250 feet above the sea. It is furnished with a twenty-four-inch refractor built by Alvan Clark & Sons, a six-inch refractor made by the same firm and a large spectroscope by Brashear which is more powerful in the red end of the spectrum than any other in existence. Owing to the quality of the air at Flagstaff the conditions for astronomical observations are exceptionally favorable.

Equipment for Naval Architecture and Marine Engineering.—The Department of Naval Architecture and Marine Engineering possesses a valuable and constantly growing equipment. The departmental library contains a large collection of standard and recent works on Naval Architecture and Marine Engineering, including technical periodicals and the students have also the advantage of the large libraries of Engineering, Physics, Chemistry, etc., belonging to the Institute.

There is in the drawing office of the Department a collection of complete sets of drawings of ships and their machinery, both merchant ships and war-ships, systematically arranged and catalogued, which, together with the proper data concerning construction, power, and speed, makes it possible to proceed with the design and arrangements of ships as is done in good practice, with the difference that attention is always given to the most efficient methods of instruction.

There is a supply of planimeters, integrators, integraphs, and calculating machines with which the students become familiar by constant use. A Ritchie compass in a standard navy binnacle and a pelorus, mounted on a revolving platform, give opportunity for practice in compass adjustments. The Department has a well-equipped shop with special machinery, in which instruction is given, at suitable times, in making ships' models, use being made of lines constructed by the student in his courses on Ship Design, to the end that he may learn to appreciate and correctly judge forms as represented by ships' lines. The drawing room is supplied with four glass topped tables for fairing ships' lines which are enlarged and laid down on the floor according to a recent and approved method of mold-loft work. The Department is also in possession of a Denny-Johnson torsion-meter for testing turbine steamers.

Aerodynamic Laboratory.—Opportunity for research in aerodynamics and for thesis work in applied aerodynamics is afforded by a wind tunnel housed in a temporary building on the new site in Cambridge. A four foot blast of air uniform in velocity and direction is directed against models of aeroplanes, wings, and bodies mounted on the vertical arm of a delicate balance in such a manner that the forces and couples about the three axes through the model may be determined for use in design.

Libraries.

The libraries of the Institute contain above one hundred thousand volumes and more than thirty thousand pamphlets, while over a thousand periodicals are received regularly. The General Library of the Institute occupies a spacious and well-lighted room on the first floor of the Rogers Building. In it are to be found more than twelve thousand volumes consisting of works in English literature, biography, history, and kindred subjects, works on education and military science, proceedings of learned societies that are of general character, and a complete set of the publications of the Institute and its officers—besides encyclopædias, dictionaries, catalogues of other libraries, and other books of reference. All students have access in this library to a hundred current periodicals, many of which are of a general or popular character, including a number of illustrated weekly papers in foreign languages. The Librarian of the Institute has his office adjoining. Near the office of the Librarian is the General Catalogue in which the location of any book belonging to the Institute may easily be ascertained. Each Departmental Library has also its special catalogue.

A collection of about four hundred volumes, chiefly on athletics, sports, and personal hygiene, given by the late Frank H. Cilley of the Class of 1889, to be placed in the Walker Memorial when that building is completed, is at present in the Technology Union. There is also a small library of about six hundred volumes in the Margaret Cheney Reading Room for the use of women students of the Institute.

Students have full use of the extensive collections of the Boston Public Library, comprising about nine hundred thousand volumes in all departments of knowledge; and also have the privilege of consulting some libraries of scientific

societies, of individuals, and of private corporations containing complete sets of scientific periodicals, which supplement the rich collections of serial publications in the Libraries of the Institute.

The greater part of the books belonging to the Institute is distributed to twelve departmental libraries, where they are easily accessible to all students. These libraries contain a careful selection of special treatises, monographs, textbooks, etc., and of periodical publications germane to the work of the respective Departments. They are thus working libraries, and valuable experience in the use of them is acquired before the completion of the regular courses, either incidentally to the preparation of theses, or in connection with lectures or recitations. This division of the library enables each student with the least possible inconvenience to consult the works needed. The departmental libraries are described in detail below.

The Library of Mathematics.—This library, called the Runkle Mathematical Library in honor of the late Professor John D. Runkle, who some time previous to his death presented the Institute with his private library of mathematical works, contains a carefully selected collection of about two thousand books in all branches of Mathematics; and new publications of value are added as soon as issued. The more important journals devoted to the subject of Mathematics are received regularly.

An extensive collection of models, which are of special interest and value in connection with the courses on Analytic Geometry of Three Dimensions, the Theory of Surfaces, and the Theory of Functions, is arranged in cases in this library.

The mathematical library is open to advanced students, who may obtain permission to use it from the Professor in charge.

The Library of History and Economics.—This library comprises sixteen thousand selected volumes and several thousand pamphlets, including the economic library of the

late President Francis A. Walker. Every student enjoys unrestricted access to the shelves, and the reading-room contains reference books, a large number of such magazines and newspapers as are useful in historical and political study, reading-tables, and work-tables for the preparation of maps, charts, diagrams, and especially for statistical work. There is a good collection of maps and diagrams, particularly serviceable for the illustration of industrial and political history. A good working library in Statistics has been gathered, and the library of the American Statistical Association, deposited with the Boston Public Library and easily accessible, affords special advantages.

The Library of Modern Languages.—Conveniently situated near the rooms where instruction in the Modern Languages is given, is a collection of about two thousand volumes of works in modern European Literature and Philology, chiefly French and German, together with dictionaries, works on Grammar, etc. Twenty French and German periodicals are taken. The more popular of these are kept in the General Library.

The Engineering Library.—The libraries of the Departments of Civil and Sanitary Engineering and of Mechanical Engineering are united into a single library. This library contains about twenty thousand volumes and six thousand pamphlets. It is especially rich in journals and transactions of societies dealing with the various branches of Engineering. Two hundred and forty publications of this kind are received annually.

The Library of Mining and Metallurgy.—The library of the Department of Mining Engineering and Metallurgy contains over six thousand volumes, and receives annually eighty periodicals.

The Architectural Library.—The Architectural Library contains five thousand volumes of technical works, and the

leading American and foreign periodicals. The Royal Institute of British Architects presents its publications to the library, and many richly illustrated and costly books have been added as gifts from friends of the Institute.

By means of a special fund raised for the purpose, several thousand photographs, prints, drawings, and casts were originally collected for the Department. To these collections large additions have been made by regular appropriations and by gifts; so that now there is deposited in the library a carefully selected collection of eighteen thousand photographs and sixteen thousand lantern slides. Models and illustrations of architectural detail and materials are arranged in the rooms of the Department. The students of the Department have free access to the Museum of Fine Arts at all times.

The Chemical Library.—The William Ripley Nichols Chemical Library is named in honor of Professor Nichols, whose private library, bequeathed to the Institute, forms the nucleus about which have been gathered some thirteen thousand volumes and three thousand pamphlets. This library, which is open to all students, contains complete sets of most of the important chemical periodicals and a noteworthy collection of works upon Sanitary Science. The number of periodicals currently received is one hundred and twenty.

The Physical Library.—The library of the Department of Physics contains ten thousand volumes, and is very complete in recent works upon Physics, Electricity, and Electrochemistry. Seventy of the principal physical periodicals are received regularly, and all new publications of importance are procured.

The Library of Electrical Engineering.—This library comprises the Institute Collection of about two thousand volumes, including important sets of periodicals dealing with electrical and engineering subjects, and the very important Vail library of electrical engineering containing some twenty thousand books, bound periodicals, and pamphlets. For

this Department the Institute takes regularly eighty-five current periodicals.

The Geological Library.—The Rogers Geological Library, which had for its foundation the private collections made by the first president of the Institute and by his brother, Professor Henry D. Rogers, contains five thousand volumes, the current periodicals, and the geological and geographical maps used in giving instruction, including a complete set of the publications of the United States Geological Survey. In the same room is a valuable collection of fossils stratigraphically arranged in two hundred and seventy-five drawers. An additional collection is selected and arranged with special reference to teaching Structural Palæontology.

The Library of Biology and Public Health.—The Department of Biology and Public Health is provided with a well-appointed library and reading-room, centrally placed, and containing more than four thousand volumes and pamphlets. For this Department there are received regularly about seventy periodicals, including the biological publications of other colleges, and the library is especially rich in the latest works upon Bacteriology and Sanitary Science.

The Library of Naval Architecture and Marine Engineering.—Conveniently situated next to the drawing-room of this Department is a collection of books that formerly was a part of the Engineering Library. It contains about eighteen hundred volumes and pamphlets on Naval Architecture, Ship-building, Marine Engineering, and Aeronautics; and twenty-seven periodicals and annuals are sent regularly to this Department.

There is also an extensive collection of plans and drawings carefully classified and arranged for easy reference by students.

Scholarships and Fellowships.

Undergraduate Scholarships.—It is the policy of the Faculty to apply the available funds to the assistance of as many well qualified students as possible by assigning, in general, amounts less than the full tuition. Preference is given in making awards to students pursuing regular courses who have completed at least a year of thoroughly satisfactory work at the Institute. In the case of an applicant not already in the Institute, it is important that full information should be presented from former teachers as to capacity. The facts considered in making assignments are the needs of the student and his promise, as indicated by his previous work. *Scholarships are awarded only to those students who produce satisfactory evidence that they are greatly in need and to those students whose records are entirely clear.* Awards will be made in August, and three-fifths of the amount awarded will be credited on the term bill due in October, and the remaining two-fifths on the term bill due in February. Applications for scholarships should be made not later than June 1, on blanks supplied by the Registrar. Application for Massachusetts State Scholarships should be made only to the Commissioner of Education, 15 Ashburton Place, Boston, from whom the necessary blanks may be obtained.

Sherwin Scholarship. Founded by the English High School Association in memory of Thomas Sherwin. The pupil to receive the privilege of this scholarship is to be a graduate of the English High School of Boston and a student pursuing a regular course at the Institute.

William Barton Rogers Scholarship Fund. The income from this fund, which was presented by the Alumni Association of the Institute as a memorial of the late President

Rogers, is applied to aiding students requiring financial assistance. Grants from this fund carry with them the obligation of ultimate repayment, and all amounts returned become immediately available as income.

Joy Scholarship. The money by which these scholarships are sustained was given by Miss Nabby Joy. They were created pursuant to a decree of the Supreme Judicial Court of Massachusetts, for the benefit of one or more women studying natural science in the Institute.

James Henry Mirrlees Scholarship. Founded by James B. Mirrlees, of Glasgow, Scotland, in memory of his son, who died in May, 1886, while attending the Institute. This scholarship will be awarded to a third- or fourth-year student in Mechanical Engineering.

Milton High School Scholarship. Founded by the Institute in recognition of contributions of residents of Milton. This scholarship will be conferred upon such former pupil of the Milton High School in good standing at the Institute as the master of that school and the school committee of the town may select.

Massachusetts State Scholarship. In consideration of support received from the Commonwealth, the Institute maintains eighty free scholarships which are granted by the Board of Education to residents or minor children of residents of the State. Information regarding the terms and conditions upon which they are to be awarded may be obtained by addressing the Commissioner of Education, 15 Ashburton Place, Boston. Applications for these scholarships must be filed on or before July 1 of each year.

Perkins Fund. By a bequest of Richard Perkins, of Boston, the income of fifty thousand dollars is available for aiding students in such amounts as shall be recommended by the Faculty.

Coöperative Scholarship. The Coöperative Society of the students of the Institute applies its annual profits to the

assistance of members of the society selected by its Board of Directors.

Charles L. Flint Scholarship. Founded by Charles L. Flint, of Boston. This scholarship is to be awarded, by preference, to a graduate of the Boston English High School.

Elisha T. Loring Scholarship. Founded by Elisha Thacher Loring, of Boston.

Class of 1891 Fund. The Class of '91, on leaving the Institute, provided funds for a system of letter-boxes for the use of students. Any profits accruing from the rental of these letter-boxes will be applied to the assistance of scholarship applicants.

William F. Huntington Scholarship. Founded in memory of William F. Huntington, who graduated in Civil Engineering in the Class of '75. Preference will be given to a student in that Course.

Susan Upham Fund. By gift of Susan Upham the income of one thousand dollars is available for students who may be in need of financial assistance.

Elisha Atkins Scholarship and Farnsworth Scholarship. Founded by Mrs. Mary E. Atkins, of Boston.

T. Sterry Hunt Scholarship. Founded by bequest of T. Sterry Hunt, for seven years Professor of Geology at the Institute. This scholarship is restricted to students of Chemistry and preference will be given those in the higher years.

Nichols Scholarship. Founded by bequest of Mrs. Betsey F. M. Nichols in memory of her son, William Ripley Nichols, of the Class of '69, for sixteen years Professor of General Chemistry at the Institute. Preference will be given to students in the Course in Chemistry.

Vose Fund. By the will of Mrs. Ann White Vose the Institute has received about sixty thousand dollars, the income of which is used for scholarships in aid of young men of American origin.

Dickinson Fund. By the will of Mrs. Ann White Dickinson the Institute has received about forty thousand dollars, the income of which is applied to the assistance of young men of American origin.

Austin Fund. From the estate of Edward Austin the Institute has received a bequest of three hundred and sixty thousand dollars to assist meritorious students and teachers in the pursuit of their studies. A part of the income from this fund is available for undergraduate scholarships.

Billings Student Fund. By the will of Robert C. Billings the Institute has received fifty thousand dollars. Any student receiving a benefit from this fund is expected to abstain from the use of alcohol and tobacco.

Isaac Warren Danforth Scholarship Fund. Founded by bequest of James H. Danforth as a memorial to his brother, Isaac Warren Danforth. The amount of this fund is five thousand dollars.

Charles C. Nichols Scholarship Fund. By the will of Charles C. Nichols the Institute has received five thousand dollars, the income of which is to be used for scholarships.

William Barton Rogers Scholarship. In commemoration of the connection of President Rogers with William and Mary College of Virginia, the Executive Committee has established a scholarship of the value of three hundred dollars a year to be known as the William Barton Rogers Scholarship. This scholarship will be granted to a student nominated by the Faculty of William and Mary College.

Lucius Clapp Scholarship Fund. The income from this fund of five thousand dollars is available to aid students who otherwise might be unable to complete their studies at the Institute.

John Felt Osgood Scholarship. By the will of Elizabeth B. Osgood, and as a memorial to her husband, John Felt Osgood, the Institute has received five thousand dollars for the establishment of a scholarship in Electrical Engineering.

William Litchfield Scholarship. By the will of William Litchfield the Institute has received five thousand dollars to be known as the William Litchfield Scholarship, the income to be awarded annually and paid to such student in said Institute as may upon a competitive examination be determined by the President of said Institute to be entitled thereto for excellence in scholarship and conduct.

Jonathan Whitney Fund. The income from this fund, established by Francis B. Greene, is available for the purpose of aiding students who need financial assistance in obtaining an education at the Institute.

Samuel Martin Weston Scholarship Fund. Founded by bequest of Frances Erving Weston in memory of her husband, the income to be used to aid a native-born American Protestant boy, preference to be given to one from Roxbury.

Frances Erving Weston Scholarship Fund. Founded by bequest of Frances Erving Weston, the income to be used to aid a native-born American Protestant girl of Massachusetts.

Architectural Society Scholarship Fund. This fund has been donated by the Architectural Society of the Institute and the income will be awarded to such student or students of the Department of Architecture as may be designated by the Trustees.

Cambridge Scholarships. A limited number of scholarships are granted to students about to enter the first year class

at the Institute, who are graduates of schools in Cambridge and children of legal residents of that city. These scholarships are awarded by competition on the results of the regular entrance examinations at the Institute held in June of each year. They are confined to students who furnish evidence of need, obtain clear records, and reach the standard required by the Faculty for scholarship aid. Those to whom scholarships are awarded in the first year receive scholarships in their second, third and fourth years provided that they maintain a scholarship record in the previous year and continue to furnish evidence of need. The amount of each scholarship is $250 in the form of remission of tuition fees. Forms of application for these scholarships, including the complete regulations concerning them, may be obtained from the Registrar. Applications must be filed with that officer during the months of May and June of the year in which the applicant intends to enter the Institute.

Sarah S. Forbes Scholarship Fund. Originally a fund of twenty-eight hundred dollars given in trust in 1868 by Sarah S. Forbes to William Barton Rogers and Henry S. Russell, Trustees, the income to be paid toward the maintenance and education of a scholar at the Institute. This amount and accumulations turned over to the Institute by succeeding trustees.

George Henry May Scholarship Fund. Founded by George Henry May of the Class of '92 to provide a scholarship for graduates of the High Schools of Newton, Mass. The scholarship is awarded by a committee consisting of the Superintendent of Schools, Chairman of the School Committee and the Headmasters of the Newton High Schools.

Jonathan Bourne Scholarship Fund. By the bequest of Hannah B. Abbe the income from a fund of ten thousand dollars is available for the purpose of aiding deserving students.

Louis Weissbein Scholarship. By the will of Louis Weissbein the Institute received four thousand dollars for found-

ing a scholarship, preference to be given to a Jewish boy in making the award.

Funds Available for Advanced Study.—Applications for grants for advanced study should be presented to the Secretary of the Faculty not later than the first of March, on forms provided for the purpose. This rule applies both to original applications and to the renewal of previous grants. If funds are still available, applications for grants will be considered up to the first of October. Each applicant must present with his application a detailed statement of the advanced work which he desires to pursue. If not a graduate of the Institute, he should present from the Registrar of the institution from which he comes a statement of his standing in the various subjects which he has there pursued. He should also fill out a special form, "schedule of equivalents," showing the extent to which he has pursued subjects required in the Undergraduate Course at the Institute leading to the advanced study which he wishes to undertake.

A student who is working for the degree of Doctor of Philosophy or Doctor of Engineering either at the Institute or under an Institute grant at another institution, may be appointed a *Fellow* upon recommendation of the Faculty, as a mark of distinction. A certificate of appointment bearing the seal of the Institute and signature of the President and Secretary of the Faculty will be issued to each Fellow upon the approval of his appointment by the Corporation.

The Institute now possesses the following funds, the income of which is available, wholly or in part, to aid students in pursuing advanced study and research.

James Savage Fund. Founded by the late James Savage. Five hundred dollars from the income of this fund will be annually awarded to a graduate student of the Institute, or of some similar institution of equal standing. This sum will be awarded only to a student of ability who wishes to engage in the advanced study of some branch or branches of knowledge taught in the Institute.

Susan H. Swett Fund. Four hundred dollars from the income of this fund will be annually awarded to a graduate student of the Institute, or of some similar institution of equal standing, who, by his character, capacity, training, and attainments, shall give evidence of special fitness to pursue advanced study in some branch or branches of knowledge taught in the Institute.

Willard B. Perkins Fund. Founded by a bequest of Willard B. Perkins, of the Class of '72. The income, amounting to one thousand dollars, will be available in 1915–1916 and every fourth year for a traveling scholarship in Architecture.

Dalton Fund. Founded by Charles H. Dalton, the income to be used for the payment of fees of American male students, graduates of the Institute, who may wish to pursue advanced chemical study and research, especially applicable to textile industries.

Henry Saltonstall Scholarship Fund. By the will of Henry Saltonstall the Institute has received ten thousand dollars, to be known as "The Henry Saltonstall Scholarship Fund," the income to be used to aid students, whether undergraduates or graduates, pursuing advanced courses. Four hundred dollars from the income of this fund is available annually.

Austin Fund. The Institute has received from the estate of Edward Austin a bequest of three hundred and sixty thousand dollars to assist meritorious students and teachers in the pursuit of their studies. From this fund a number of awards of two hundred and fifty dollars each, equivalent to free tuition, are made each year to students working for the degree of Master of Science. A limited number of awards not exceeding five hundred dollars each are also available for candidates for the degree of Doctor of Philosophy and Doctor of Engineering.

Two Austin Research Fellowships carrying an award of

five hundred dollars each in addition to remission of tuition fees have been established. Candidates for the degree of Doctor of Philosophy or Doctor of Engineering who have shown exceptional ability may be appointed to these Fellowships.

Richard Lee Russel Fund. Founded by Theodore E. Russel in memory of his brother, Richard Lee Russel. The income of two thousand dollars is to be awarded to some student of high standing in Civil Engineering to enable him to continue his studies either as a graduate or undergraduate.

Ellen H. Richards Memorial Research Fund. The income of this fund will be devoted to the promotion of research in sanitary chemistry, the branch of science to whose development Mrs. Richards so greatly contributed. The income will be utilized by the Institute for the award of fellowships to advanced students competent to pursue this line of research, for the employment of research assistants, and in such other ways as will best promote investigation in the field in question.

Moore Scholarship Fund. The income from five thousand dollars, the gift of Mrs. F. Jewett Moore, to be awarded a graduate student for advanced study in Europe, specializing in organic chemistry. Preference will be shown to one who has distinguished himself in this subject while an undergraduate.

Traveling Fellowship in Architecture. One thousand dollars to be devoted to travel and study abroad under the direction of the Department of Architecture. The competition for this fellowship is open to regular and special students who have passed at least two consecutive years in the school within the last three years, one of which must have been in the graduate class.

Prizes.—The following annual prizes are offered to the students of the Department of Architecture, and are awarded through competitions in Design:

Student Medal of the American Institute of Architects. This medal is awarded on the recommendation of the Department to the member of the graduating class whose record for the course is the best.

Rotch Prizes. The gift of Mr. Arthur Rotch. Two prizes of two hundred dollars awarded at the end of the senior year to the regular and the special student having the best general records. The special student must have spent at least two years in residence to be eligible as a candidate.

The Boston Society of Architects' Prizes. The gift of the Society. Two prizes of fifty dollars awarded to a regular and a special student in the senior class.

The Chamberlin Prize. The gift of Mr. W. E. Chamberlin of the Class of 1877. Twenty-five dollars awarded to a student in the graduate class.

The F. W. Chandler Prizes. The gift of the alumni of the Department and of Professor Chandler's friends. Five prizes of ten dollars each awarded for sketch problems in the third, fourth, and graduate years.

The "Class of 1904" Prizes. The gift of the Class of 1904. Two prizes of ten dollars awarded to a regular and a special student in the junior class.

School for Health Officers.

ADMINISTRATIVE BOARD.

WILLIAM T. SEDGWICK, Sc.D.
Chairman.

MILTON J. ROSENAU, A.M., M.D.
Director.

GEORGE C. WHIPPLE, S.B.
Secretary.

This school for the training of Health Officers was established in 1913 by Harvard University and the Massachusetts Institute of Technology, and is conducted by an Administrative Board appointed for the purpose by both institutions.

The principal object of the School is to prepare young men for public health work; especially to fit them to occupy administrative and executive positions, such as health officers, or members of boards of health, or secretaries, agents, or inspectors of health organizations. To this end, lectures, laboratory work, and other forms of instruction are provided by both institutions, and by special instructors from national, state, and local health services. The subjects embraced in the courses of study have been selected to cover a wide range, including medical, biological, hygienic, sanitary, and engineering sciences, besides practical health administration.

The opportunities for the practical study of the arts of public sanitation offered to students of the School for Health Officers are believed to be exceptional. The city of Boston is an important port of entry for foreign and domestic shipping and for immigration, and has thirty or more municipalities in its immediate vicinity, while the state of Massachusetts is a commonwealth which has long been recognized as standing in

the forefront of American communities in respect to public health arts and sciences. To the advantages of location are added the combined resources of Harvard University and the Massachusetts Institute of Technology.

Graduates in Medicine of Harvard University and other recognized medical schools will be admitted to the school for Health Officers upon their records, and registered as candidates for the Certificate in Public Health (C. P. H.) Bachelors of Science in Biology and Public Health of the Massachusetts Institute of Technology and other recognized institutions will likewise be admitted and registered as candidates for that certificate.

Masters of Civil Engineering of Harvard University who have specialized in Sanitary Engineering and Bachelors of Science in Sanitary Engineering of the Massachusetts Institute of Technology and other recognized institutions will be admitted to the School upon their records, but will be required to spend at least one year in preparation before being accepted as candidates for the Certificate in Public Health.

Other graduates of colleges or technical or scientific schools will be admitted to the School without examination, provided their collegiate courses have included adequate instruction in physics, chemistry, biology, French and German; but they will be required to spend two or more years in preparation before being accepted as candidates for the Certificate in Public Health. Applications for admission to the School will be considered from those who have spent at least two years in a recognized college or technical or scientific school and have pursued satisfactory courses in physics, chemistry, biology, French and German, and also from persons of unusual experience or special qualifications; but these will also be required to spend two or more years in preparation before being admitted as candidates for the certificate.

Special students, not candidates for the Certificate in Public Health, who desire to fit themselves for some special field may be admitted to the School and may take any course or courses for which they are properly qualified, on approval of the Administrative Board.

CERTIFICATE.

The Certificate in Public Health (C. P. H.) will be granted to candidates who have satisfactorily completed the studies of an approved schedule, who have spent not less than one academic year in residence, and who have otherwise complied with all requirements. This certificate will be issued by Harvard University and the Massachusetts Institute of Technology and will be signed by authorities of both institutions.

FEES.

The tuition fee for candidates for the Certificate in Public Health and for all other students pursuing regular courses in the School is $250 per year and must be paid in advance as follows:—$150 on or before the first day of the first term, and $100 on or before the first day of the second term. For one half of the school year the fee is $150.

Special students who do not pay the regular fee must pay a special fee for each course.

A deposit of $50 is required to be made in advance against charges for breakage in the laboratories, and any balance remaining at the end of the year will be returned. There will be no extra laboratory fees for instruction taken in course.

Further information may be had on application to Professor William T. Sedgwick, Massachusetts Institute of Technology, Boston, Mass., or to Dr. Milton J. Rosenau, Harvard Medical School, Boston, Mass.

Lowell Institute.[1]

SCHOOL FOR INDUSTRIAL FOREMEN.

The Trustee of the Lowell Institute has established, under the auspices of the Massachusetts Institute of Technology, a Free Evening School for Industrial Foremen. The school comprises, at present, three Courses,—Mechanical Course, Electrical Course, and Buildings Course, each extending over two years.

The Courses of Instruction.—These Courses are intended to bring the systematic study of applied science within the reach of young men who are following industrial pursuits and desire to fit themselves for higher positions, but are unable to attend courses during the day. The subjects included in the Courses are as follows:

First-year Mechanical and Electrical Courses.—Mathematics; Physics and Elementary Electricity; Elements of Mechanism, and Drawing.

Second-year Mechanical Course.—Elements of Thermodynamics, the Steam-engine and Boilers; Valve-gears; Mechanics; Elementary Hydraulics; Testing Laboratory; Steam and Hydraulic Laboratory; Mechanism and Machine Design.

Second-year Electrical Course.—Elements of Thermodynamics, the Steam-engine and Boilers; Valve-gears; Steam Laboratory; Direct Current Machinery; Alternating Currents; Electric Distribution; Electrical Testing Laboratory; Laboratory of Dynamo Electric Machinery.

First-year Buildings Course.—Mathematics; Physics and Elementary Electricity; Elements of Mechanism, and Draw-

[1] For general information in regard to the Lowell Institute, application should be made to Professor W. T. Sedgwick, Curator, 491 Boylston St., Boston.

ir g; Applied Mechanics and Graphic Statics; Steam and Hydraulic Machinery; Heating and Ventilation.

Second-year Buildings Course.—Materials and Testing Materials; Structural Design; Foundations; Electrical Machinery, and Electrical Laboratory; Electrical Wiring; Steam Laboratory; Buildings Laws, Contracts, Sanitation, etc.

It is the aim to adapt the courses to the men for whom the instruction is intended and to include the study of those principles with which they are not likely to become familiar in practice. The instruction embraces recitations, lectures, drawing-room practice, and laboratory exercises; and is given by members of the instructing staff of the Institute of Technology. Many of the lectures are fully illustrated by apparatus and experiments. Written tests are given from time to time, and problems are assigned for home work at nearly every exercise. Text-books are used in many of the subjects, but in some of the work, where the instruction differs widely from available books, printed notes are supplied to the students at cost. Students are expected to purchase such text-books, note-books, instruments, and other material as may be recommended throughout the course.

The scholarship of the students and their ability to continue the courses is determined in part by examinations, but considerable weight is given to the term's work. Those students who fail to keep well up with the work or to profit sufficiently by the instruction are informed that they are not qualified to pursue the course advantageously. Those who complete satisfactorily the required courses of the two years and pass the examinations are given certificates.

The School Year.—The next school year will begin September 25, 1916, and will close May 19, 1917. There will be a recess of one week at Christmas, and on legal holidays the exercises of the school will be suspended. Attendance from 7.30 to 9.30 for three or four evenings a week is required, in addition to outside study.

Requirements for Admission.—Application for admission should be made early and before June 1, if possible. To be

admitted to the first-year Course the applicant must be at least eighteen years of age, and must pass satisfactorily entrance examinations in Arithmetic (including the Metric System), Elementary Algebra, Plane Geometry, and Mechanical Drawing. These examinations may be, in a measure, of a competitive nature, and considerable weight will be attached to the applicant's occupation and practical experience. The courses are open to those only who are ambitious and willing to study, and who purpose to complete the full course of two years. The character and amount of the instruction is such that, if the student is not well fitted to take up the work of the school, it will not be possible for him to derive full benefit from the Course, or perhaps to maintain his standing.

A circular giving detailed information regarding the nature of the entrance examinations and other requirements may be obtained by sending a stamped, addressed envelope to Professor Charles F. Park, Director, Lowell Institute School for Industrial Foremen, Massachusetts Institute of Technology, Boston.

Alumni Associations.

THE ALUMNI ASSOCIATION.

The Alumni Association of the Institute holds its annual banquet in Boston in January. It includes in its membership all graduates of the Institute. Membership is also open, by election, to non-graduate members of classes that have been graduated and to members of the former School of Mechanic Arts. Honorary membership is open to present and former members of the Corporation and of the Faculty.

Its officers for 1915 are:

President: HENRY J. HORN, '88.

Vice-Presidents: WALTER H. KILHAM, '89, JOHN L. MAURAN, '89, JAMES W. ROLLINS, '78.

Secretary-Treasurer: WALTER HUMPHREYS, '97, Massachusetts Institute of Technology.

Executive Committee: THE PRESIDENT, VICE-PRESIDENTS, SECRETARY-TREASURER, JOSEPH H. KNIGHT, '96, JAMES F. MCELWAIN, '97, MATTHEW C. BRUSH, '01, WARREN K. LEWIS, '05.

COUNCIL OF THE ALUMNI ASSOCIATION.

The constitution establishes a Council which is a body thoroughly representative of the Alumni Association. The membership of this Council is made up as follows: the five latest living ex-presidents, ten members elected at large, one representative from each graduated class and from each local organization which is given representation by the executive committee, besides the general officers of the association.

In accordance with the constitution the present membership of the Council is as follows:

Five Latest Living Ex-Presidents:

A. Farwell Bemis, '93.
Arthur A. Noyes, '86.
James W. Rollins, '78.
Frederic H. Fay, '93.
Jasper Whiting, '89.

Representatives at Large:

Term expires in 1916.	*Term expires in 1917.*
Franklin B. Richards, '84.	William D. Sohier, '78.
Charles W. Eaton, '85.	Leonard C. Wason, '91.
Frank A. Merrill, '87.	Raymond B. Price, '94.
George C. Whipple, '89.	William D. Coolidge, '96.
Sumner B. Ely, '92.	Proctor L. Dougherty, '97.

Class Representatives:

'68, Robert H. Richards.
'69, Howard A. Carson.
'71, Edward W. Rollins.
'72, Edgar W. Upton.
'73, Samuel E. Tinkham.
'74, George H. Barrus.
'75, Thomas Hibbard.
'76, Charles T. Main.
'77, Belvin T. Williston.
'78, Charles M. Baker.
'79, Charles S. Gooding.
'80, George H. Barton.
'81, John Duff.
'82, James P. Munroe.
'83, Horace B. Gale.
'84, Harry W. Tyler.
'85, Isaac W. Litchfield.
'86, Arthur A. Noyes.
'87, Henry F. Bryant.
'88, Arthur T. Bradlee.
'89, Henry Howard.
'90, William Z. Ripley.
'91, Arthur H. Alley.
'92, Leonard Metcalf.
'93, George B. Glidden.
'94, Samuel C. Prescott.
'95, Harold K. Barrows.
'96, J. Arnold Rockwell.
'97, Charles W. Bradlee.
'98, Seth K. Humphrey.
'99, Hervey J. Skinner.
'00, Ingersoll Bowditch.
'01, Robert L. Williams.
'02, Frederick H. Hunter.
'03, Thomas E. Sears.
'04, Merton L. Emerson.
'05, Grosvenor D'W. Marcy.
'06, John F. Norton.
'07, Lawrence Allen.
'08, Herbert T. Gerrish.
'09, Carl W. Gram.
'10, Charles E. Green.
'11, Herbert Fryer.
'12, Randall Cremer.
'13, William R. Mattson.
'14, Charles Parker Fiske.
'15, Marshall B. Dalton.

Local Societies Represented:

TECHNOLOGY CLUB OF THE MERRIMACK VALLEY,
RICHARD A. HALE, '77.
TECHNOLOGY CLUB OF NEW YORK,
RALPH H. HOWES, '03.
NORTHWESTERN ASSOCIATION, M. I. T.,
B. R. T. COLLINS, '88.
PITTSBURGH ALUMNI ASSOCIATION,
SUMNER B. ELY, '92.
TECHNOLOGY CLUB OF PHILADELPHIA,
REGINALD A. WENTWORTH, '04.
WASHINGTON SOCIETY OF THE M. I. T.,
HENRY MORSS, '93.
TECHNOLOGY CLUB OF MILWAUKEE,
ALEXANDER MACOMBER, '07.
THE CINCINNATI M. I. T. CLUB,
H. N. DAWES, '93.
M. I. T. CLUB OF CENTRAL NEW YORK,
THEODORE H. SKINNER, '92.
TECHNOLOGY CLUB OF NORTHERN OHIO,
G. R. WADSWORTH, '98.
TECHNOLOGY CLUB OF RHODE ISLAND,
ELEAZER B. HOMER, '85.
TECHNOLOGY CLUB OF PUGET SOUND,
DON GALUSHA, '04.
TECHNOLOGY CLUB OF SOUTHERN CALIFORNIA,
JOHN C. CHASE, '74.
TECHNOLOGY CLUB OF NEW HAMPSHIRE,
ANDREW FISHER, JR., '05.
TECHNOLOGY CLUB OF BUFFALO,
ARTHUR C. ANTHONY, '86.
TECHNOLOGY ASSOCIATION OF MINNESOTA,
ALLAN W. ROWE, '01.
DETROIT ASSOCIATION OF THE M. I. T.,
EVERETT MORSS, '85.
INTERMOUNTAIN TECHNOLOGY ASSOCIATION,
GEORGE E. RUSSELL, '00.
TECHNOLOGY CLUB OF THE CONNECTICUT VALLEY,
EBEN S. STEVENS, '68.

TECHNOLOGY CLUB OF HARTFORD, CONN.,
G. H. GLEASON, '03.
INLAND EMPIRE ASSOCIATION OF THE M. I. T.,
H. W. GARDNER, '94.
TECHNOLOGY CLUB OF NEW BEDFORD,
C. F. LAWTON, '77.
TECHNOLOGY ASSOCIATION OF NORTHERN CALIFORNIA,
BURTON G. PHILBRICK, '02.
TECHNOLOGY ASSOCIATION OF OREGON,
ANDREW D. MACLACHLAN, '96.
ROCKY MOUNTAIN TECHNOLOGY CLUB,
ALLEN H. ROGERS, '90.
TECHNOLOGY CLUB OF THE SOUTH,
HAROLD E. KEBBON, '12.
TECHNOLOGY ASSOCIATION OF JAPAN,
WILLIAM H. KING, '94.
TECHNOLOGY CLUB OF ROCHESTER,
HOWARD C. TURNER, '03.
ST. LOUIS SOCIETY OF THE M. I. T.,
C. M. SPOFFORD, '93.
SOUTHEASTERN TECHNOLOGY ASSOCIATION,
HARRY S. MORK, '99.
SOUTHWESTERN ASSOCIATION OF M. I. T.,
W. LYMAN UNDERWOOD, '98.
PITTSFIELD ALUMNI ASSOCIATION,
WALTER B. SNOW, '82.
HAWAII TECHNOLOGY CLUB,
EDWIN S. WEBSTER, '88.
TECHNOLOGY CLUB OF LOWER CANADA,
GEORGE W. VAILLANT, '92.
TECHNOLOGY CLUB OF BRIDGEPORT
FREDERICK C. BLANCHARD, '91.
DAYTON TECHNOLOGY ASSOCIATION,
CHARLES F. PARK, '92.

THE TECHNOLOGY CLUBS ASSOCIATED.

This association was organized in New York City, January 17, 1913. Its object is to promote the general interest and

social relations between the various Technology clubs and to assist in spreading information concerning the Massachusetts Institute of Technology. General meetings, at which the place of the following meeting is to be designated, are to be held annually or as otherwise determined by the Executive Committee of the federation. The meeting in 1914 was held in Chicago, and in 1915 in Pittsburgh. In 1916 the meeting will take place in Boston.

President: JAMES W. ROLLINS, '78.

Vice-Presidents: WALTER LARGE, '79, 15 William Street, New York City; HARRY M. MONTGOMERY, '79, 137 South La Salle Street, Chicago, Ill.; E. B. RAYMOND, '90, 1624 Frick Building, Pittsburgh, Pa.; HOLLIS GODFREY, '98, Drexel Institute, Philadelphia, Pa.; PAUL W. LITCHFIELD, '96, 38 Marshall Avenue, Akron, Ohio; JAMES H. HASTE, '96, Eastman Kodak Co., Kodak Park, Rochester, N. Y.

Secretary-Treasurer: WALTER HUMPHREYS, '97, Massachusetts Institute of Technology, Boston, Mass.

Associate Secretary: HARRY A. RAPELYE, '08, 2123 Oliver Building, Pittsburgh, Pa.

THE M. I. T. WOMEN'S ASSOCIATION.

This association was organized in 1900, in Boston, Mass., and incorporated under the law of Massachusetts in 1907. Its object is to promote education, unity and good fellowship among women graduates and past students of the Institute, and to advance the cause of education and the general welfare of the women undergraduates. A Students' Aid Committee stands ready to assist these women in any emergency. The association has about one hundred and fifty members. Social meetings are held four times during the winter, and the annual meeting and luncheon is held early in January. New members are cordially welcomed. The corresponding secretary will be glad to be notified of any change in a member's address.

President: MARGARET E. DODD, '92.
First Vice-President: MARION TALBOT, '88.
Second Vice-President: MABEL K. BABCOCK, '08.
Recording Secretary: EMELINE E. TORREY, '96.
Corresponding Secretary: LILLIE C. SMITH, '06, 1 Winchester Street, Brookline, Mass.
Treasurer: ANNIE E. ALLEN, '94.

THE TECHNOLOGY CLUB OF BOSTON.

Founded in 1896 in Boston, Mass. The object of the club is to promote the welfare of the Institute and the common social interests of its past and present officers and students. The membership is at present about seven hundred, including graduates and other former students, members of the Corporation and of the instructing staff, and a limited number of undergraduates.

In view of the removal of the Institute to Cambridge next year, the Council of the Technology Club felt it wise to take advantage of a favorable opportunity to sell the club house at 83 Newbury Street. The Engineers Club, 2 Commonwealth Avenue, has extended to the Technology Club the privileges of its house during the coming year. The Technology Club retains its own organization with the following officers:

President: SAMUEL C. PRESCOTT, '94.
Vice-President: DWIGHT PORTER.
Secretary: ROBERT S. WILLIAMS, '02, Massachusetts Institute of Technology, Boston, Mass.
Treasurer: ANDREW D. MACLACHLAN, '96.

NORTHWESTERN ASSOCIATION, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

This association was founded in 1887, in Chicago, Ill., and originally drew for its membership upon the whole country west of Pittsburgh. During recent years Technology associations have been formed at Detroit, Pittsburgh, Indianapolis, Milwaukee, St. Louis, San Francisco and many other points in this territory, but this association still includes a few members from Michigan, Indiana, Ohio and other points South and West of the Great Lakes where there is no local association. The present regular membership is about 300. The headquarters of the association is in Chicago, and a majority of the members are located in this city and its vicinity. All former students of the Institute are welcomed to the association, and may enjoy full privileges upon payment of dues, which are $2.00 per year for resident members,—that is, members living in Chicago or vicinity,—and $1.00 for non-resident members. The association holds informal gatherings at various clubs (including at least one outdoor summer meeting) during the year, and the annual dinner occurs towards the end of February or early in March. Officers are elected at one of the winter meetings. Regular luncheons are held every Tuesday at 12.30 at the Morrison Hotel, Clark Street and Madison Avenue. The association publishes bulletins from time to time, announcing meetings, speakers and other items of interest to the members. A directory containing addresses and occupation of all members is also published and may be obtained from the secretary.

President: KENNETH LOCKETT, '02.

Vice-President: HARRY M. MONTGOMERY, '79.

Secretary-Treasurer: GEORGE B. JONES, '05, 1445 Monadnock Block, Chicago, Ill.

Alumni Council Representative: B. R. T. COLLINS, '88.

Executive Committee: This Committee acts in an advisory capacity and is composed of nine members elected from among the past presidents of the Association.

Directors: PHILIP W. MOORE, '01, JOHN M. FRANK, '07, HARVEY S. PARDEE, '09.

THE ROCKY MOUNTAIN TECHNOLOGY CLUB.

This club was founded in 1889 in Denver, Colo., and originally included members from Colorado, Kansas, Wyoming, Montana, Utah and New Mexico. The impracticability of attempting to cover so large a territory and the formation of the club in Salt Lake City have caused the reduction in scope to include Colorado alone. There are at present about one hundred Technology Alumni in the state. Dinners are usually given in honor of some special event such as the visit of some man prominently associated with Tech work. An occasion of this sort crystallizes the interest of the members and ensures a good attendance and an enthusiastically successful affair. Tech men visiting Denver are cordially urged to call up the president and make their presence known.

President: SAMUEL C. LIND, '02.

Vice-President: H. O. BOSWORTH, '02.

Secretary: FREDERICK W. HORTON, '04, U. S. Bureau of Mines, Foster Bldg., Denver, Colo.

Alumni Council Representative: ALLEN H. ROGERS, '90.

THE TECHNOLOGY CLUB OF NEW YORK.

The Technology Club of New York was organized in 1895, in New York City, and incorporated in 1903. From September 1, 1903, till May 1, 1909, it occupied a small club house of three stories, only one of which was devoted to club purposes, and its membership was between two and three hundred. It then obtained an adequate club house of four stories and basement at 17 Gramercy Park, the two upper stories comprising rooms rented to resident and transient members, and the remainder of the house used for general club purposes including reception room, dining rooms, café, library, billiard rooms,

card and writing rooms. Its membership is now about one thousand, and from fifty to seventy men dine in the house daily. Students and instructors connected with the Institute for one year or more are eligible for resident or non-resident membership. Smokers and entertainments are held monthly. The annual meeting is held on the first Saturday of May. The annual dinner is held on Saturday evening, two weeks prior to the first Saturday in February. The affairs of the club are conducted by a Board of Governors of ten members, five of whom are elected from divisions of classes for five-year terms, and five elected from the membership at large for one-year terms. As a rule members of the Board are officers or chairmen of standing committees. The organization at the present time is as follows:

President: FRANK C. SCHMITZ, '95.

Vice-President: SCHUYLER SCHIEFFELIN, '90.

Treasurer: IRA ABBOTT, '81.

Assistant Treasurer: CLIFTON W. WILDER, '98.

Secretary: RALPH H. HOWES, '03, 105 West 40th St., New York, N. Y.

Board of Governors: IRA ABBOTT, '81; T. HOWARD BARNES, '81; HOWARD L. COBURN, '87; FRANK C. SCHMITZ, '95; THEODORE I. JONES, '96; OSWALD C. HERING, '97; LESTER D. GARDNER, '98; CLIFTON W. WILDER, '98; RALPH H. HOWES, '03; THOMAS C. DESMOND, '09.

Alumni Council Representative: RALPH H. HOWES, '03.

Chairman House Committee: OSWALD C. HERING, '97.

Chairman Membership Committee: HOWARD L. COBURN, '87.

Chairman Publicity Committee: LESTER D. GARDNER, '98.

Chairman Entertainment Committee: THOMAS C. DESMOND, '09.

Chairman Art and Library Committee: NOEL CHAMBERLIN, '04.

Chairman Business Opportunities Committee: THEODORE I. JONES, '96.

Chairman Annual Dinner Committee: DANIEL W. EDGERLY, '98.

THE TECHNOLOGY ASSOCIATION OF THE CONNECTICUT VALLEY.

This club was formed in 1895. The region from which the membership is drawn comprises the entire territory in, and adjacent to the Connecticut Valley. Usually a winter meeting and banquet is held at Springfield or Hartford. A summer outing is held at the Hartford Yacht Club at Fenwick, Conn. Some of the men go down on the boat the night before and enjoy a special dinner, which is served before reaching Fenwick, and the balance of the members arrive during the early morning hours. A very interesting ball game between the Hartfords and the Springfields is played at 11 A.M. Fishing, bathing, boating and other sports are enjoyed, and a shore dinner is served at 2 P.M. All Tech men not already enrolled as members, expecting to be in this territory at the time of the annual meeting, are requested to send their names to the secretary. All Technology men living within the territory named are considered members and notices are sent to them if possible.

President: EDMUND P. MARSH, '89.
Vice-President: CLARENCE E. WHITNEY, '91.
Secretary-Treasurer: ERNEST W. PELTON, '03, 77 Forest Street, New Britain, Conn.
Alumni Council Representative: EBEN S. STEVENS, '68.

THE TECHNOLOGY CLUB OF PHILADELPHIA.

This club was formed in 1896, in Philadelphia, Pa., and at present has seventy-five members. Conditions of membership are, that one must have been connected with the Institute, either as student or instructor, at least one year, and must have a residence within fifty miles of Philadelphia. Meetings are held about once a month, the time and place being determined by the executive committee. At these meetings papers or addresses on current topics are given by men eminent in the various branches of engineering and all Technology

men are welcomed. A buffet lunch is usually served and the social features of the meetings are enjoyed by all present.

President: RICHARD WATERMAN, '92.
Vice-President: CHARLES F. WILLARD, '01.
Secretary-Treasurer: GEORGE C. LEES, '08, 826 South Alden Street, Philadelphia, Pa.
Alumni Council Representative: LOUIS K. ROURKE, '95.
Executive Committee: PRESIDENT, VICE-PRESIDENT, SECRETARY and W. H. BLAKEMAN, '05, E. E. PIERCE, '99, PERCY E. TILLSON, '06, CHESTER P. WETHERBEE, '13.

THE PITTSBURGH ASSOCIATION, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

This organization, which was founded in 1899, in Pittsburgh, Pa., now numbers one hundred and ninety-nine members. Any one who has been connected with the Institute as a student or an instructor is eligible for membership. The territory is not restricted, but the membership is composed mainly of men from western Pennsylvania, southeastern Ohio and northern West Virginia.

Annual meetings are held in February, the exact date being decided by the executive committee. Smokers and other informal gatherings are held at least quarterly.

President: C. S. ROBINSON, '84.
Vice-President: WILLIAM B. BLAKE, '87.
Secretary-Treasurer: HARRY A. RAPELYE, '08, 2123 Oliver Building, Pittsburgh, Pa.
Alumni Council Representative: SUMNER B. ELY, '92.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY-TREASURER, ALUMNI COUNCIL REPRESENTATIVE, MAURICE R. SCHARFF, '09, FREEMAN A. COBB, '04, LEE PHILLIPS, '04.

THE TECHNOLOGY CLUB OF BUFFALO.

The club was founded in 1898, in Buffalo, N. Y., and at present has fifty-four members. Any one who has been connected with the Institute for one year, and is now living in or near Buffalo, is eligible for membership. The meetings take the form of monthly informal dinners, the January dinner being considered the annual meeting. Technology men stopping over in Buffalo are urged to get in touch with one of the officers and arrange to attend these gatherings.

President: HARRY L. NOYES, '90.

Secretary-Treasurer: ELLERY E. ROOT, '11, Standard Ink Co., Buffalo, N. Y.

Treasurer: CARL HOUCK, '05.

Alumni Council Representative: ARTHUR C. ANTHONY, '86.

Executive Committee: THE PRESIDENT, SECRETARY-TREASURER, ROY W. LINDSAY, '07, GEORGE C. FURNESS, '06, EDWARD G. HENRICH, '01.

WASHINGTON SOCIETY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

This society was established in Washington, D. C., February 18, 1899, and at present has an address roll of about two hundred and fifty names, although only about one-fifth of this number are to be considered as active members. The territory from which the membership is drawn includes the District of Columbia, Maryland, northern Virginia and southern Delaware. Six or more meetings are held yearly and in addition excursions and trips are arranged during the summer months. The annual meeting and election of officers is held the first week in December and the annual dinner in January or February. All Technology men who come to Washington are urged to communicate with the secretary in order that they may be notified of meetings, and visiting alumni are cordially invited to meet with us.

President: OSCAR C. MERRILL, '05.
Vice-President: HERBERT S. BAILEY, '06.
Secretary: HENRY G. A. BLACK, '10, U. S. Patent Office, Washington, D. C.
Treasurer: F. CHARLES STARR, '05.
Alumni Council Representative: HENRY MORSS, '93.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY, TREASURER and EARLE B. PHELPS, '99.

M. I. T. CLUB OF CINCINNATI.

This club was organized in Cincinnati in 1901, and the membership now includes about one hundred, and embraces members from Cincinnati and vicinity. Anyone who has been connected with the school, either as a student or instructor for one year is eligible. Several outings and other meetings are held during the year, and the club meets regularly every week at luncheon at the Metropole Hotel, on Walnut Street, above Sixth, and out of town Tech men are always very welcome. The time is on Tuesdays, from 12.00 to 2.00 o'clock.

President: RICHARD W. PROCTOR, '94.
Vice-President: JOHN HARGRAVE, '12.
SECRETARY: EDWARD H. KRUCKEMEYER, '11, Union Central Building, Cincinnati, Ohio.
Treasurer: CHARLES R. STRONG, '11.
Alumni Council Representative: H. N. DAWES, '93.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY, TREASURER, STUART R. MILLER, '07, H. S. MORSE, '03, J. H. FEEMSTER, JR., '06.

THE TECHNOLOGY CLUB OF THE MERRIMACK VALLEY.

This club was organized in 1901, in Lawrence, Mass., and now numbers about one hundred members, who are located in the Merrimack Valley. The annual meeting occurs early in February, and numerous other gatherings called by the exec-

utive committee are held during the year, the time and place varying according to convenience.

President: CHARLES H. EAMES, '97.
Vice-President: ROBERT F. PICKLES, '87.
Treasurer: WILLIAM O. HILDRETH, '87.
Secretary: JOHN A. COLLINS, JR., '97, 67 Thorndyke Street, Lawrence, Mass.
Alumni Council Representative: RICHARD A. HALE, '77.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY, and WILLIAM M. PERLEY, '98.

THE TECHNOLOGY CLUB OF MINNESOTA.

This club was organized in Minneapolis, Minn., in January, 1904, and now has about sixty members. The object of the club is to maintain the Technology influence in graduate life, to further the interests of Technology, and to be mutually helpful to one another in professional and business affairs.

Membership is limited to those who have attended the Institute for one year or longer. There is no hard and fast rule concerning meetings, but it is the custom to hold either a dinner or smoker once a month during the winter. The annual banquet and meeting is held in February or March.

President: W. H. BOVEY, '94.
Vice-President: G. H. GOODELL, '92.
Secretary: DE WITT C. RUFF, '07, 502 Plymouth Building, St. Paul, Minn.
Treasurer: MARK G. MAGNUSON, '04.
Alumni Council Representative: ALLAN W. ROWE, '02.

THE TECHNOLOGY CLUB OF NEW BEDFORD.

The club was established in 1904, in New Bedford, Mass., and now numbers about forty members. The annual meeting takes place on the first Thursday in November, and is followed shortly afterwards by the annual dinner. Other meetings are held from time to time on call of the executive committee.

President: CHARLES F. WING, JR., '98.

Secretary-Treasurer: RICHARD D. CHASE, '92, 607 Purchase Street, New Bedford, Mass.

Alumni Council Representative: CHARLES F. LAWTON, '77.

Executive Committee: THE PRESIDENT, SECRETARY-TREASURER and IRA M. CHACE, JR., '98.

THE TECHNOLOGY CLUB OF HARTFORD.

The club was established in 1905, in Hartford, Conn., and has about seventy-five members, most of whom reside in Hartford and its vicinity. Beginning in November, meetings are held once a month except in the summer, and the gatherings usually take place at Heublein's Hotel on the first Saturday in the month. Talks and discussions on subjects of general interest form a part of the program of these meetings, and all Institute men not members of the club are invited to attend. The annual meeting and dinner are held at the Hartford Club on the first Saturday in February.

President: JOHN H. FELLOWS, '07.

Vice-President: HARRY E. DART, '01.

Secretary-Treasurer: GEORGE W. BAKER, '92, Box 983, Hartford, Conn.

Alumni Council Representative: G. H. GLEASON, '03.

Board of Governors: THE PRESIDENT, VICE-PRESIDENT, SECRETARY-TREASURER, CHARLES P. WATERMAN, '03, and ATWOOD C. PAGE, '10.

THE TECHNOLOGY CLUB OF RHODE ISLAND.

This club was formed in 1905 in Providence, R. I., was reorganized in 1910, and now numbers about two hundred members. The annual meeting takes place in March, and several informal meetings are held during the year.

President: WILLIAM C. DART, '91.

Vice-President: Z. W. BLISS, '89.

Secretary-Treasurer: CLARENCE L. HUSSEY, '08, 1547 Smith St., Fruit Hill, Providence, R. I.

Alumni Council Representative: ELEAZER B. HOMER, '85.

Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY-TREASURER, ALUMNI COUNCIL REPRESENTATIVE, and ARTHUR E. HILL, '81, EDWIN D. PINGREE, '96.

THE TECHNOLOGY CLUB OF NORTHERN OHIO.

This club was formed in 1906, in Cleveland, Ohio, and has a membership of about two hundred alumni of the Institute residing in the northern part of Ohio. Meetings are held at frequent intervals throughout the year and have been in the nature of outdoor field days, banquets and smokers. All men moving into the vicinity are earnestly urged to affiliate.

President: PAUL W. LITCHFIELD, '96.

Vice-President: FREDERICK METCALF, '90.

Secretary-Treasurer: DONALD R. STEVENS, '11, Goodyear Tire and Rubber Co., Akron, Ohio.

Alumni Council Representative: GEORGE R. WADSWORTH, '98.

Executive Committee: FRANK A. SMYTHE, '89, HENRY B. DATES, '94, GEORGE W. SHERMAN, '94, ALBERT D. HATFIELD, '96, GEORGE E. MERRYWEATHER, '96, ARTHUR T. HOPKINS, '97, GEORGE T. GLOVER, '08, EDWIN R. HALL, '08, TYLER W. CARLISLE, '10, ALLEN A. GOULD, '10.

TECHNOLOGY ASSOCIATION OF NORTHERN CALIFORNIA.

This association was organized in 1907, in San Francisco, Cal., and its list of about one hundred men is made up of Technology men residing in or near northern California. The purpose of the association is to bring all Technology men in this region into the closest possible touch with each other. Dinners and other social gatherings are held at frequent in-

tervals, and the annual meeting takes place on the first Saturday in May. Technology men visiting California are requested to notify the secretary of their presence in order that small gatherings of special friends may be encouraged. Headquarters, Eaton Laboratories, 444 Market Street, San Francisco.

President: ERNEST A. HERSAM, '91.
Secretary-Treasurer: GEORGE E. ATKINS, '04, Hobart Building, San Francisco, Cal.
Alumni Council Representative: BURTON G. PHILBRICK, '03.
Executive Committee: FREDERICK M. EATON, '05, H. S. GRISWOLD, '10.

TECHNOLOGY CLUB OF THE SOUTH.

This club was formed in 1907, in New Orleans, La., and has now twenty-seven members. No constitution has been published, but it is the intention to hold quarterly meetings, and on May 1 the annual meeting. Any Technology alumnus not a member is heartily welcomed to these gatherings.

President: ALLISON OWEN, '94, Interstate Bank Building, New Orleans, La.
Vice-President: WALTER G. ZIMMERMANN, '98.
Alumni Council Representative: HAROLD E. KEBBON, '12.

THE M. I. T. CLUB OF CENTRAL NEW YORK.

This club was founded in 1907, in Syracuse, N. Y., with a membership of twenty-five. Any one who has been connected with the Institute for one year, either as instructor or student, and who now resides in Central New York may become a member. Technology alumni from other places are invited to attend the meetings and members of other Technology alumni societies are given full privileges.

The annual meeting is held the first Monday in October,

in Syracuse, and other meetings at the call of the president, when the occasion warrants.

President: H. W. JORDAN, '91.
Vice-President: E. M. SMITH, '06.
Secretary-Treasurer: JAMES R. VEDDER, '07, 704 Sedgwick, Andrews & Kennedy Building, Syracuse, N. Y.
Alumni Council Representative: THEODORE H. SKINNER, '92.
Executive Committee: PRESIDENT, VICE-PRESIDENT, SECRETARY-TREASURER, HOWARD H. MCCHESNEY, '07, and C. S. GLENN, '03.

INLAND EMPIRE ASSOCIATION OF THE M. I. T.

This club was organized in December, 1907, in Spokane, Wash., and at present numbers thirty-eight members. The object of the club is to further the well-being of the Massachusetts Institute of Technology by increasing the interest of members in the Institute and in each other. Any former student of the Institute may become a member of the association provided he has been a member of a class which has been graduated.

The annual meeting and banquet of the association are held on a Saturday evening between December 15 and February 15. At least two informal meetings are held during the year, the date of which is arranged by the executive committee.

President: SHIRLEY S. PHILBRICK, '98.
Vice-President: WILLIAM J. ROBERTS, '91.
Secretary: PHILIP F. KENNEDY, '07, 1129 Hamilton Street, Spokane, Wash.
Alumni Council Representative: H. W. GARDNER, '94.
Executive Committee: PRESIDENT, VICE-PRESIDENT, SECRETARY, FRANCIS F. EMERY, '81, EDWIN R. CRANE, '04, and JOHN F. GREENE, '08.

TECHNOLOGY CLUB OF SOUTHERN CALIFORNIA.

The club was organized in 1908, in Los Angeles, Cal. Its object is to maintain the spirit of Technology and to promote interest in its welfare, as well as to make Institute men mutually helpful to each other. Any one who has been connected with the Institute one year is eligible for membership, and any Technology man who may be in the vicinity is urged to call on the Secretary.

President: EDWARD L. MAYBERRY, '06.
Vice-President:
Secretary-Treasurer: PAUL E. JEFFERS, '12, 472 Pacific Electric Bldg., Los Angeles, Cal.
Alumni Council Representative: JOHN C. CHASE, '74.

DETROIT TECHNOLOGY ASSOCIATION.

The club was founded August 1, 1908, in Detroit, Mich., and now has one hundred and eight members. All graduates and former students of the Institute, living in or near Detroit are eligible for membership. The annual meeting with election of officers is held the latter part of January. An outing is held in the summer and other meetings are held quarterly, or more often if desired. The purpose of the association is mainly to get all Technology men in Detroit well acquainted with each other and the secretary will be very glad to receive notice of the arrival of new men in the vicinity.

President: WILLIAM R. KALES, '92.
Vice-President: GEORGE R. ANTHONY, '98.
Secretary-Treasurer: DONALD V. WILLIAMSON, '10, Care of The Detroit Edison Co., Whitney Bldg., Detroit, Mich.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, SECRETARY-TREASURER, WALDSO TURNER, '05, JOHN M. HASTINGS, JR., '13.
Alumni Council Representative: EVERETT MORSS, '85.

TECHNOLOGY ASSOCIATION OF OREGON.

The club was founded November 19, 1908, in Portland, Ore., and at present numbers about forty members. Membership includes any one who has attended or taught for one year at the Institute.

Luncheons are held once a month during the winter and business meetings whenever necessary.

President: ROBERT S. EDWARDS, '02.

Secretary-Treasurer: ROBERT E. CUSHMAN, '06, 266 East 27th St., N., Portland, Ore.

Alumni Council Representative: ANDREW D. MACLACHLAN, '96.

TECHNOLOGY CLUB OF PUGET SOUND.

This club was organized in Seattle, Wash., November 20, 1908, and includes in its membership all Technology men in the Puget Sound country. Regular luncheons are held in Seattle, where the majority of the members live, once a month, usually the third Friday.

The club has about seventy members. The officers will be very glad to be notified of any Tech men who are visiting in or passing through this district, so that arrangements may be made for them to meet the Western men. Headquarters are at the Anderson Supply Co., 111 Cherry St., Seattle, Wash.

President: MAURICE P. ANDERSON, '10.

Vice-President: WALTER A. GLEASON, '97.

Secretary-Treasurer: JOSEPH DANIELS, '05, 5511 University Blvd., Seattle, Wash.

Alumni Council Representative: DON GALUSHA, '04.

TECHNOLOGY CLUB OF MILWAUKEE.

The Technology Club of Milwaukee, organized in 1909, in Milwaukee, Wis., has now twenty-nine active members. The members lunch together every Thursday noon at the

University Club of Milwaukee, and all visiting Technology men are invited to attend. Information in regard to Tech men visiting or locating in or near Milwaukee is desired by the secretary.

Secretary: MITCHELL MACKIE, '05, Commercial Auto Co., Milwaukee, Wis.

Alumni Council Representative: ALEXANDER MACOMBER, '07.

TECHNOLOGY CLUB OF ROCHESTER.

This club was organized in January, 1910, in Rochester, N. Y., and has about fifty members residing in Rochester and the vicinity. Any one who has studied or taught at the Institute is eligible to membership and all Tech men are cordially welcome to the meetings. The meetings are primarily of a social character and are called at intervals by the executive committee. The annual meeting takes place on the last Monday in October. It is hoped that Tech men visiting Rochester will make themselves known to the officers of the club.

President: WILLIAM E. HOYT, '68.

First Vice-President: JAMES H. HASTE, '96.

Second-Vice-President: ADOLPH LOMB, '88.

Secretary-Treasurer: CHARLES E. MEULENDYKE, '11, 21 Culver Road, Rochester, N. Y.

Alumni Council Representative: HOWARD C. TURNER, '03.

Executive Committee: H. O. STEWART, '09, CLARENCE C. CULVER, '96, and HENRY H. TOZIER, '96.

TECHNOLOGY ASSOCIATION OF JAPAN.

This association was organized in April, 1911, in Tokio, and is in a flourishing condition.

Secretary-Treasurer: TAKUMA DAN, '78, 344 Awoyama, Harajiku, Tokio, Japan.

Alumni Council Representative: WILLIAM H. KING, '94.

ST. LOUIS SOCIETY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

This society was organized April 11, 1911, in St. Louis, Mo., on the occasion of a banquet in celebration of the semi-centennial of the founding of the Institute, by seventeen Technology men of St. Louis and vicinity. An annual banquet in April, an outing in July, and occasional luncheons during the winter months have comprised the society's activities since its organization. The society now numbers twenty members. There are about seventy Technology men in St. Louis and vicinity on the secretary's list. Newcomers are requested to send their names and addresses to the secretary-treasurer.

Chairman: JOHN L. MAURAN, '89.
Secretary-Treasurer: AMASA M. HOLCOMBE, '04, 510 Pine Street, St. Louis, Mo.
Assistant Secretary: BENJAMIN F. THOMAS, JR., '13.
Alumni Council Representative: CHARLES M. SPOFFORD, '93.

THE TECHNOLOGY CLUB OF NEW HAMPSHIRE.

This club was organized June 27, 1911, in Manchester, N. H., with a membership of twenty-four men from Manchester and vicinity. Through the enthusiastic efforts of its first members it now numbers fifty-seven, out of a total of one hundred and twenty-five alumni in the State.

There are two regular meetings a year, one in the summer at the home of Mr. E. W. Rollins, '71, Three Rivers Farm, Dover, N. H., and one at Manchester, N. H., in the winter.

The present officers of the club are:

President: EDWARD W. ROLLINS, '71.
Vice-President: NORWIN S. BEAN, '94.
Secretary-Treasurer: WALTER D. DAVOL, '06, Amoskeag Bank Building, Manchester, N. H.
Alumni Council Representative: ANDREW FISHER, JR., '05.

TECHNOLOGY ASSOCIATION OF WORCESTER COUNTY.

This organization was formed in 1911 in Worcester, Mass., and draws its membership from a constituency of about sixty former students of the Institute, who are now residents of Worcester County. A constitution has been drawn up, but not yet published. It is proposed to hold meetings semi-annually or oftener, the annual meeting being in March.

President: ALBERT S. HEYWOOD, '92.
Vice-President: FRANK E. DAVIS, '83.
Secretary-Treasurer: LOUIS E. VAUGHAN, '02, 4 Fenimore Road, Worcester, Mass.
Executive Committee: WALDO E. BUCK, '76, and ORVILLE B. DENISON, '11.

TECHNOLOGY CLUB OF ALBANY AND SCHENECTADY.

This club was organized December 20, 1911, in Albany, N. Y., and has a membership of nearly one hundred and fifty in Albany, Troy, Schenectady and vicinity. Its meetings take the form of informal dinners at intervals of about two months throughout the school year; they are held in the different cities, in rotation.

President: RALPH C. ROBINSON, '01.
Vice-President: RUSSELL SUTER, '00.
Secretary-Treasurer: N. J. KINGSBURY, '02, General Electric Co., Schenectady, N. Y.

ATLANTA M. I. T. ALUMNI ASSOCIATION.

This association was organized in January, 1912, in Atlanta, Ga. Social gatherings and informal dinners are held at frequent intervals, the time and place varying according to convenience.

The present officers of the club are:

President: L. M. THACHER, '86.
Secretary: HARRY M. KEYS, '99, 78 South Pryor Street, Atlanta, Ga.

THE SOUTHEASTERN TECHNOLOGY ASSOCIATION.

This association was formed in February, 1912, with headquarters in Birmingham, Ala., and now has twenty-two members.

Secretary: ARTHUR F. MOHAN, '08, Care of Kirkpatrick Sand and Cement Co., Birmingham, Ala.
Alumni Council Representative: HARRY S. MORK, '99.

INTERMOUNTAIN TECHNOLOGY ASSOCIATION.

This club was organized April 27, 1912, in Salt Lake City, Utah, and now numbers about thirty members, who are located in the Intermountain States. The annual meeting occurs early in January. Numerous other gatherings are held during the year, the time and place varying according to convenience.

President: CHARLES S. MCDONALD, '99.
First Vice-President: GEORGE S. HUMPHREY, '10.
Secretary-Treasurer: WALTER H. TRASK, JR., '06, University Club, Salt Lake City, Utah.
Alumni Council Representative: GEORGE E. RUSSELL, '00.

SOUTHWESTERN ASSOCIATION, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

This organization was formed in Kansas City on November 16, 1912. Fifteen Technology men located in Kansas and Missouri were present. The membership districts were defined and a constitution adopted.

President: GEORGE M. HOLBROOK, '00.
Vice-President: FRANK CUSHMAN, JR., '00.
Secretary-Treasurer: HERMANN C. HENRICI, '06, 715 Reserve Bank Building, Kansas City, Mo.
Alumni Council Representative: W. LYMAN UNDERWOOD, '98.

THE TECH CLUB OF THE UNIVERSITY OF ILLINOIS.

This club was organized in December, 1912, in Urbana, Ill. The membership is composed of about twenty Technology men now residing in the neighborhood of Urbana and Champaign. All Tech men coming to Illinois are invited to put themselves into communication with the club.

President: ARTHUR C. WILLARD, '04.
Secretary-Treasurer: ELMER A. HOLBROOK, '04, 915 West Green St., Urbana, Ill.

THE TECHNOLOGY CLUB OF HAWAII.

The club was founded in 1912, in Honolulu, and now has a membership of twenty-four.

President: JACOB F. BROWN, '78.
Secretary-Treasurer: NORMAN WATKINS, '98, Box 767, Honolulu, Hawaii.
Executive Committee: PRESIDENT, SECRETARY-TREASURER and WILLIAM C. FURER, '06.
Alumni Council Representative: EDWIN S. WEBSTER, '88.

TECHNOLOGY CLUB OF PITTSFIELD.

This club was organized in Pittsfield, Mass., February 6, 1913. Fifteen alumni were present. All former students of the Institute now residing in Berkshire County are particularly urged to interest themselves in this organization.

President: EDWARD A. JONES, '87, P. O. Box 1623, Pittsfield, Mass.
Executive Committee: THE PRESIDENT, VICE-PRESIDENT, CHARLES W. POWER, '89, GEORGE C. HARDING, '89, PETER F. MCLAUGHLIN, '08, W. C. SLADE, '12.
Alumni Council Representative: WALTER B. SNOW, '82.

TECHNOLOGY CLUB OF LOWER CANADA.

The Technology Club of Lower Canada was established in Montreal, April 21, 1913. Headquarters of the association are at present located at 357 St. Catherine Street, W.

The officers for the following year who were elected at the last annual meeting are:—

President: DAVID J. SPENCE, '97.

Vice-President: H. O. KEAY, '00.

Secretary-Treasurer: EDWARD B. EVANS, '06, 357 St. Catherine St., W., Montreal, Quebec.

Board of Governors: GEORGE R. HECKLE, '99, WILLIAM E. WEST, '99, F. J. FRIEDMAN, '08.

Alumni Council Representative: GEORGE W. VAILLANT, '92.

TECHNOLOGY CLUB OF LAKE SUPERIOR.

The Technology Club of Lake Superior was organized in Duluth, Minnesota, January 1, 1914, and since then has been holding monthly meetings on the second Saturday of every month. These meetings are held in the evening, and after an informal supper the members become better acquainted with each other and talk over matters of interest in connection with the Institute.

President: SAMUEL B. SHELDON, '89.

Vice-President: WALTER G. ZIMMERMANN, '98.

Secretary: FLOID M. FULLER, '06, 812 Torrey Building, Duluth, Minn.

Executive Committee: PRESIDENT, VICE-PRESIDENT, SECRETARY, and WILLIAM PEYTON, '90.

INDIANA ASSOCIATION M. I. T.

The alumni of the Institute of Technology living in the vicinity of Indianapolis met at the University Club of that city on January 10, 1914, and perfected a local organization,

to be known as the Indiana Association M. I. T. The membership is now thirty-six. Luncheons are held on the fifteenth of every month at the University Club. A picnic and annual dinner are regular functions and in addition many special activities are held during the year.

President: J. LLOYD WAYNE 3d, '96.
Vice-President: WILLIAM G. WALL, '96.
Secretary: WILSON B. PARKER, '88, 805 Board of Trade, Indianapolis, Ind.

DAYTON TECHNOLOGY ASSOCIATION.

In March, 1914, it was discovered that there were twenty-five good and loyal Technology men making their homes in Dayton, Ohio. A self-appointed committee arranged for an informal dinner which was held at the Phillips House in Dayton on April 2d. The Dayton Technology Association was organized by the election of the following officers:

President: WALTER G. WUICHET, '89.
Vice-President: HENRY M. WAITE, '90.
Secretary-Treasurer: JAMES E. BARLOW, '05, City Hall, Dayton, Ohio.

TECHNOLOGY CLUB OF BRIDGEPORT.

Sixteen Technology men attended a dinner at the University Club, Bridgeport, Conn., Friday, April 17, 1914, and with Mr. Clinton E. Woods, '84, acting as chairman, a business meeting was held at which it was decided to form a permanent Alumni Association to be known as the Technology Club of Bridgeport. The following officers were elected:

President: HALSEY R. PHILBRICK, '06.
Secretary: WILBUR A. SWAIN, '15, Criterion Club, Bridgeport, Conn.
Treasurer: PHILIP W. DALRYMPLE, '12.
Committee on Proceedings: P. W. DALRYMPLE, '12, EDWARD G. GALLAGHER, '00, WALTER D. ALLEN, '11.

TECHNOLOGY CLUB OF MONTANA.

On July 19, 1914, eleven men from Butte and Anaconda, Montana, and one from Boston, Professor Robert H. Richards, '68, met in Butte for a dinner and a general good time.

The result of the occasion was the organization of the Technology Club of Montana, with the following officers:

President: CHARLES W. GOODALE, '75.
Vice-President: RALPH HAYDEN, '06.
Secretary-Treasurer: CHARLES D. DEMOND, '93, 704 Main St., Anaconda, Mont.

TECHNOLOGY CLUB OF CHINA.

This club was formed in Shanghai, China, in 1915. Luncheons are held on the first Saturday of every month at the Carlton Café at 12.30 and are well attended by the Tech men in this vicinity who are always glad to meet new comrades in this part of the world.

President: WILLIAM W. STEVENS. '98.
Secretary: WILLIAM A. ADAMS, '08, 39 Nanking Road, Shanghai, China.

TECHNOLOGY CLUB OF SPRINGFIELD.

Seventy-five former students of the Massachusetts Institute of Technology, all residents of Springfield, Mass., met at the Worthy Hotel, April 6, 1915, and after a banquet formed the Technology Club of Springfield. The officers of the club are:

President: FREDERIC W. FULLER, '96.
Secretary-Treasurer: GEORGE W. HAYDEN, '95, 283 Worthington Street, Springfield, Mass.
Executive Committee: EDMUND P. MARSH, '89, FRANK H. PAGE, '85, MAURICE S. CHAPIN, '10.

THE TECHNOLOGY CLUB OF FALL RIVER.

The Technology Alumni of Fall River held a meeting at the Quequechan Club, April 21, 1915, and expressed their approval of the founding of an association which would be helpful to the community and of benefit to members of the organization. The association was formed with the election of the following officers:

President: JOSEPH E. NUTE, '85.

Secretary: EARL R. HAMILTON, '10, Fall River Gas Works Co., Fall River, Mass.

Treasurer: ARTHUR E. HIRST, '13.

Executive Committee: PRESIDENT, SECRETARY-TREASURER, GEORGE S. DARLING, '13, and CHARLES H. WARNER, '89.

TECHNOLOGY CLUB OF CHILE.

The Technology Club of Chile was organized August, 1915, at a dinner held at Rancagua, Chile. The following men comprised the charter members: William L. Stevens, '00, John P. Chadwick, '07, Richard F. Goodwin, Jr., '10, John L. Bray, '12, Edmund G. Brown, '13, William S. Conner, '14, Franklin Osborn, 2nd, '11.

SECRETARIES OF THE CLASSES.

Robert Hallowell Richards	'68	Frederic Harold Fay	'93
Howard Adams Carson	'69	Samuel Cate Prescott	'94
Charles Robert Cross	'70	William Henry Winkley	'95
Edward Warren Rollins	'71	Charles E. Locke	'96
Calvin Frank Allen	'72	John Arthur Collins, Jr.	'97
Samuel Everett Tinkham	'73	Arthur A. Blanchard	'98
Charles French Read	'74	William Malcolm Corse	'99
Edward A. W. Hammatt	'75	Ingersoll Bowditch	'00
John Ripley Freeman	'76	Robert Longfellow Williams	'01
Richard Augustus Hale	'77	Frederick Huston Hunter	'02
Edmund Pomeroy Collier	'78	Myron Henry Clark	'03
Edwin Child Miller	'79	Henry Warren Stevens	'04
George Hunt Barton	'80	Grosvenor DeWitt Marcy	'05
Frank Elden Came	'81	Charles F. W. Wetterer	'06
Walter Bradlee Snow	'82	Bryant Nichols	'07
Harvey Stuart Chase	'83	Rudolph Boynton Weiler	'08
Harry Walter Tyler	'84	Carl William Gram	'09
Isaac White Litchfield	'85	Charles Edward Green	'10
Arthur Graham Robbins	'86	Orville Boardman Denison	'11
Edward Galbraith Thomas	'87	Randall Cremer	'12
William Gage Snow	'88	Frederick David Murdock	'13
Walter Harrington Kilham	'89	Charles Parker Fiske	'14
George L. Gilmore	'90	William Benjamin Spencer	'15
Howard Carleton Forbes	'91	Donald Blake Webster	'16
William Atkinson Johnston	'92	Walter Albert Wood	'17

James Councill Wooten 2d '18

Statistics of the Graduates.

DOCTORS OF PHILOSOPHY.

The degree of Doctor of Philosophy was first conferred by the Institute in 1907, and of the twenty candidates upon whom it has been bestowed six have received their Bachelor's degree from the Institute and three have received the Master's degree.

DOCTOR OF ENGINEERING.

The degree of Doctor of Engineering was first granted by the Institute in 1910, and the four candidates upon whom it was bestowed had previously received the Bachelor's degree from the Institute, and two had also received the Master's degree.

MASTERS OF SCIENCE.

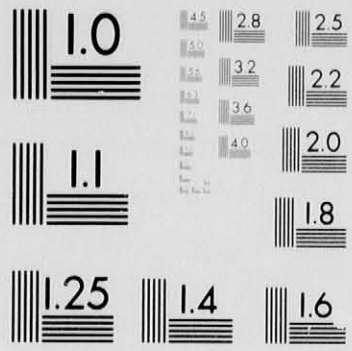
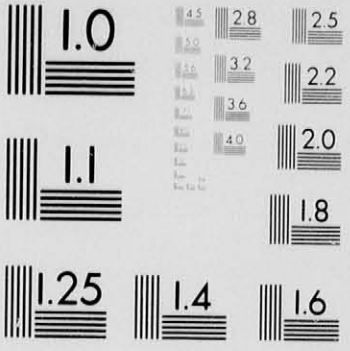
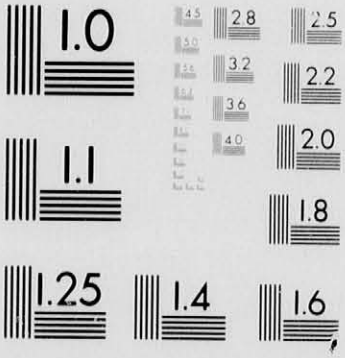
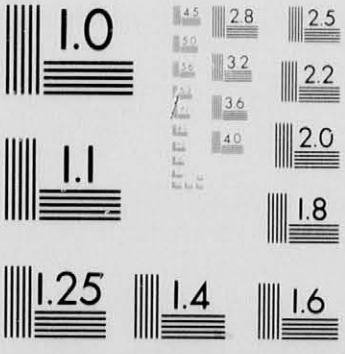
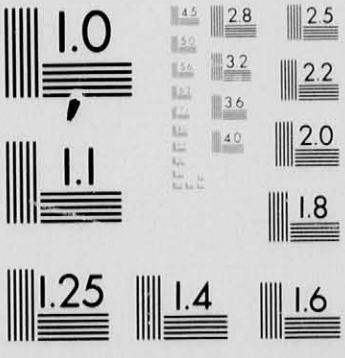
The degree of Master of Science was first granted by the Institute in 1886, and since then the title has been conferred two hundred and sixty-two times. Of the total number of recipients of the Master's degree one hundred and forty-seven received their Bachelor's degree also from the Institute.

MASTERS OF SCIENCE BY YEARS.

1886	1	1898	5	1907	15
1887	1	1899	3	1908	12
1890	1	1901	4	1909	19
1893	1	1902	8	1910	19
1894	1	1903	7	1911	20
1895	3	1904	12	1912	22
1896	3	1905	18	1913	20
1897	4	1906	9	1914	25
				1915	29
				Total	262

GRADUATES BY COURSES.

The following table exhibits the number of persons who have received the Bachelor's degree in each of the several Courses since the foundation of the school.


1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8

1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8

1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8

1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8

1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8

GRADUATES BY YEARS AND COURSES.

YEAR.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Natural History or Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-chemistry.	Total.
1868	6	1	6	—	—	—	—	—	1	—	—	—	—	—	14
1869	2	2	—	—	1	—	—	—	—	—	—	—	—	—	5
1870	4	2	2	—	1	—	—	—	1	—	—	—	—	—	10
1871	8	2	5	—	2	—	—	—	—	—	—	—	—	—	17
1872	3	1	5	—	3	—	—	—	—	—	—	—	—	—	12
1873	12	2	3	1	7	—	—	—	1	—	—	—	—	—	26
1874	10	4	1	1	—	—	—	—	2	—	—	—	—	—	18
1875	10	7	6	1	1	—	—	1	2	—	—	—	—	—	28
1876	12	8	8	—	5	—	2	3	4	—	—	—	—	—	42
1877	12	6	8	4	2	—	—	—	—	—	—	—	—	—	32
1878	8	2	2	3	3	—	—	—	1	—	—	—	—	—	19
1879	6	8	3	1	3	—	1	1	—	—	—	—	—	—	23
1880	3	—	3	—	1	—	—	—	1	—	—	—	—	—	8
1881	3	5	6	3	8	—	1	—	2	—	—	—	—	—	28
1882	2	5	5	3	6	—	1	1	1	—	—	—	—	—	24
1883	3	7	5	1	3	—	—	—	—	—	—	—	—	—	19
1884	5	6	13	—	12	—	—	—	—	—	—	—	—	—	36
1885	4	7	8	2	4	2	—	—	1	—	—	—	—	—	28
1886	9	23	7	1	7	10	1	—	1	—	—	—	—	—	59
1887	10	17	8	1	9	8	1	1	3	—	—	—	—	—	58
1888	11	25	4	5	10	17	3	1	1	—	—	—	—	—	77
1889	14	24	5	3	8	17	1	1	2	—	—	—	—	—	75
1890	25	28	3	5	13	18	3	2	6	—	—	—	—	—	103
1891	18	26	4	6	11	23	3	3	1	7	—	1	—	—	103
1892	22	26	4	13	7	36	6	1	7	4	6	1	—	—	133
1893	25	30	5	2	8	41	2	—	6	8	—	2	—	—	129
1894	21	31	4	14	11	33	1	3	5	12	3	—	—	—	138
1895	25	30	3	15	14	33	—	2	4	11	4	—	5	—	144*
1896	26	34	10	24	17	48	3	3	7	7	4	3	5	—	190*
1897	25	40	7	16	20	33	2	3	7	12	4	1	9	—	179
1898	32	41	7	29	25	33	3	4	6	9	3	—	7	—	199
1899	30	37	9	22	22	32	2	2	1	10	1	—	8	—	173*
1900	32	34	21	21	19	23	3	3	5	11	4	—	9	—	185
1901	37	39	18	21	17	25	1	1	6	14	4	1	16	—	200
1902	24	46	14	18	14	35	5	3	3	9	7	—	14	—	192
1903	26	37	27	15	13	39	1	3	1	10	4	1	12	1†	100
1904	34	45	32	24	15	34	3	5	5	7	2	1	17	8†	232
1905	46	54	26	12	23	31	3	—	3	13	5	1	24	3†	244
1906	47	69	38	22	21	37	2	4	—	10	6	—	19	3†	278
1907	37	52	22	21	10	32	—	—	—	14	3	2	10	5†	208
1908	48	61	19	19	16	38	4	—	—	15	2	—	5	2†	229
1909	51	41	30	18	12	42	5	3	—	13	9	—	5	3	232
1910	57	57	24	18	10	36	3	—	2	18	12	—	11	3	251
1911	46	49	17	10	12	49	1	1	2	19	15	—	6	5	231*
1912	55	47	21	21	7	52	4	2	1	31	14	—	3	3	260*
1913	58	50	20	25	12	43	2	1	—	30	15	—	4	8	268
1914	60	65	17	19	9	50	6	1	4	37	19	—	8	8	300*
1915	48	68	5	28	21	41	3	3	2	32	—	11	7	9	277*
Totals	1,107	1,307	518	482	475	987	82	62	107	364	157	14	204	61	5,908*

Names counted twice, students graduating in two different years	22
Bachelors of Science	5,886*
Masters of Science, not including 129 counted above	133
Doctors of Philosophy and of Engineering, not including 9 counted above	15
Total	6,034*

*Deducting names counted twice (students graduating in two courses).

†Prior to 1909 this Course was designated as Option 3 (Electro-chemistry) of Course VIII.

Titles of Theses

OF SUCCESSFUL CANDIDATES FOR GRADUATION, JUNE, 1914.

Candidates for the Degree of Doctor of Philosophy.

FREDERIC HASTINGS SMYTH — Boston

Awarded the degree of Bachelor of Arts by Hamilton College in June, 1909. Studied Chemistry at the University of Berlin during the winter of 1909–1910. Awarded in June, 1914, the degree of Master of Arts by Hamilton College and of Master of Science in Chemistry by this Institute. Pursued advanced studies in Chemistry and Mathematics at this Institute from September, 1913, to June, 1915, carrying on investigations on the potential of the bismuth electrode and on sodium lead compounds in liquid ammonia solutions. Presented to the Faculty in May, 1915, a thesis describing these investigations.

LOUIS WEISBERG — Dallas, Texas

Awarded the degree of Bachelor of Arts by the University of Texas in June, 1912. Pursued advanced studies in Chemistry and Mathematics at this Institute from September, 1912, to June, 1915. Austin Fellow in Chemistry, 1914–1915. Carried on during this period an investigation of the equilibrium of the reaction between carbon and ammonia at high temperatures and a study of the free energy of dilution of hydrochloric acid. Presented to the Faculty in May, 1915, a thesis describing these investigations.

Candidate for the Degree of Doctor of Engineering.

ROBERT JOSEPH WISEMAN — Arlington

Awarded the Degree of Bachelor of Science in Electrical Engineering by the Massachusetts Institute of Technology, June, 1912.

Assistant in Electrical Engineering at the Massachusetts Institute of Technology, 1912–1913.

Pursued advanced studies in Electrical Engineering, Mathematics, and Electrochemistry at this Institute from September, 1913, to June, 1915.

Carried on during this period an investigation on the dielectric strength of cables. Presented to the Faculty on May 26, 1915, a thesis describing these investigations.

During the year 1914–1915, Saltonstall Fellow.

Candidates for the Degree of Master of Science.

COURSE I. CIVIL ENGINEERING.

HARRY LAKE BOWMAN, B.S. (As of Class of 1914) Philadelphia, Pa.
A Design for a Two-hinged Steel Arch Highway Bridge.

LOUIS MITCHELL, B.S. Syracuse, N.Y.
A Review of the Sewerage System and the Sewage Disposal Works of Brockton, Massachusetts.

COURSE II. MECHANICAL ENGINEERING.

JOHN HARLAND BILLINGS, B.A.Sc. Leskard, Ont.
An Investigation of Bearings and the Design of a New Ball and Roller Bearing Testing Machine.

CHARLES HUGH CHATFIELD, S.B. Waterbury, Conn.
An Experimental Investigation of Compound Stresses in Steel Tubes.

WILLIAM GREEN, S.B. Waverley
Absorption Refrigeration Applied to Small Units; A Study of Machines and Refrigerants.

RAYMOND DOUGLAS MCCART, S.B. Dorchester
Ice Making by the Can System.

COURSE III. MINING ENGINEERING AND METALLURGY.

CLYDE POLHEMUS ROSS, S.B. Brookline
A Design of a Plant for a Small Copper Mine. (*Assisted by T. C. Hsi.*)

COURSE IV. ARCHITECTURE.

WALTER JOSEPH HAUSER, S.B. Dorchester
A Design for a Memorial Hall, Library, and Museum for a Military School.

JOHN HAROLD MACKINNON, S.B. Seattle, Wash.
An Investigation of a Design for a Strauss Trunnion Bascule Bridge.

JOHN ALDEN ROOT, S.B. Denver, Colo.
A Design for a Church School for Boys.

FRANCIS WHITTEN, Jr., S.B. Malden
A Design for a Civic Center for a New England City.

COURSE V. CHEMISTRY.

HUANG CHEN, B.S. Kwong Chow, China
An Investigation of Carbonation and Allied Processes as Applied to Low-Grade Cane Products.

LESTER FRANCIS HOYT, S.B. Springfield
Investigations into the Chemistry of Commercial Glucose.

COURSE VI. ELECTRICAL ENGINEERING.

RUPEN EKSERGIAN Somerville
An Investigation of Core Losses in Electric Machinery.

GOOEY YUE FONG, B.S. San Francisco, Cal.
The Breakdown Strength of Dielectrics between Disc Electrodes.

ANTONIO RIBEIRO GUIMARAES, B.S. Rio Preto, Brazil
The Hydro-electric Development at Ohio Pyle Falls, Ohio Pyle, Pennsylvania.

JAMES FRANK LESLIE, B.E.E. Winnipeg, Man.
Relief Valves for Hydraulic Power Plants.

PARK DANIEL MANBECK, A.B., B.S. East Cleveland, Ohio
The Determination of a Rational Future Policy for the Municipal Electric Plant of Danvers, Massachusetts.

HUGH GERARD PASTORIZA, S.B. Houston, Texas
The Cost of Hydro-electric Plants.

CLAIRE WILLIAM RICKER, S.B. Pasadena, Cal.
Tests on Artificial Transmission Line.

GORDON DUDLEY ROBINSON, M.E. Baltimore, Md.
The Potential Water Power of New England.

LEON HUBERT WEBBER, S.B. North Brookfield
Electrostatic Potentials about Transmission Conductors.

JESHINE ZOHN ZEE, S.B. Shanghai, China
The Capitalization of an Electrical Railway.

COURSE X. CHEMICAL ENGINEERING.

CLARK SHOVE ROBINSON, S.B. South Boston

I. The Production of Lampblack from Carbon Monoxide.

II. A Study of the Formation of Hydrocyanic Acid at High Temperatures.

III. The Effect of Gas Velocity on the Transfer of Heat from a Solid to a Gas. (*With E. E. Snyder.*)

ELWYN EDWARD SNYDER, Jr., S.B. Newton

I. The Influence of Temperature and Time of Heating upon the Color of the Iron Oxide Produced from Ferrous Sulfate.

II. The Effect of Gas Velocity on the Transfer of Heat from a Solid to a Gas. (*With C. S. Robinson.*)

NAVAL ARCHITECTURE AND MARINE ENGINEERING.

COURSE XIII.

WAI GYIAO LOO, S.B. Ningpo, China

An Investigation of the Longitudinal Stability of a Submarine Boat.

COURSE XIIIA.

CHARLES LEES BRAND, U.S.N. Beverly, N.J.

The Effect of Sweeping Back the Wings of an Aeroplane. (*With H. E. Rossell.*)

HENRY EASTIN ROSSELL, U.S.N. New Brighton, N.Y.

The Effect of Sweeping Back the Wings of an Aeroplane. (*With C. L. Brand.*)

AERONAUTICAL ENGINEERING.

HOU-KUN CHOW, S.B. Shanghai, China

The Experimental Determination of the Damping Coefficients of an Aeroplane.

COURSE XIV. ELECTROCHEMISTRY.

LOUIS ALEXANDER WILSON, S.B. Dorchester

An Investigation of the Effect of Pressure on Overvoltage.

Candidates for the Degree of Bachelor of Science.

In Two Courses.

Wai Po Loo — Canton, China

Course II.

An Investigation of the Longitudinal Stability of an Aeroplane. (*With O. E. Strahlmann.*)

Course XIII.

An Investigation of Aeroplane Wing Struts in Compression. (*With J. R. L. Santos, II.*)

Otto Edward Strahlmann — San Diego, Cal.

Course II.

An Investigation of the Longitudinal Stability of an Aeroplane. (*With W. P. Loo.*)

Course VI.

The Blondel Double Reaction Method of Calculating Regulation of Alternators. (*With P. L. Alger, VI., and E. W. Brown, VI.*)

In One Course.

Course I. Civil Engineering.

Albert Hovey Anderson — Lawrence

A Proposed Relocation and Design for a Highway Bridge on Union Street, Lawrence, Massachusetts.

Sarkis Manoog Bagdoyan — Aintab, Turkey

A Study of Concrete Roads with Respect to their Development and Adaptability to Various Kinds of Traffic.

Joseph Woodward Barnwell, Jr., B.S. — Charleston, S.C.

A Design for a Vertical Framed Lock Gate.

Edgar Dorus Bascom — Gill

A Project for the Drainage of Hockomock Swamp in the Towns of Easton and West Bridgewater, Massachusetts.

Alejandro Bibolini, B.A. — Asuncion, Paraguay

A Design for a Sewerage System for Weymouth, Massachusetts. (*With J. Cohen.*)

Fritz Charles Blomquist — Lynn

A Comparison of the Various Types of Reinforced Concrete Flat Slab Floors.

ARTHUR HAZARD BOND, B.S. Springfield
A Project for the Revision of the Plymouth Terminal of the New York, New Haven and Hartford Railroad.

LLOYD HAMILTON CHELLMAN Roslindale
An Experimental Investigation of the Method of Measuring the Velocity of Water in Open Channels by Means of a Moving Vane. (*With P. Connor.*)

HORACE LITTLE CLARK Exeter, N.H.
An Investigation of the Effect of "Frostproofing" upon Concrete.

ALFRED HENRY CLARKE, A.B. Portland, Ore.
An Experimental Investigation of the Value of Zinc Chloride as a Preservative of Structural Timber.

JACOB COHEN Jersey City, N.J.
A Design for a Sewerage System for Weymouth, Massachusetts. (*With A. Bibolini.*)

PAUL CONNOR Dorchester
An Experimental Investigation of the Method of Measuring the Velocity of Water in Open Channels by Means of a Moving Vane. (*With L. H. Chellman.*)

MARSHALL BERTRAND DALTON Portland, Me.
An Experimental Determination of the Coefficient of Discharge for Use in the Weir Formula for a Dam at Newton Lower Falls, Massachusetts. (*With M. B. Pinkham.*)

FREDERICK AUGUSTUS WILLIAM DAVIS Pelham, N.Y.
A Study of Recent Developments in Passenger Terminal Design.

HENRY DOWST, Jr. Manchester, N.H.
An Experimental Investigation of the Continuous Flow of Water from the Neponset Reservoir, Foxborough, Massachusetts. (*With J. Hyneman.*)

BROR VIKING ENEBUSKE Brookline
A Design for a Sewerage System for Whitman, Massachusetts. (*With W. Jennings.*)

SAMUEL MICKLE FOX, Jr. Torresdale, Pa.
An Experimental Investigation of the Effect of Bridge Piers upon River Flow.

JOHN SEARS GALLAGHER, A.B. Waco, Texas
A Study of the Development of the Use of Steel in Freight Car Construction.

EDWIN CLARENCE GERE (As of Class of 1914) Syracuse, N.Y.
A Design for Imhoff Tanks for a Sewage Disposal System for Oneida, New York.

CHARLES LORING HALL Dorchester
An Experimental Investigation of the Strength of Rivets in Tension. (*With S. Highley.*)

SEWARD HIGHLEY Medford
An Experimental Investigation of the Strength of Rivets in Tension. (*With C. L. Hall.*)

JOHN HYNEMAN Jamaica Plain
An Experimental Investigation of the Continuous Flow of Water from the Neponset Reservoir, Foxborough, Massachusetts. (*With H. Dowst, Jr.*)

WILLIAM JENNINGS Salt Lake City, Utah
A Design for a Sewerage System for Whitman, Massachusetts. (*With B. V. Enebuske.*)

GERALD MARCY KEITH Brooklyn, N.Y.
An Investigation of the Effect of a Variable Moment of Inertia upon the Stresses in Swing Bridge Trusses.

HOWARD LANGDON KING, A.B., A.M. New York City, N.Y.
An Experimental Investigation of the Determination of Stream Discharge by Chemical Methods. (*With R. O. Bailey, XI.*)

NASSIME SOLOMON KLINK Lawrence
A Design for a Spheroidal Gas Tank.

JOSEPH MASON LIVERMORE Boston
A Design for a Water Supply System for Lunenburg, Massachusetts. (*With N. Stone.*)

GAETANO MACONI Newton Centre
An Experimental Investigation of the Waterproofing Qualities of Various Substances when Applied to Concrete. (*With H. Niemann.*)

RALPH READ MALCOLM Stoughton
Designs for a Plate Girder and a Steel Truss Bridge across the Charles River at Auburndale, Massachusetts, and a Comparison of their Relative Merits. (*With H. J. Murphy.*)

ERALBERT TALMADGE MILLER (As of Class of 1914) Columbus, Ga.
A Plan for a Proposed Hydro-electric Development at Croyden Flats, New Hampshire.

CHARLES LESTER MORSE — Lancaster, N.H.
An Investigation of the Water Supply System at Winchester, Massachusetts.

PERCIVAL JUDSON MUNN — Lowell
An Investigation of the Strength and Condition of the Pawtucket Bridge at Lowell, Massachusetts, with a Preliminary Design for a Concrete Arch Bridge.

HARRY JOSEPH MURPHY — Wollaston
Designs for a Plate Girder and a Steel Truss Bridge across the Charles River at Auburndale, Massachusetts, and a Comparison of their Relative Merits. (*With R. R. Malcolm.*)

HENRY NIEMANN — West Newton
An Experimental Investigation of the Waterproofing Qualities of Various Substances when Applied to Concrete. (*With G. Maconi.*)

WALDO FRANCIS PIKE — Cambridge
A Photographic Survey of Gardner's Lake, Maine. (*With J. Potter.*)

MILLARD BARTLETT PINKHAM — Roxbury
An Experimental Determination of the Coefficient of Discharge for Use in the Weir Formula for a Dam at Newton Lower Falls, Massachusetts. (*With M. B. Dalton.*)

JESSE POTTER — Concord
A Photographic Survey of Gardner's Lake, Maine. (*With W. F. Pike.*)

EDWIN DANA PRATT — E. Orange, N.J.
A Study of a Public Market System for the City of Boston. (*With C. P. Putnam, II., and E. A. Teeson, II.*)

FRANCIS PAUL SCULLY — Cambridge
An Experimental Investigation of the Compressive Strength of Cinder Concrete. (*With H. C. Sheils.*)

HENRY CONNOR SHEILS — Roxbury
An Experimental Investigation of the Compressive Strength of Cinder Concrete. (*With F. P. Scully.*)

WILLIAM HENRY SMITH — Dedham
A Design and a Comparison of the Relative Economy of a Plate Girder Bridge Masked with Concrete and a Reinforced Concrete Arch Bridge at Spring Street, West Roxbury, Massachusetts. (*With E. R. Stearns.*)

EDMUND RAND STEARNS — Derry, N.H.
A Design and a Comparison of the Relative Economy of a Plate Girder Bridge Masked with Concrete and a Reinforced Concrete Arch Bridge at Spring Street, West Roxbury, Massachusetts. (*With W. H. Smith.*)

EDWARD HOPKINSON STELLE — Brooklyn, N.Y.
A Study of Column Formulas including an Experimental Investigation of the Effects of Central and Eccentric Loading upon I-beam Columns. (*With L. H. Young, II.*)

NELSON STONE, B.S. — Wareham
A Design for a Water Supply System for Lunenburg, Massachusetts. (*With J. M. Livermore.*)

HERBERT ALFRED SWEET (As of Class of 1914) — Bridgewater
A Design for a Sewerage System for Bridgewater, Massachusetts.

HOWARD CUSHING THOMAS — Wellesley Hills
A Study for the Extension of Chestnut Street over the Tracks of the Boston & Albany Railroad at Wellesley Hills, Massachusetts.

WALTER GLADSTONE TIRRELL — South Chatham
An Efficiency Test on the Hydro-electric Development at Shelburne Falls, Massachusetts.

CHARLES JOHNSON WARD, B.S. — Newark, Ohio
A Study of a Hydro-electric Project on the Swift River, New Hampshire. (*With C. F. Wolfe.*)

GEORGE HAROLD WARFIELD — Woonsocket, R.I.
An Investigation of the Water Supply System of Whitman, Massachusetts, with Reference to its Availability for Fire Protection. (*With C. W. Williams.*)

CHARLES WYATT WILLIAMS — Corning, N.Y.
An Investigation of the Water Supply System of Whitman, Massachusetts, with Reference to its Availability for Fire Protection. (*With G. H. Warfield.*)

CHRISTIAN FREDERICK WOLFE — Brooklyn, N.Y.
A Study of a Hydro-electric Project on the Swift River, New Hampshire. (*With C. J. Ward.*)

COURSE II. MECHANICAL ENGINEERING.

WALTER MURRAY AFRICA — Manchester, N.H.
The Determination of the Moisture Given off per Person per Hour. (*With R. L. Fletcher.*)

HERBERT WALFRED ANDERSON — Mattapan
The Discharge Capacity of Hydraulic Relief Valves. (*With R. B. Cady.*)

HAROLD REUBEN BASSETT — Bridgeport, Conn.
An Investigation of the Change in Young's Modulus for Steel, with Change in Temperature. (*With L. W. Prescott.*)

KSHITISH CHANDRA BASU, M.A. — Howrah, India
Force Fits.

NELSON EDWARD BAXTER — Hyde Park
The Determination of the Coefficient of Friction of Brake Linings under Different Loads and the Effect which Oils, Water, and Gasolene have upon it. (*With C. W. Olesen.*)

GERALD WALTER BLAKELEY, A.B. (As of Class of 1914) — Springville, N. Y.
An Evaporative Test of Boilers and a Duty Test of the Worthington High-Duty Pumping Engine at the Fall River Municipal Pumping Station. (*With G. A. Beach, 1914.*)

JOHN WESSON BOLTON, Jr. — Lawrence
A Study of the Physical Properties of Brake Linings. (*With E. L. Sullivan.*)

RUSH BOYD CADY — Syracuse, N.Y.
The Discharge Capacity of Hydraulic Relief Valves. (*With H. W. Anderson.*)

ORTON PLATT CAMP, A.B. — Waterbury, Conn.
A Study of the Effects of Tensional Overstrain in Steel. (*With A. U. Walter.*)

JAMES BRITTAIN CARSON, B.Sc. — Dartmouth, N.S.
The Development of a Perfect Caster. (*With F. L. Cook.*)

SIDNEY E. CLARK — Fredonia, N.Y.
A Study of the Strength of Concrete When Frozen After an Initial Set. (*With C. M. Runels, IV.*)

FRED LYSLE COOK — Boston
The Development of a Perfect Caster. (*With J. B. Carson.*)

HENRY FRANCIS DALEY — Fall River
A Test on a 200 Horse Power Marine Gas Engine Producer. (*With C. T. Dunn.*)

MARVIN JAMES DODD, B.S. — East Orange, N.J.
The Determination of the Probable Saving by a Turbo-Generator in Place of Four Reciprocating Units at the Lynn Gas and Electric Co. (*With A. S. Morrison.*)

CARL THEODORE DUNN — Dorchester
A Test on a 200 Horse Power Marine Gas Engine Producer. (*With H. F. Daley.*)

CHAUNCEY HILTON DURKEE — Haverhill
Economy Tests on a Battery of Vertical Boilers with Riley Stokers. (*With H. I. Lewis.*)

DEAN ABNER FALES — West Newton
The Design of a Machine for Determining the Machining Hardness of Metals. (*With W. S. Thomas.*)

RALPH LESLIE FLETCHER — Providence, R.I.
The Determination of the Moisture Given off per Person per Hour. (*With W. M. Africa.*)

HAMILTON SCHAEFFER FRAZINE — Buffalo, N.Y.
An Investigation of the Effect of an Air Filter on the Capacity and Operation of an Induction Motor. (*With C. W. Hale, IX.*)

JACOB GINSBURG — Lawrence
A Design for Apparatus for Testing Diagonal Boiler Braces. (*With J. F. Guthrie.*)

MORRIS GOLDENBERG — Roxbury
An Experimental Investigation of the Efficiency of Boiler Plate along Diagonal Lines.

THEODORE HERVEY GUETHING — Hollis, N.H.
Tests on a Modified Form of a Two Cycle Oil Engine.

JOHN FOSTER GUTHRIE — Waltham
A Design for Apparatus for Testing Diagonal Boiler Braces. (*With J. Ginsburg.*)

ALFRED EDGAR BURTON HALL — Portland, Me.
The Determination of the Strength of Rawhide Gear Teeth. (*With D. O. Hooper.*)

WALTER RICHARDSON HANCHETT — Lowell
A Determination of the Losses in a Boiler House and Pipe Line. (*With O. G. Norton.*)

HAROLD LEE HARLOW — Malden
Tests on Watches.

WILLIAM BERNARD HARRIS, A.B. (As of Class of 1914) — Villa Nova, Pa.
The Determination of the Breaking Strength, Modulus of Elasticity and Coefficient of Expansion of "Copper Clad" Steel Wire. (*With D. W. Douglas, 1914.*)

OTTO WILLIAM HILBERT — Holyoke
A Design of Apparatus for the Study of the Vibratory Motion of Small Internal Combustion Engines. (*With J. Kuttner.*)

JOHN COLBURN HOLMES, A.B. Franklin, N.H.
Heat Transmission through Cast Iron Radiators. (*With A. D. Wheeler, Jr.*)

DONALD OREN HOOPER Woodfords, Me.
The Determination of the Strength of Rawhide Gear Teeth. (*With A. E. B. Hall.*)

WILLIAM ARNOLD HOUSER, A.B. Detroit, Mich.
An Investigation of the Deterioration of Wrought Iron Water-Tube Boiler Tubes. (*With F. L. Hurlbutt.*)

THOMAS HENRI HUFF Overbrook, Penn.
An Investigation of the Practicability of a Power Driven Aeroplane Model.

FREDERICK LEWIS HURLBUTT Buffalo, N.Y.
An Investigation of the Deterioration of Wrought Iron Water-Tube Boiler Tubes. (*With W. A. Houser.*)

GORDON ROGERS JAMESON Wollaston
An Investigation of the Efficiency of the Gear Train and the Deflections in the Frame of a Sixteen Ton Arbor Press. (*With F. R. Jones.*)

ARTHUR WALLACE JOHNSON South Boston
The Relation between Quenching Temperatures and Hardness of Carbon Steels.

KENNETH SHERMAN JOHNSON Albany, N.Y.
A Test of an 8 inch Centrifugal Pump using Interchangeable Impellers. (*With W. R. McEwen.*)

FISKE REED JONES East Boston
An Investigation of the Efficiency of the Gear Train and the Deflections in the Frame of a Sixteen Ton Arbor Press. (*With G. R. Jameson.*)

TAKANG KAO Shanghai, China
Comparative Economy Tests of a 20 Horse Power Internal Combustion Engine using Kerosene and Gasolene. (*With G. T. Woolley, Jr.*)

PARRY KELLER Somerville
The Steam Consumption of Laundry Equipment.

NORRIS EATON KIMBALL Haverhill
An Investigation of the Efficiency of the Friction Transmission used in the Metz Automobile. (*With C. G. Norton.*)

EDWARD JOSLIN KINGSBURY Keene, N.H.
The Design and Test of an Automatic Chucking, Drilling and Ferruling Machine. (*With K. W. Roy.*)

JULIUS KUTTNER — New York, N.Y.
A Design of Apparatus for the Study of the Vibratory Motion of Small Internal Combustion Engines. (*With O. W. Hilbert.*)

HARRY IRVING LEWIS — Boston
Economy Tests on a Battery of Vertical Boilers with Riley Stokers. (*With C. H. Durkee.*)

SING DJI LI — Hofei, Anhui, China
An Investigation of the Strength of Bamboo under Cracked and Weathered Conditions.

WILLIAM ROBERT MCEWEN — Wellsville, N.Y.
A Test of an 8 inch Centrifugal Pump using Interchangeable Impellers. (*With K. S. Johnson.*)

ARCHIBALD STONE MORRISON — Lynn
The Determination of the Probable Saving by a Turbo-Generator in Place of Four Reciprocating Units at the Lynn Gas and Electric Co. (*With M. J. Dodd.*)

HERMAN EDWARD MORSE — East Bridgewater
The Determination and Distribution of the Operating Cost of the Central Heating Plant at Hotel Beaconsfield, Brookline, Massachusetts.

CHARLES GRANDERSON NORTON — Vineyard Haven
An Investigation of the Efficiency of the Friction Transmission used in the Metz Automobile. (*With N. E. Kimball.*)

OLIVER GOVE NORTON — Kearney, Neb.
A Determination of the Losses in a Boiler House and Pipe Line. (*With W. R. Hanchett.*)

CHARLES WILLIAM OLESEN — Salem
The Determination of the Coefficient of Friction of Brake Linings under Different Loads and the Effect Which Oils, Water and Gasolene have upon it. (*With N. E. Baxter.*)

GUERNSEY AARON PALMER — Amenia, N.Y.
The Determination of the Economical Vacuum or a 1000 K.W. Turbo-Generator Unit at the Pacific Mills, Lawrence, Massachusetts.

LEWIS WILLIAM PRESCOTT — Takoma Park, D.C.
An Investigation of the Change in Young's Modulus for Steel, with Change in Temperature. (*With H. R. Bassett.*)

FORREST GRANVILLE PURINTON — Beverly
An Investigation of the Effect of the Time Element in Tempering High Carbon Steels. (*With D. P. Rogers.*)

CHARLES PARSONS PUTNAM — Cliftondale
A Study of a Public Market System for the City of Boston. (*With E. A. Teeson, II. and E. D. Pratt, I.*)

DAVID PEARSON ROGERS, B.A. — Toronto, Ont.
An Investigation of the Time Element in Tempering High Carbon Steels. (*With F. G. Purinton.*)

KENNETH WARREN ROY — New York, N.Y.
The Design and Test of an Automatic Chucking, Drilling and Ferruling Machine. (*With E. J. Kingsbury.*)

JOHN RICARDS LONG SANTOS — Blue Ridge Summit, Pa.
An Investigation of Aeroplane Wing Struts in Compression. (*With W. P. Loo, II. and XIII.*)

EDWARD LYNCH SULLIVAN — South Boston
A Study of the Physical Properties of Brake Linings. (*With J. W. Bolton, Jr.*)

HERBERT DYER SWIFT — Detroit, Mich.
An Investigation of a Combined Heating and Sprinkler System. (*With H. H. Whitcomb.*)

ERCELL ARTHUR TEESON — Lowell
A Study of a Public Market System for the City of Boston. (*With C. P. Putnam and E. D. Pratt, I.*)

WALLACE SENTENY THOMAS — Springfield, Ohio
The Design of a Machine for Determining the Machining Hardness of Metals. (*With D. A. Fales.*)

ALBERT ULMAN WALTER — Baltimore, Md.
A Study of the Effects of Tensional Overstrain in Steel. (*With O. P. Camp.*)

FREDERIC ELMER WATERS — Salem
A Study of the Mechanical and Physical Properties of Asbestos Board. (*With C. H. Wilkins.*)

ALDEN DODGE WHEELER, Jr., B S. — Newton Centre
Heat Transmission through Cast Iron Radiators. (*With J. C. Holmes.*)

HERBERT HARTWELL WHITCOMB — Littleton
An Investigation of a Combined Heating and Sprinkler System. (*With H. D. Swift.*)

CHARLES HOWARD WILKINS — Newtonville
A Study of the Mechanical and Physical Properties of Asbestos Board. (*With F. E. Waters.*)

GEORGE THOMPSON WOOLLEY, Jr. Salina, Kansas
Comparative Economy Tests of a 20 Horse Power Internal Combustion Engine using Kerosene and Gasolene. (*With T. K. Kao.*)

LOUIS HENRY YOUNG Boston
A Study of Column Formulas including an Experimental Investigation of the Effects of Central and Eccentric Loading upon I-beam Columns. (*With E. H. Stelle, I.*)

COURSE III. MINING ENGINEERING AND METALLURGY.

BENJAMIN COFFIN CROMWELL, Jr. (As of Class of 1914) Vineyard Haven
A Report on the Oguawka Mine of the Savanna Copper Co., and Concentration Test of the Ore.

LOUIS WADE CURRIER (As of Class of 1914) Lynn
The Amalgamation and Cyanidation of a Cupriferous Gold Ore from Nevada.

GABE BOUCK HILTON Oshkosh, Wis.
The Concentration of a Complex Sulphide Ore from Rico, Colorado. (*With R. A. Schmucker.*)

TECHUN HSI Shanghai, China
A Study of the Geology and Copper Deposits of Bristol, Connecticut.

ROBERT ANTOINE SCHMUCKER Red Hook, N.Y.
The Concentration of a Complex Sulphide Ore from Rico, Colorado. (*With G. B. Hilton.*)

FRANK SAMUEL SINNICKS Manchester
The Concentration Tests on Zinc Ore from Quebec.

SANFORD LAWTON WILLIS Dorchester
The Roasting and Leaching of a Low-Grade Copper Ore from Montana.

COURSE IV. ARCHITECTURE.

BAHJAT AMIN ABDULNOUR, A.B. Beyrout, Syria
A Design for a Mosque in the Arabic Style of Architecture.

ROLAND WEBSTER BALDREY Medford
A Design for a National Pantheon.

ROSWELL FORMAN BARRATT (As of Class of 1914) East Orange, N.J.
A Design for a North Shore Country Estate.

THOMAS JAMES BARRY — Dorchester
The Design of a Reinforced Concrete Arch Highway Bridge. (*With W. B. Rivers.*)

EVERETT ROUNDS BRIGHAM — Atlantic
The Structural Design for a Reinforced Concrete Power Station.

HORATIO WHITTEMORE BROWN — Concord
An Experimental Study of Concrete Groined Arches with Reference to Their Use in Floor Construction.

BENJAMIN HARRISON BYRNES, A.B. — Emporia, Kansas
A Design for a Banking Institution

DONALD ADAMS FOWLE — Woburn
A Design for a Small Museum of Renaissance Art.

EDWIN BURPEE GOODELL, Jr. — Montclair, N.J.
A Design for an International Park and Peace Monument.

STIRLING HART HARPER — Watertown
A Design for a Graduate College for an American University.

PAUL SAMPSON HOWES — Springfield
A Design for St. Dunstan's College, a Monastic Study House.

WILLIAM ROBERT LEWIS — Elkhorn, W. Va.
A Design for an Establishment for Testing and Manufacturing Submarines.

EDWIN CLIFFORD LUCE, Jr. — Marion
A Design for a Consul's Residence in a Southern Country.

EDWIN ELLISON MERRILL, B.S. — Portland, Ore.
A Design for a Small Athletic Club.

ELMER HERMAN NEUMANN — Brooklyn, N.Y.
A Study of the Relation between the Strength of Mortar and Concrete.

GEORGE FREDERIC NIXON — Leominster
An Experimental Investigation of the Bearing Values of Hard Pine and Spruce. (*With A. F. Nye.*)

ELWIN PAUL NORBERG — Pasadena, Cal.
A Design for a Library and Museum.

ALFRED FRANCIS NYE — Fairhaven
An Experimental Investigation of the Bearing Values of Hard Pine and Spruce. (*With G. F. Nixon.*)

ST. ELMO TOWER PIZA — New York City, N.Y.
A Design for a Memorial Building for a University in a Large City.

WALTER BEN RIVERS — Los Angeles, Cal.
The Design of a Reinforced Concrete Arch Highway Bridge. (*With T. J. Barry.*)

CHESTER MORRILL RUNELS — Lowell
A Study of the Strength of Concrete when Frozen after an Initial Set. (*With C. E. Clark, II.*)

HENRY PALMER SABIN — Denver, Colo.
A Design for a Summer Home in Colorado for the President of the United States.

MAURICE WERTHEIM SALOMONSON — Boston
A Design for a Casino Group at a Seaside Resort.

ULRICH CHRISTOPHER SCHIESS — Brooklyn, N.Y.
A Design for a Monastic Refuge in the Mountains.

EDWARD SCHOEPPE — Philadelphia, Pa.
A Design for a Modern Bank and Office Building.

PHILIP LINDSLEY SMALL — Jamestown, N.Y.
A Design for a Memorial Museum of History.

WILLIAM BENJAMIN SPENCER — Medford
An Experimental Investigation of the Effects of Filler Plates on the Strength of Rivetted Joints. (*With R. D. Waterman.*)

JOHN FANZ STAUB, B.S. — Knoxville, Tenn.
A Design for a Country Residence after the Style of the French Chateaux.

RALPH DOUGLAS WATERMAN — Denver, Colo.
An Experimental Investigation of the Effects of Filler Plates on the Strength of Rivetted Joints. (*With W. B. Spencer.*)

COURSE V. CHEMISTRY.

ALLEN ABRAMS, A.B. — Butler, Pa.
The Influence of Steam upon the Combustion of Powdered Coal. (*With J. S. Little, X.*)

LUCIUS AURELIUS BIGELOW, Jr. — Boston
The Action of Chlorine and Bromine upon Abietic Acid.

MAURICE FRANKLAND BRANDT — Trenton, N.J.
Colored Halogen Derivatives of Diphenylmethane.

TSUN CHANG — Donsi, Hupeh, China
A Method of Determining the Hydrolysis of Ammonium Salts at 100°.

MING CHOW — Kiang-su, China
The Potential of the Bismuth Electrode.

ALTON ALDRICH COOK — Dorchester
The Detection of Coconut Oil in Butter.

JAMES HENRY DEVINE — Needham
The Analysis of Zinc Dust.

NORMAN DAVID DOANE, B.S. — Meadville Pa.
Shortened Methods for the Analysis of Cocoa Products.

FRANK WINSTON HALL, B.S. — Georgetown, Texas
The Solubility of Bismuth Oxychloride in Hydrochloric Acid.

LESLIE JOHN HEATH, A.B., A.M. — Chelsea
The Nephelometric Determination of Small Amounts of Essential Oils.

PIERRE FANEUIL JONES, B.S. — Brooklyn, N.Y.
The Effect of Ultraviolet Rays on the Coagulation of Colloidal Platnum.

HERBERT ISAAC KNOWLES — Brookline
A Comparative Study of Methods for the Determination of Temporary Hardness in Water.

LOVELL WALDO MASON, A.B. — Danbury, Conn.
The Determination of Titanium in Ores.

ROBERT WATKEYS MITCHELL — Winthrop
The Relation of Structure to Color in the Salts of Schiff's Bases.

MARY ELSA PLUMMER — Newton
The Adaptability of Calcium Acid Lactate as a Baking Powder Material.

HOMER ROGERS — Saxonville
The Relationships of Certain Sulphur Derivatives of Diphenylmethane.

ALBERT EDWARD SAMPSON — Gorham, Me.
The Reduction of Potassium Dichromate as a Measure of the Value of Chrome Assistants.

SOLOMON SCHNEIDER — Roxbury
The Water-Soluble Solids of Ginger Extract.

FRANK LIVINGOOD SURLS, A.B. — Brookline
An Investigation of the Action between Certain Mordants and Dyes.

KEBE TOABE — Lawrence
A Study of the Lixiviation of Picric Acid from Silk.

LOUIS HARRINGTON ZEPFLER — Needham
The Qualitative Determination of the Halogens, Nitrogen and Sulphur in Organic Compounds.

COURSE VI. ELECTRICAL ENGINEERING.

LEON RUSSELL ABBOTT — Barre, Vt.
A Traffic Study on the Boston Elevated Railway System. (*With C. A. Bidwell, E. S. Coldwell, W. M. Harbaugh, C. W. Lacy, and C. W. Whitall.*)

PHILIP LANGDON ALGER, B.S. — Annapolis Md.
The Blondel Double Reaction Method of Calculating Regulation of Alternators. (*With E. W. Brown and O. E. Strahlmann, II. and VI.*)

DOUGLAS BROOKS BAKER — Melrose
An Investigation of the Rotational Losses of a Direct Current Motor by the Method of Retardation. (*With K. K. Boynton.*)

FREDERICK BALSTON BARNS — Morgan Hill, Cal.
An Appraisal of the Steam-Electric Power Plant and System of the Town of B——, Mass.

JOHN THOMAS BAUER, Jr. — Mobile, Ala.
The Appraisal of a Central Station.

CHARLES ALANSON BIDWELL, Jr. — Stockbridge
A Traffic Study on the Boston Elevated Railway System. (*With L. R. Abbott, E. S. Coldwell, W. M. Harbaugh, C. W. Lacy, and C. W. Whitall.*)

CHARLES THOMAS BLACKMORE, B.S. — Hampton, Va.
A Storage Battery Installation for Lighting and Power in a Large Department Store.

FRANCIS HENRY BOYNTON, E.E. — Boston
Comparative Tests on Kimble Electric Company Variable Speed Alternating Current Motors. (*With L. L. Travis.*)

KENNETH KENASTON BOYNTON — South Framingham
An Investigation of the Rotational Losses of a Direct Current Motor by the Method of Retardation. (*With D. B. Baker.*)

WILLIAM HENRY BRACKETT — Dorchester
A Design of a Regenerative Control System for Electric Vehicles.

EARLE WILLIAM BROWN — Oakland, Cal.
The Blondel Double Reaction Method of Calculating Regulation of Alternators. (*With P. L. Alger and O. E. Strahlmann, II. and VI.*)

CHARLES HOWARD CALDER — Newtonville
The Effect of Diaphragm Thickness on Sensitivity of Telephone Receivers.

RICHARD BELMONT CATTON — Honolulu, Hawaii
An Investigation of the Relation between Speed of Opening and Current Broken by Knife-blade Switches. (*With H. L. Leeb.*)

EVERETT SHARPLES COLDWELL — South Swansea
A Traffic Study on the Boston Elevated Railway System. (*With L. R. Abbott, C. A. Bidwell, W. M. Harbaugh, C. W. Lacy, and C. W. Whitall.*)

ALFRED VICTOR COLEMAN — Louisville, Ky.
A Method for Calculating the Voltage Regulation of Alternators.

JOHN WOODHULL CONOVER, B.A. — Norfolk, Va.
An Oscillograph Investigation of the Effect upon Push Button Switches of Breaking the Circuit. A Life Test of the Switches. (*With C. L. Muzzey.*)

ALAN STANDISH DANA — Portland, Me.
Corrosion Tests on Electric Car Heaters. (*With C. L. Smith.*)

ALBERT VICTOR DEBEECH — New Bedford
The Design of an Electrostatic Oscillograph. (*With G. O. Eaton.*)

JAMES WASHINGTON EASTER, A.B. (As of Class of 1914) — Baltimore, Md.
The Design and Construction of a Fly-wheel Motor for Cranking an Automobile Engine.

GEORGE OSCAR EATON — Marlboro
The Design of an Electrostatic Oscillograph. (*With A. V. DeBeech.*)

RUPEN EKSERGIAN (As of Class of 1914) — Somerville
Tests and Investigations of the Goodell Electric System, Antrim, N.H.

EDWARD LAWRENCE FONSECA — Cambridge
A Study of the Effect of Frequency upon the Losses in a Transformer.

ROGER MORSE FREEMAN (As of Class of 1914) — Providence, R.I.
The Design of a Junkers Oil Engine.

WILLIAM MILTON HARBAUGH, A.B. — Colorado Springs, Colo.
A Traffic Study on the Boston Elevated Railway System. (*With L. R. Abbott, C. A. Bidwell, E. S. Coldwell, C. W. Lacy, and C. W. Whitall.*)

STEPHEN ROY HOLMES, A.B. Corydon, Iowa
The Effects of Frequency on the Cyclic Variations in Candle Power of the Nitrogen Filled Tungsten Lamp. (*With L. B. Miller.*)

VERNE CORNELIUS KENNEDY Canton, So. Dakota
The Management and Operation of the Boiler Room of a Large Electric Light Station.

CLIVE WOODBURY LACY Dubuque, Iowa
A Traffic Study on the Boston Elevated Railway System. (*With L. R. Abbott, C. A. Bidwell, E. S. Coldwell, W. M. Harbaugh, L. Segal, C. W. Whitall, and J. F. Wostrel.*)

HENRY LORENT LEEB South Orange, N.J.
An Investigation of the Relation between Speed of Opening and Current Broken by Knife-blade Switches. (*With R. B. Catton.*)

CHARLES BOOTH MALONE, Jr. Savannah, Ga.
The Convection of Heat from Small Wires in Water. (*With H. Worthington.*)

HENRY LEONARD MARION Burlington
Electric Locomotive Tests at the Hoosac Tunnel, North Adams, Massachusetts. (*With E. E. Place.*)

LEO B. MILLER, A.B. Indianola, Iowa
The Effects of Frequency on the Cyclic Variations in Candle Power of the Nitrogen Filled Tungsten Lamp. (*With S. R. Holmes.*)

CLIFFORD LORING MUZZEY (As of Class of 1914) Lexington
An Oscillograph Investigation of the Effect upon Push Button Switches of Breaking the Circuit. A Life Test of the Switches. (*With J. W. Conover.*)

ARTHUR LINDSAY NELSON Ashmont
Power Plant Centralization. (*With C. E. Sifton.*)

CHARLES WILLIAM NOYES Smithtown, N.H.
The Resistance and Impedance of Ground Connections.

EVERETT EUGENE PLACE Woburn
Electric Locomotive Tests at the Hoosac Tunnel, North Adams, Massachusetts. (*With H. L. Marion.*)

WILLIAM JOSEPH ROONEY, A.B. Waltham
An Investigation of the Effect of Layers on the Losses in a Dielectric. (*With F. J. Vogel.*)

CLIFFORD EDWARD SIFTON Hood River, Ore.
Power Plant Centralization. (*With A. L. Nelson.*)

CLARENCE LESTER SMITH — Roxbury, Mass.
Corrosion Tests on Electric Car Heaters. (*With A. S. Dana.*)

LAWRENCE LEVALLEY TRAVIS — Chicago, Ill.
Comparative Tests on Kimble Electric Company Variable Speed Alternating Current Motors. (*With F. H. Boynton.*)

CHOU CHUAN TSENG — Changsha, China
Nonpolarized Relay.

HERBERT NEWTON TURRELL, Jr. — Oakland, Cal.
An Experimental Investigation of an Electric Hammer.

FRED JOHN VOGEL — Somerville
An Investigation of the Effect of Layers on the Losses in a Dielectric. (*With W. J. Rooney.*)

CHARLES WHITMORE WHITALL, A.B. — Cambridge
A Traffic Study on the Boston Elevated Railway System. (*With L. R. Abbott, C. A. Bidwell, E. S. Coldwell, W. M. Harbaugh, and C. W. Lacy.*)

HAROLD WORTHINGTON, A.B. — New York City
The Convection of Heat from Small Wires in Water. (*With C. B. Malone, Jr.*)

COURSE VII. BIOLOGY AND PUBLIC HEALTH.

LAURENCE PATTEN GEER — Lynn
A Study of the Sterilization of Fruit Juices and Their Products by Ultra-Violet Light.

PETER MASUCCI — Revere
The Life Cycle of a *Fusarium* and the Effect upon it of Certain Fungicides.

WARREN CLIFFORD WHITMAN, A.B. — Abington
A Study of Aniline Dyes with Reference to Their Further Use in Bacteriological Culture Media.

COURSE VIII. PHYSICS.

JOSEPH ARTHUR BALL — Cambridge
Energy Losses in Dielectrics.

JOSEPH LOUIS FINKELSTEIN — Boston
On the Decay of Phosphorescence of Sidot Blende.

HORATIO WELLINGTON LAMSON — Arlington Heights
Investigations of Quantitative Radio Receivers.

COURSE IX. GENERAL SCIENCE.

HENRY MAYNARD GRIFFITH (As of Class of 1914) Seattle, Wash.
A Design for an Installation of Signaling to Provide for Abnormal Operating Conditions, and to Increase the Capacity of the Single Track, at Tehachapi Pass, on the San Joaquin Division of the Southern Pacific Company, California.

CLARENCE WILLIAM HALE Springfield
An Investigation of the Effect of an Air Filter on the Capacity and Operation of an Induction Motor. (*With H. S. Frazine, II.*)

HENRY JAMES GRAY RUDOLF Brookline
An Investigation of the Proper Capacity of Turbines for Installation at Turners Falls, Massachusetts.

COURSE X. CHEMICAL ENGINEERING.

LAWRENCE HUMPHREY BAILEY Newton
The Production of Pure Carbon Monoxide from Producer Gas.

DONALD BELCHER Newtonville
An Investigation of the Rate of Drying of Printing Ink.

FRED WILLIAM BOMMER (As of Class of 1914) Chelsea
A Study of the Bursting Pressure of Rubber Hose.

ELBRIDGE JOHNSON CASSELMAN Washington, D.C.
The Oxidation of Tin as Determined by Chemical Equilibrium Measurements.

PHILIP WITTGENSTEIN CODWISE Melrose Highlands
The Determination of the Tensile Strength of Glue.

JOHN NOLAN DALTON Milford
The Periodides of Acid Anilides.

ROSCOE GILKEY DICKINSON Hyde Park
The Ternary Alloys of Tin, Antimony and Bismuth.

BURNHAM EVANS FIELD Portland, Me.
The Effect of Weathering on Asbestos Shingles.

RALPH HART Roxbury
The Derivatives of Cyclopropane.

ROBERT EVERETT HAYLETT, B.S. Milwaukee, Wis.
The Flow of Viscous Liquid through Pipes. (*With H. J. Lucey.*)

SIGURD TRYGVE HELSETH, A.B. Appleton, Minn.
The Determination of Heat of Dilution at High Temperature.

CLARENCE WEARE HOWLETT Cambridge
The Adsorption of Color from Water by Aluminum Hydrate.

BENJAMIN HURVITZ Boston
The Influence of the Copper Content of Steel on Depolarization.

CLIFTON NEWMAN JACOBS Waltham
A Comparison of Certain Viscosimeters with an Absolute Viscosimeter.

RALPH PALMER JOSLYN Holliston
The Coagulation of Colloidal Arsenious Sulfide by Ultraviolet Rays.

KENNETH DESPRES KAHN South Bend, Ind.
The Coagulation of Colloids by Contact with Metal Surfaces.

MANAHAN BREMNER KAUFMAN Lawrence
The Composition and Properties of the so-called Lime-Sulfur Solution.

HARRY MCLAIN KEATING (As of Class of 1914) Rockland, Me.
The Relative Heat Absorbing Capacities of Straight, Corrugated, and Spiral-Flow Condenser Tubes.

BERNARD LANDERS Boston
Reductions with the Aid of Colloidal Platinum.

JOHN SHIRLEY LITTLE Burlington, Iowa
The Influence of Steam upon the Combustion of Powdered Coal. (*With A. Abrams, V.*)

JOHN WHITE LIVINGSTON (As of Class of 1914) Alto, Mich.
The Quantitative Determination of Aldehydes in Concentrated Solutions.

HENRY J[illegible]E LUCEY Natick
The F[illegible] of Viscous Liquid through Pipes. (*With R. E. Haylett.*)

AZEL WASHINGTON MACK Jamaica Plain
Some Factors which Influence the Adhesive Property of Starch Paste.

ROBERT ALOYSIOUS MCMENIMEN Cambridge
A Study of the Production of Oxalic Acid [illegible]rom Sawdust.

DOUGLAS HOWARD MCMURTRIE, A.B. Portland, Me.
The Engineering Factors Controlling the Decomposition of Nepheline by Sulfurous Acid.

JAMES BENSON NEAL Braintree
A Study of the Devulcanization of Rubber.

REGINALD FLINT POLLARD — Lynn
The Application of the Air Lift to Viscous Liquids.

THOMAS CLIFFORD POND — Franklin
The Counter Current Lixiviation of Caustic Soda from Wood Pulp.

WILLIAM HENRY PRICE, Jr. — Chicago, Ill.
A Study of the Crystalline Structure of Galvanized Iron.

CHARLES HENRY ROSENTHAL — Cincinnati, Ohio
The Recovery of Iron from Waste Ferrous Sulfate Solutions.

THEODORE FRANKLIN SPEAR — Boston
A Test on an Automatic Yarn Dryer at the Plant of the Ludlow Manufacturing Associates. (*With G. R. Urquhart.*)

FREDERICK WALTER STETSON — Somerville
The Oxidation of Linseed Oil by Means of Ultraviolet Light.

VERNON THEODORE STEWART, Ph.B. — Silver Creek, N.Y.
A Study of the Factors which Determine the Capacity of a Gas Washer.

RAYMOND BEVERLY STRINGFIELD, A.B. — Los Angeles, Cal.
Dry Reactions as a Basis for Rapid Qualitative Analysis.

GEORGE ROBERT URQUHART — Concord
A Test on an Automatic Yarn Dryer at the Plant of the Ludlow Manufacturing Associates. (*With T. F. Spear.*)

DONALD HEALD WHITE, A.B. — Waterville, Me.
The Factors which Control the Capacity of a Gas Filter.

COURSE XI. SANITARY ENGINEERING.

RICHARD ORCUTT BAILEY, A.B. — Oneida, N.Y.
An Experimental Investigation of the Determination of Stream Discharge by Chemical Methods. (*With H. L. King, I.*)

CHARLES ANTHONY CALDERARA, B.S. — Milford, N.H.
An Experimental Investigation of the Water-Works at Milford, New Hampshire, with Special Regard to Fire Protection.

ZIANG YIEN CHOW — Shanghai, China
An Experimental Investigation of the Water Supply System at Reading, Massachusetts, with Reference to Fire Protection.

MARTIN WARREN COWLES — Fairfield, Conn.
A Design for a Sewerage System for Fairfield, Connecticut.

RAYMOND DANIEL GLADDING, B.S. Fall River
An Investigation of the Treatment of Municipal Refuse in the United States, with Special Studies of Fall River and Haverhill, Massachusetts. (*With G. W. Simons, Jr.*)

WILLIAM REA HOLWAY Sandwich
A Design for a Water Supply System for Sandwich, Massachusetts. (*With A. N. Wardle.*)

GEORGE WASHINGTON SIMONS, Jr., B.S. Portland, Ore.
An Investigation of the Treatment of Municipal Refuse in the United States, with Special Studies of Fall River and Haverhill, Massachusetts. (*With R. D. Gladding.*)

RALPH VOSBURG TIFFANY Winsted, Conn.
An Investigation of Means for Increasing the Water Supply of Winsted, Connecticut.

ELLIS SPENCE TISDALE Needham
An Experimental Investigation of the Efficiency of the Sewage Filter Beds at Medfield, Massachusetts. (*With S. L. Tolman.*)

SAMUEL LELAND TOLMAN Hanover
An Experimental Investigation of the Efficiency of the Sewage Filter Beds at Medfield, Massachusetts. (*With E. S. Tisdale.*)

ANDREW NELSON WARDLE Dedham
A Design for a Water Supply System for Sandwich, Massachusetts. (*With W. R. Holway.*)

COURSE XIII. NAVAL ARCHITECTURE AND MARINE ENGINEERING.

AUBREY DONNITHORNE BEIDELMAN Braintree
Freight Handling at Coastwise Steamship Terminals.

HAROLD TOWNSEND BENT Boston
An Investigation of Deflection during Launching of Cargo Steamer "Atlantic."

EVERS BURTNER Lynn
An Investigation of the Deflection of the Cargo Steamer "Atlantic." (*With D. C. Ramsay.*)

CHARLES ELLIS ELLICOTT, Jr., A.B. Melvale, Md.
Government Acceptance Trials of the Sea-going Dredge "Absecon." (*With R. P. Sherman.*)

DeWitt Converse Ramsay — West Roxbury
An Investigation of the Deflection of the Cargo Steamer "Atlantic." (*With E. Burtner.*)

Robert Parker Sherman — Manila, P.I.
Government Acceptance Trials of the Sea-going Dredge "Absecon." (*With C. E. Ellicott, Jr.*)

COURSE XIV. ELECTROCHEMISTRY.

Edward Isadore Berenson — Boston
The Action of Nitrogen on Pure Calcium Carbide.

George Jones Easter — El Paso, Texas
The Electrolytic Reduction of Aluminum from Aluminum Chloride. (*With A. R. Greenleaf.*)

Allen Raymond Greenleaf — Wakefield
The Electrolytic Reduction of Aluminum from Aluminum Chloride. (*With G. J. Easter.*)

Eugene Moness — Libau, Russia
The Preparation of Pure Calcium Carbide and the Determination of its Melting Point.

Gilbert Lawrence Peakes — Lynn
A Study of the Effect of Temperature on the Electrical Conductivity of Borosilicate Glass.

Gale Colburn Shedd — Keene, N.H.
The Effect of Temperature on the Capacity of the "Starting-Lighting" Type of Storage Cells.

Edward Cyrus Walker, 3d, A.B. — Boston
An Investigation of the Electrolysis of Glass used for Sealing in Leads of Nitrogen Lamps.

Eastman Atkins Weaver — West Newton
The Electrolytic Separation of Nickel and Copper from Commercial Matte and from Monel Metal. (*With G. C. Wilson.*)

Gardiner Cushing Wilson — Brighton
The Electrolytic Separation of Nickel and Copper from Commercial Matte and from Monel Metal. (*With E. A. Weaver.*)

Register of Students.

For residence addresses the following abbreviations are used.

Abington	Ab.	Milton	Mil.
Allston	A.	Montello	Mont.
Amesbury	Ames.		
Andover	And.	Natick	Na.
Arlington	Arl.	Needham	Need.
Ashmont	Ash.	Neponset	Nep.
Atlantic	Atl.	Newbury	New.
Auburndale	Aub.	Newburyport	Np.
		Newton	N.
Beachmont	Bea.	Newton Center	N. C.
Belmont	Bel.	Newton Highlands	N. H.
Beverly	Bev.	Newton Upper Falls	N. U. F.
Braintree	Brain.	Newtonville	Nv.
Bridgewater	Brid.	North Abington	N. Ab.
Brighton	Bri.	North Attleboro	N. At.
Brockton	Brock.	Norwood	Nor.
Brookline	Br.		
Burlington	Bur.	Pawtucket	Paw.
		Peabody	P.
Cambridge	Cam.	Plymouth	Ply.
Campello	Camp.	Providence	Prov.
Canton	Can.		
Charlestown	C.	Quincy	Q.
Chelsea	Ch.		
Chestnut Hill	C. H.	Raynham	Ray.
Cliftondale	Clif.	Reading	Read.
Concord	Con.	Revere	Rev.
		Rockland	Roc.
Danvers	Dan.	Roslindale	Ros.
Dedham	Ded.	Roxbury	R.
Dorchester	D.		
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Greenwood	Gr.		
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		Tewksbury	Tewk.
Haverhill	Hav.	Tufts College	T. C.
Holbrook	Hol.		
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Ipswich	Ips.	Waban	Wab.
		Wakefield	Wak.
Jamaica Plain	J. P.	Walpole	Walp.
		Waltham	Wal.
Lawrence	Law.	Watertown	Wat.
Lexington	Lex.	Waverley	Wav.
Lowell	Low.	Wellesley	Wel.
Lynn	L.	Wellesley Hills	Wel. H.
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Mansfield	Mans.	Weymouth	Wey.
Marblehead	Marb.	Whitman	Whit.
Marlboro	Mar.	Winchester	Winc.
Mattapan	Mat.	Winter Hill	W. H.
Medford	Med.	Winthrop	Win.
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Jacobson, David Lyon . . . . B.S., Columbia University.	*Jersey City, N. J.*	43 Warren Ave.
James, Linda . . . . . B.A., University of Minnesota.	*St. Paul, Minn.*	2 Divinity Ave., Cam.
Johns, Alfred Augustus . . . A.B., University of Rochester.	*Rochester, N. Y.*	47 Rutland Sq.
Johnston, Archibald Borhek . . Ph.B., Yale University.	*Bethlehem, Pa.*	137 Newbury St.
Jones, Byron Quimby, U.S.A. . Graduate, United States Military Academy.	*Boston*	Hotel Westminster
Jones, Charles Edward . . . . Ph.B., Yale University.	*Pittsfield*	137 Newbury St.
Jones, David Morris . . B.A., University of Minnesota.	*Wabasha, Minn.*	820 Massachusetts Ave., Cam.
Junkins, Walter Hilton . . . . B.S., Dartmouth College.	*Portsmouth, N. H.*	17 Bowker St., Br.
Keller, Arthur Ripont . . . C.E., Cornell University. LL.B., National University Law School.	*Honolulu, T. H.* .	106 St. Botolph St.
Kelly, Joyce Raymond . . . . A.B., Reed College.	*Portland, Ore.*	33 St. Botolph St.
Kemkemian, Bedros . . . . . B.A., Syrian Protestant College.	*Cairo, Egypt* . .	316 Huntington Ave.
Kennedy, Grafton Sherwood . A.B., Yale University.	*Dayton, O.* . . .	11 Irvington St.
Kenney, Arthur Webster . . . S.B., S.M., Massachusetts Institute of Technology.	*Dorchester* . . .	12 Taft St., D.
Kinthong, Chan . . . . . A.B., Harvard University.	*Bangkok, Siam* .	497 Huntington Ave.
Klemin, Alexander . . . . . B.Sc., London University. A.C.G.I., Central Technical College.	*London W. England*	86 St. James Ave.
Kline, Franklin Latimore . . . B.A., University of Virginia.	*Chattanooga, Tenn.*	44 The Fenway
Knowlton, Lauriston Edward . A.B., Harvard University.	*Cambridge* . . .	18 Forest St., Cam.
Knox, Cornelius Van Santwood A.B., Princeton University.	*New Brunswick, N. J.*	100 Huntington Ave.
Koo, Vi Tsing . . . . . Graduate Imperial Polytechnic College at Shanghai. B.S., University of Illinois.	*Shanghai, China* .	45 Oxford St., Cam.
Kuhns, Austin . . . . . B.A., Wesleyan University.	*Middletown, Conn.*	Drayton Hall, Cam.
Lanphier, Basil . . . . . A.B., Creighton University.	*Omaha, Neb.* . .	45 E. Newton St.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Lapham, Samuel, Jr. . . . . A.B., College of Charleston.	*Charleston, S. C.* .	91 Newbury St.
Lauer, Luther Michael . . . . A.B., Ursinius College.	*Thomasville, Pa.* .	18 Westland Ave.
Leach, William Butler, Jr. . . S.B., University of Chicago.	*Hubbard Woods, Ill.*	9 Follen St.
Lebby, Thomas Dotterer, Jr. . A.B., College of Charleston.	*Summerville, S. C.*	30 Newbury St.
Lemmon, Mark . . . . . B.A., University of Texas.	*Dallas, Tex.* . . .	1079 Beacon St., Br.
Lennox, Frank Joseph . . . . B.S., Rhode Island State College.	*Woonsocket, R. I.*	916 Beacon St.
Lewis, Samuel Oliver . . . . . B.S., Virginia Military Institute.	*Houston, Tex.* . .	5 Idlewild St., A.
Lindgren, Ray Harrison . . . B.S., University of Maine.	*Manchester, N. H.*	139 Jewett St., Man.
Ling, Homer Chuen . . . . . B.A., St. John's University.	*Amoy, China* . .	177 St. Botolph St.
Little, Thomas Wolcott . . . . B.S., Trinity College.	*Hartford, Conn.* .	213 Newbury St.
Littlefield, Walter Berry . . . A.B., Harvard University.	*Roxbury*	35 Hutchins St., R.
Loo, Pang Chieh . . . . . B.S., Michigan College of Mines.	*Shanghai, China*	6 St. Botolph St.
Loo, Wai Po . . . . . S.B., Massachusetts Institute of Technology.	*Canton, China* . .	77 Tyler St.
Loper, Cleveland Scott . . . . B.S., University of Kansas.	*Topeka, Kan.*	18 Trowbridge St., Cam.
Lowe, Russell Edmund . . . . B.E., Union College.	*New York, N. Y.*	211 Newbury St.
Lunn, John Aleck . . . . . B.S., Colorado Agricultural College.	*Fort Collins, Col.*	82 Huntington Ave.
McAdams, William Henry . . B.S., M.S., State University of Kentucky.	*Lexington, Ky.* .	316 Huntington Ave.
McDill, Bruce Magaw . . . . A.B., Miami University.	*Oxford, O.* . . .	543 Boylston St.
McDonald, Kenneth Madison . B.S., University of Alabama.	*Birmingham, Ala.*	53 St. Stephen St.
Macheca, George Michael . . . A.B., Loyola University.	*New Orleans, La.*	421 Marlborough St.
Mack, Lewis Gerstle . . . . . A.B., University of California.	*San Francisco, Cal.*	Garrison Hall
MacKenzie, John David . . . S.B., Massachusetts Institute of Technology.	*Baddeck, Cape Breton*	19 Beals St., Br.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
McKown, Frederick Whittlesey A.B., Williams College.	*Rochester, N. Y.*	1078 Boylston St.
McLaughlin, Harold Clarke A.B., University of Missouri.	*Sedalia, Mo.*	176 Newbury St.
MacRae, Duncan B.S., University of North Carolina.	*Wilson, N. C.*	530 Massachusetts Ave.
Mar, Pellian Teh-che Graduate, Naval College at Nanking.	*Foo-Chow, China*	35 St. Botolph St.
Martin, Alexander B.S., University of Oregon.	*Eugene, Ore.*	30 Newbury St.
Martin, Richard Penberthy, Jr. A.B., Yale University.	*Hartford, Conn.*	101 St. James Ave.
Martinez, John Miguel A.B., Williams College.	*New York, N. Y.*	64 Charlesgate East
Martinez, José Félix B.A., Institute National Central.	*Santa Ana, Salvador*	7 Albemarle St.
Mayers, Hadyn Potter B.S., Agricultural and Mechanical College of Texas.	*San Antonio, Tex.*	168 Huntington Ave.
Mears, Edward Norris Kirk A.B., Williams College. M.D., Albany Medical College.	*Lowville, N. Y.*	48 Brattle St., Cam.
Meinzer, Gotthold Holda B.A., State University of Iowa.	*Ackley, Ia.*	Trinity Hall, Cam.
Meloy, Thomas Kronenberg A.B., Harvard University.	*New York, N. Y.*	402 Craigie Hall, Cam.
Mendelsohn, Herbert A.B., Yale University.	*New York, N. Y.*	237 Beacon St.
Miller, Charles Gideon B.S., Virginia Military Institute.	*Richmond, Va.*	5 Idlewild St., A.
Miller, Frank Oliver B.S.C.E., University of Georgia.	*Athens, Ga.*	535 Newbury St.
Miller, Robert Anderson, Jr. A.B., Yale University.	*Pelham Manor, N. Y.*	316 Huntington Ave.
Mitchell, Robert Walkeys S.B., Massachusetts Institute of Technology.	*Winthrop*	55 Park Ave., Win.
Moore, Walter Allan, Jr. B.S., Military College of South Carolina	*Charleston, S. C.*	52 Ivy St.
Moulton, Robert Selden B.S., Amherst College.	*Poughkeepsie, N. Y.*	210 Newbury St.
Murray, Albert Francis B.A., Maryville College.	*New Decatur, Ala.*	21 Norway St.
Naumburg, Robert Elkan A.B., Williams College.	*New York, N. Y.*	84 Coolidge St., Br.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Neave, Arthur Stuart A.B., University of Cincinnati.	*Cincinnati, O.*	11 Irvington St.
Neilson, Halbert Hall B.S., Mississippi Agricultural and Mechanical College.	*Lexington, Miss.*	261 Newbury St.
Neumann; Eimer Herman S.B., Massachusetts Institute of Technology.	*Brooklyn, N. Y.*	587 Columbia Rd.
Newhall, Ralph Perkins S.B., Harvard University.	*Cambridge*	37 Kirkland St., Cam.
Newton, Burkett, Dunlap A.B., Yale University.	*Los Angeles, Cal.*	8 Irvington St.
Nichols, William Robert, U.S.A. B.S., Virginia Military Institute.	*Allston*	1277 Commonwealth Ave., A.
Niemann, Henry S.B., Massachusetts Institute of Technology.	*West Newton*	21 Chestnut St., W. N.
Nightingale, Winthrop Eliot A.B., Harvard University.	*Boston*	13 James St.
Niles, Alfred Salem A.B., Johns Hopkins University.	*Baltimore, Md.*	Hotel Oxford
Nixon, George Frederic S.B., Massachusetts Institute of Technology.	*Leominster*	916 Beacon St.
North, Dexter B.S., Hamilton College.	*Washington, D. C.*	211 Newbury St.
O'Connell, Regina Josephine A.B., Trinity College, Washington, D.C.	*Marlboro*	24 Fairmount St., Mar.
Ogden, William Lardner. A.B., University of Michigan.	*Deadwood, S. D.*	237 Beacon St.
O'Keefe, Philip A.B., Harvard University.	*Lynn*	418 Broadway, L.
Orlady, George Phillips B.A., University of Virginia.	*Huntington, Pa.*	100 Mt. Vernon St.
Pace, Ernest Milton, Jr. U.S.N. Graduate, United States Naval Academy.	*Calvert, Tex.*	2 Prescott St., Cam.
Paine, George Thomas B.S., Brown University.	*Warwick, R. I.*	41 Bickerstaff St.
Parker, Henry Godwin A.B., William and Mary College.	*Portsmouth, Va.*	96 St. Botolph St.
Patch, Ernest Llewellyn, U.S.N. Graduate, United States Naval Academy.	*Stoneham*	46 Gloucester St.
Paugh, Charles Thomas A.B., Ohio University.	*Athens, O.*	11 Newbury St.
Paul, George Philip M.D., University and Bellevue Hospital Medical College.	*Round Lake, N. Y.*	187 St. Botolph St.
Peters, Edward Brooks A.B., Yale University.	*Providence, R. I.*	8 Irvington St.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Pettee, Allen Danforth . . . . A.B., Yale University.	*Great Barrington*	820 Mass. Ave., Cam.
Pierce, David Eugene . . . . A.B., Smith College.	*West Middlesex, Pa.*	47 Rutland Sq.
Phelps, Charlotte Lewis . . . Ph.B., University of Wooster.	*Kenilworth, Ill.*	102 Fenway
Pitman, Earle Carver . . . . A.B., Harvard University.	*Salem*	260 Lafayette St., S.
Piza, St. Elmo Tower . . . . S.B., Massachusetts Institute of Technology.	*New York* . . .	130 St. Botolph St.
Pond, Walter Franklin . . . . B.S., Amherst College.	*Greenfield* . . .	8 Irvington St.
Poteat, John Robinson . . . . B.A., Furman University.	*Greenville, S. C.*	182 W. Brookline St.
Pratt, Aaron Paul . . . . . A.B., Clark University.	*Cambridge* . . .	2 Arnold Circle, Cam.
Putnam, Roger Lowell . . . A.B., Harvard University.	*Manchester* . .	49 Beacon St.
Randolph, Frank Harrison . . A.B., Yale University.	*Rahway, N. J.* .	49 Rutland Sq.
Raymond, Shih Shun . . . . . B.S., Purdue University.	*Canton, China* . .	6 St. Botolph St.
Reeve, Austin Bryant . . . . Ph.B., Yale University.	*Chicago, Ill.* . . .	16 Exeter St.
Repetti, George William . . . A.B., Georgetown University.	*Washington, D. C.*	16 Exeter St.
Richards, Clarence Earl, Jr. . Ph.B., Denison University.	*Columbus, O.* . .	84 St. James Ave.
Robertson, Erskine Herman . . B.S., Dakota Wesleyan University.	*Conde, S. D.* . .	79 Montgomery St.
Robinson, Edgar Steel . . . . A.B., Harvard University.	*Evanston, Ill.* .	1069 Beacon St., Br.
Robinson, Russell King . . . . A.B., Ohio Wesleyan University.	*Ashtabula, O.* . .	85 Westland Ave.
Rogers, Herman Livingston . . A.B., Yale University.	*New York, N. Y.*	5 Story St., Cam.
Rood, Melville Halstead . . . A.B., Marietta College.	*Marietta, O.* . . .	209 West Canton St.
Root, Marshall Jewell. . . . . B.S., Middlebury College.	*Providence, R. I.* .	1451 Tremont St., R.
Ross, William Byron . . . . . B.Sc., Wooster University.	*Uhrichsville, O.* .	47 Rutland Sq.
Roth, Ernest Charles . . . . . A.B., University of Michigan.	*Peru, Ill.* . . .	41 Perkins Hall, Cam.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Sabin, Henry Palmer S.B., Massachusetts Institute of Technology.	*Denver, Colo.*	98 Hemenway St.
Sadler, Walter Clifford B.S., University of Illinois.	*Elgin, Ill.*	106 St. James Ave.
Salah, John Solomon A.B., Syrian Protestant College.	*Palestine, Turkey.*	4 Yarmouth St.
Samper, Bernardo B.A., Colegio Mayor de Nuestra del Rosario. M.D., Universidad National.	*Bogota, Columbia*	84 The Fenway
Sandlas, William Henry B.S., Pennsylvania College, Gettysburg.	*Baltimore, Md.*	84 Huntington Ave.
Saunders, Harold Eugene, U.S.N. Graduate, United States Naval Academy.	*Detroit, Mich.*	640 Huntington Ave.
Saville, Thorndike A.B., Harvard University. B.S., C.E., Dartmouth College.	*Hartford, Conn.*	5 Sumner Rd., Cam.
Sawyer, Charles Baldwin A.B., Yale University.	*Cleveland, O.*	56 Charlesgate East
Scannell, Robert Henry Litt.B., Princeton University.	*Cambridge*	Felton Hall, Cam.
Searles, Thomas Mount, U.S.N. Graduate, United States Naval Academy. S.B., Mississippi Agricultural and Mechanical College.	*Allston.*	1384 Commonwealth Ave., A.
Sheils, Henry Connor S.B., Massachusetts Institute of Technology.	*Roxbury*	101 Fenwood Rd., R.
Shimizu, Giichi Graduate, Kyoto Imperial University.	*Miyeken, Japan*	15 Ellery St., Cam.
Shogenji, Kazu Graduate, Tokio Imperial University.	*Tokio, Japan*	10 Hamilton St., D.
Shuey, Arthur Ferguson A.B., Miami University.	*Camden, O.*	215 Newbury St.
Smainis, George Abraham B.A., Syrian Protestant College.	Larnaca, Cyprus	4 Yarmouth St.
Smith, Richard Harbert B.S., Moore's Hill College.	*Dillsboro, Ind.*	80 Gainsboro St.
Smith, Russell Gilman B.S., University of Wisconsin.	*Chicago, Ill.*	174 St. Botolph St.
Smith, Sophia Lyman A.B., Smith College.	*Portland, Me.*	Newton Hospital, N. L. F.
Smith, Winfred Wenner B.S., Pennsylvania College.	*Lehighton, Pa.*	11 Irvington St.
Soble, Ellis Barnet A.B., Harvard University.	*Elmira, N. Y.*	1709 Cambridge St., Cam.
Solakian, Haig Nerses B.A., Central Turkey College.	*Kilis, Turkey*	602 Tremont St.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Stason, Edwin Blyth . . . . . B.A., University of Wisconsin.	*Sioux City, Iowa* .	48 Harvard St., Nv.
Staub, John Fanz . . . . . B.S., University of Tennessee. S.B., Massachusetts Institute of Technology.	*Knoxville, Tenn.* .	98 Hemenway St.
Steese, George Morris . . . . A.B, Yale University.	*Harrisburg, Pa.* .	11 Irvington St.
Stewart, Vernon Theodore . . Ph.B., Syracuse University. S.B., Massachusetts Institute of Technology.	*Newtonville* . . .	51 Bridges Ave., Nv.
Stickney, George Horton . . . B.S., Dartmouth College.	*Beverly*	88 Cabot St., Bev.
Stimets, Bruce Negus . . . . A.B., Amherst College.	*Jersey City, N. J.*	112 Newbury St.
Storrow, James Jackson, Jr. . . A.B., Harvard University.	*Lincoln*	417 Beacon St.
Stribling, Simpson, Ridley . . B.S., Texas Agricultural and Mechanical College.	*Waco, Tex.* . . .	168 Huntington Ave.
Strieby, Maurice Edward . . . A.B., Colorado College.	*Colorado Springs, Colo.*	90 St. James Ave.
Sun, Chi Ting . . . . . B.S., Purdue University.	*Shantung, China* .	16 Mellen St., Cam.
Sung, Chien Hsun . . . . . A.B., Pekin University. B.M.E., University of Michigan.	*Foochow, China* .	177 St. Botolph St.
Sutherland, George . . . . . A.B., Yale University.	*Fort Plain, N. Y.*	89 St. James Ave.
Swain, Robert Burrough . . . A.B., Williams College.	*Pomfret Center, Conn.*	64 Charlesgate East
Swain, Winthrop Chester . . . A.B., Harvard University.	*West Roxbury*	95 Mt. Vernon St., W. Rox.
Swan, Horace Gilbert . . . . B.S., University of Rochester.	*Rochester, N. Y.* .	371 Harvard St., Cam.
Thomas, Francis Elliott . . . B.S., Pennsylvania State College.	*Bellefonte, Pa.* . .	154 Huntington Ave.
Thornton, Irving Taylor . . . A.B., Amherst College. A.M., Yale University.	*Buffalo, N. Y.* .	530 Massachusetts Ave.
Toabe, Kebe . . . . . S.B., Massachusetts Institute of Technology.	*Lawrence, Mass.* .	125 Myrtle St.
Trease, Harold William . . . . S.B., Cornell College, Ia.	*Newton, Ia.* . . .	5 DeWolfe St., Cam.
Tu, Hin Yung . . . . . Graduate, Naval College, Canton.	*Canton, China* . .	39 St. Botolph St.
Tyler, John Cowperthwaite . . A.B., Williams College.	*Brooklyn, N. Y.* .	Hemenway Hotel

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Venable, Charles Scott . . . . A.B., M.A., University of North Carolina.	*Chapel Hill, N. C.*	530 Massachusetts Ave.
Walker, Edward Cyrus, 3rd . . A.B., Hamilton College. S.B., Massachusetts Institute of Technology.	*Batavia, N. Y.*	191 Babcock St., Br.
Wallace, Edwin Shellabarger . B.A., Wittenberg College. M.A., Ohio State University.	*Springfield, O.*	Technology Chambers
Wanamaker, Elmer Milton . . A.B., Harvard University.	*Melrose Highlands*	24 Thayer Hall, Cam.
Wang, Chou . . . . . Graduate Nanking Naval College.	*Nanking, China*	820 Mass. Ave., Cam.
Weaver, Eastman Atkins . . . S.B., Massachusetts Institute of Technology.	*Des Moines, Ia.*	12 Newbury St.
Webster, Walter Wynne, U.S.N. Graduate, United States Naval Academy.	*Fargo, N. D.*	46 Gloucester St.
Wellman, Harvey Elijah . . . A.B., Williams College.	*Providence, R. I.*	16 Exeter St.
Wells, Everett Deane . . . . B.S., Grinnell College.	*Nashua, Ia.*	47 St. Stephen St.
Wescott, Ernest Waters . . . S.B., Harvard University. S.M., Massachusetts Institute of Technology.	*Cambridge*	106 Trowbridge St., Cam.
Wheeler, Evan Rupert . . . . B.S., A.M., Colby College.	*Waterville, Me.*	45 St. Botolph St.
Whetzel, Joshua Clyde . . . . B.S., Washington and Lee University.	*Martinsburg, W. Va.*	101 St. James Ave.
Whitall, Charles Whitmore . . A.B., Harvard University. S.B., Massachusetts Institute of Technology.	*Cambridge*	71 Larch Rd., Cam.
Whitehead, Walter Lucius . . S.B., Massachusetts Institute of Technology.	*Fryeburg, Me.*	203 Bay State Rd.
Whittier, Ross . . . . . A.B., Harvard University.	*Milton*	48 Claverly Hall, Cam.
Williams, Edward Hudson . . B.S.M.E., Purdue University.	*South Bend*, Ind.	136 Newbury St.
Williams, Roger . . . . . S.B., Massachusetts Institute of Technology.	*Gothenburg, Neb.*	115 Browne St., Br.
Wilson, LeRoy Waring . . . . B.S., Military College of South Carolina	*Allendale, S. C.*	44 Frances St., Br.
Wilson, Robert Erastus . . . . Ph.B., University of Wooster.	*Wooster, O.*	41 Rutland Sq.
Wong, Shao Fung . . . . . B.Sc., Armstrong College, University of Durham.	*Tsinanfu, China*	99 St. Botolph St.
Wong, Tsoo . . . . . B.Sc., Armstrong College, University of Durham.	*Pekin, China*	79 St. Botolph St.

GRADUATE STUDENTS (*continued*).

NAME.	HOME.	RESIDENCE.
Woo, Sien Ming . . . . . A.B., St. Johns University. M.D., Johns Hopkins University.	*Chong Chow, China*	119 Hemenway St.
Woodruff, Benjamin Hicks, Jr. B.S., Georgia School of Technology.	*Porterdale, Ga.*	316 Huntington Ave.
Wright, Henry Wagner . . . . A.B., Yale University.	*Danvers*	241 Locust St., Dan.
Wright, Theodore Paul . . . . B.S., Lombard College.	*Cambridge*	72 Fayerweather St., Cam.
Wrigley, Paul Pickering . . . A.B., Williams College.	*Brooklyn, N. Y.*	121 Newbury St.
Wu, Tai Ming . . . . . Graduate, Canton Naval College.	*Canton, China*	7 Follen St.
Yeh, Chi Foo . . . . . Graduate, Canton Naval College.	*Canton, China*	7 Follen St.
Yeh, Tek-Chen . . . . . Graduate, Tsing Hua College, Pekin.	*Shanghai, China*	135 Appleton St.
Yokoyama, Wakamaten . . . Graduate, Tokio Imperial University.	*Port Arthur, Japan*	25 Cortes St.
Yoshikawa, Hiroshi . . . . . Graduate, Tokio Imperial University.	*Tokio, Japan*	113 Thorndike St., Bri.
Young, Vertrees . . . . . B.S., Trinity College.	*Oakmont, Pa.*	213 Newbury St.
Yu, Tsao . . . . . B.Sc., Armstrong College, University of Durham.	*Chinkiang, China*	99 St. Botolph St.
Yuen, Tsin . . . . . Graduate, Nanking Naval College.	*Nanking, China*	99 St. Botolph St.
Zamore, Birger Verner . . . . S.B., Harvard University.	*Cambridge*	11 Wadsworth House, Cam.
Zeigler, Samuel Jacob, Jr., U.S.N. Graduate, United States Naval Academy.	*Shreveport, La.*	10 Avon St., Cam.

CLASSIFIED STUDENTS.

FOURTH YEAR.

NAME.	COURSE.	HOME.	RESIDENCE.
Ahearn, Richard Lombard	I.	*Brighton*	18 Foster St., Bri.
Aiken, Walter Scott	II.	*Melrose*	283 Newbury St.
Aldridge, Blair Grigsby	II.	*Arcola, Miss.*	37 Astor St.
Alfaro-Moran, Rafael	I.	*Ahuachapan, Salvador*	179 Bay State Rd.
Andrews, Pearl Kinney	IV.	*Yarmouth, N. S.*	49 Gainsborough St.
Aronson, Mark	I.	*Roxbury*	25 Lawrence Ave., R.
Atchison, Thomas Calvin, A.B.	XIV.	*Lawrence*	89 St. James Ave.
Austin, Paul Page, Jr.	II.	*San Francisco, Cal.*	112 Newbury St.
Ayer, Harold Ellsworth	IV.	*Portland, Me.*	128 St. Botolph St.
Bagby, Ralph Bridges, A.B.	II.	*New Haven, Mo.*	11 Irvington St.
Baker, Philip Custer	II.	*Lansing, Mich.*	97 Hemenway St.
Ball, Edwin Leo	IV.	*Alexandria, La.*	179 St. Botolph St.
Balyozian, Nicholas	V.	*Dorchester*	80 Lucerne St., D.
Bannister, Alfred Edward	II.	*Duluth, Minn.*	316 Huntington Ave.
Barker, Joseph Warren	VI.	*Rockford, Ill.*	203 Bay State Rd.
Barney, Eugene Judson, B.S.	VI.	*Dayton, O.*	261 Newbury St.
Barrett, Lawrence William	I.	*Brockton*	53 Weston St., Brock.
Barrett, William Joseph	II.	*South Boston*	640 Seventh St., S. B.
Barry, Edward Hearsey, A.B.	II.	*Newton Center*	530 Ward St., N. C.
Bennett, Horace Ralph	I.	*Lowell*	71 Varney St., Low.
Berger, Richard George	V.	*Bridgeport, Conn.*	207 Harvard St., D.
Berrigan, Thomas Augustine	XI.	*South Boston*	890½ Broadway, S. B.
Best, Leonard Ernest	X.	*Brooklyn, N. Y.*	291 Harvard St., Br.
Binger, Walter David	I.	*New York, N. Y.*	106 Trowbridge St., Cam.
Blackall, Robert Murray, A.B.	IX.	*Cambridge*	16 Chauncy St., Cam.
Blaine, Emmons, S.B.	II.	*Chicago, Ill.*	24 Dunster Hall, Cam.
Blank, Wesley Howard	I.	*Winchester*	4 Myrtle St., Winc.
Bliss, Mervin Washington, A.B.	VI.	*East Concord, N. H.*	524 Columbus Ave.
Blodgett, Charles Albert	X.	*Portland, Me.*	138 West Canton St.
Bolton, Meade	IV.	*Washington, D. C.*	261 Newbury St.
Boulton, Berthoud Clifford	I.	*Cambridge*	431 Putnam Ave., Cam.
Bresth, Alexander	XI.	*West Acton*	114 Pembroke St.
Brophy, Thomas D'Arcy, A.B.	IV.	*Butte, Mont.*	44 The Fenway
Brown, Raymond Grout	XIV.	*Melrose Highlands*	136 Greenwood St., Mel. H.
Brown, Willard Cowles, B.S.	VI.	*Chestertown, N. Y.*	30 Newbury St.
Brown, William Goss	VIII.	*Rye Beach, N. H.*	261 Newbury St.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Bryant, Frederick Copeland, A.B.	I.	*Newport, R. I.*	78 Mt. Auburn St., Cam.
Bucknam, Frank White	I.	*Swampscott* .	114 Norfolk Ave., Swam.
Burbank, James Archer	I.	*East Milton*	48 Washington St., E. M.
Burnap, Robert Samuel	VI.	*Ivoryton, Conn.*	36 Waverly St., R.
Buxton, Paul Henry	II.	*Dorchester* . . .	30 Newbury St.
Byrne, Leroy Richard	XIV.	*East Lynn* . .	138 President St., E. L.
Caldwell, Arthur Percy, Jr., B.S.	VI.	*New York, N. Y.*	124 Newbury St.
Camp, George Dashiell, B.S. . .	I.	*San Antonio, Tex.*	168 Huntington Ave.
Carr, Jasper Blanchard	VI.	*Wilkes-Barre, Pa.*	237 Beacon St.
Carstens, Carl Eberhard, B.A. .	III.	*Ackley, Ia.* .	120 Mt. Auburn St., Cam.
Cellarius, Charles Frederick, A.B.	IV.	*Norwood, O.* .	246 Newbury St.
Chalatow, Leon Sergius	II.	*Petrograd, Russia*	308 Newbury St.
Chand, Diwan Nanak	VI.	*Karachi, India* .	497 Huntington Ave.
Chandler, Frank Davenport . .	VI.	*Cambridge* . .	140 Magazine St., Cam.
Chu, Chi-Che	XIII B.	*Hangchow, China*	86 Huntington Ave.
Clarke, Bruce Addison	VI.	*Auburndale* .	373 Lexington St., Aub.
Clarkson, Edward Hale, Jr. . . .	XI.	*Newburyport* . .	1067 Beacon St., Br.
Clarkson, Freeman, A.B.	VI.	*Brooklyn, N. Y.*	89 St. James Ave.
Claussen, Howard Paul	II.	*Hartford, Conn.* .	12 Newbury St.
Coleman, Caruthers Askew . . .	II.	*Como, Miss.* . .	234 Newbury St.
Comiskey, Daniel Louis.	I.	*Dover*	Main St., Dover
Connolly, Joel Irving	XI.	*Dorchester* . . .	7 Fenno Place, D.
Cornelius, Charles Over, A.B. . .	IV.	*Richmond*	85 Pinckney St.
Correia, Joâo Nunes	VI.	*Lisbon, Portugal*	33 Bickerstaff St.
Cousineau, Aimé, B.A.Sc. . . .	XI.	*Montreal, Que.* .	68 Huntington Ave.
Crandall, Willard Raymond . . .	V.	*Westerly, R. I.* .	41 St. Botolph St.
Crosby, Robert Addison	II.	*Dorchester* . . .	8 Bellevue St., D.
Crosier, Charles Leavett	XI.	*Hadley*.	114 Pembroke St.
Crowell, George Ira	II.	*Campello* . . .	104 St. Botolph St.
Crowell, Harold Ryder	IV.	*Los Angeles, Cal.*	215 Newbury St.
Curtis, Bradford Scott	VI.	*Medfield* . . .	92 Worcester St.
Curtis, Theron Smith	II.	*North Attleboro*	89 Washington St., N. At.
Dana, Duncan, A.B.	VI.	*New York, N. Y.*	60 Mt. Auburn St., Cam.
Daniels, Donald Potter	V.	*Chicago, Ill.* . .	1080 Beacon St., Br.
Daniels, Harvey William	I.	*Whitman* . . .	87 Beulah St., Whit.
Darlington, Frank Graef Jr., C.E.	VI.	*Indianapolis, Ind.*	31 Newbury St.
Davies, Ralph Vivian.	V.	*Plymouth* . . .	Technology Chambers
Dean, Kemerton	II.	*Brookline* . . .	1004 Beacon St., Br.
Devine, Elbridge Russell	X.	*Needham* . . .	Cedar Place, Need.
Diemer, Robert Winfield	VI.	*Germantown, Pa.*	316 Huntington Ave.
Dodd, Sidney Reginald	V.	*East Orange, N.J.*	61 Montview St., W.R.
Dodge, Harold French	VI.	*Lowell*	607 School St., Low.
Duff, Paul Harrington	VII.	*Charlestown* . .	283 Newbury St.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Duggan, Joseph Richard	XI.	*Milford*	1 West St., Milf.
Dunn, Donald Omar	IV.	*Westerly, R. I.*	85 Pinckney St.
Duryea, George Root	II.	*Springfield*	237 Beacon St.
Easley, Cary Breckenridge	VI.	*Richmond, Va.*	30 Newbury St.
Eberhardt, John Dennett	II.	*Arlington*	248 Gray St., Arl.
Eddy, Carlton Winne	VI, II.	*Dorchester*	54 Magnolia St., D.
Ekdahl, Edwin Albert	VI.	*Roxbury*	9 Cardington St., R.
Ellicott, Valcoulon LeMoyne	VII.	*Baltimore, Md.*	17 Bowker St., Br.
Ellis, Herbert William	VI.	*Middleboro*	36 Waverly St., R.
Ellsworth, Samuel Morrison	XI.	*Braintree*	117 Adams St., Brain.
Engstrom, Karl Emil	II.	*Lancaster*	210 Newbury St.
Evans, Howard Tasker	IV.	*Haverhill*	11 Park St., Hav.
Evans, James Morrison	II.	*Patterson, N. J.*	16 Exeter St.
Fairfield, John Guthrie	II.	*Littleton*	15 Cottage St., Cam.
Farhi, Joseph	I.	*Constantinople, Turkey*	26 Canterbury St., D.
Farrar, John Robinson	IV.	*Abington*	Technology Chambers
Farthing, William Jones	I.	*Houston, Tex.*	168 Huntington Ave.
Fisher, D. K. Este, Jr., Litt. B.	IV.	*Baltimore, Md.*	1079 Beacon St., Br.
Flannagan, Coke, B.S.	VI.	*Montclair, N. J.*	290 Newbury St.
Fleming, William Harold	II.	*Akron, O.*	234 Newbury St.
Fletcher, Ralph Andrew	I.	*Westford*	215 Newbury St.
Fogerty, Joseph Samuel	VI.	*Somerville*	118 Bartlett St., Som.
Foote, Francis Chandler	I, XI.	*Cooperstown, N. Y.*	333 Commonwealth Ave.
Foster, Howard Leslie	XI.	*Amesbury*	102 Huntington Ave.
Fouhy, Joseph John	XI.	*Charlestown*	21 Wall St., C.
Fowle, Walter Harrison	II.	*Woburn*	8 Cedar St., Wo.
Frank, Harry	X.	*Dorchester*	80 McLellan St., D.
Freeman, Hovey Thomas	II.	*Providence, R. I.*	215 Newbury St.
Freeman, John Ripley, Jr.	XIV.	*Providence, R. I.*	215 Newbury St.
Freeman, Osborn Ricker	IV.	*Helena, Mont.*	316 Huntington Ave.
Fuller, Harold Chipman	X.	*Salem*	22 Summit Ave., S.
Fulton, Garland, U.S.N.	XIII.A.	*Charlottesville, Va.*	428 Charles River Rd., Cam.
Gagnon, Ernest Camille	X.	*Lynn*	18 Windsor Ave., L.
Gfroerer, Herbert	II.	*Dorchester*	50 Richfield St., D.
Giles, Allen Lester	IV.	*Walpole*	66 Massachusetts Ave., Walp.
Giles, Wesley Marshall	VI.	*Anchorage, Ky.*	1295 Commonwealth Ave., A.
Gilkey, Herbert James, B.S.	I.	*Grants Pass, Ore.*	209 W. Canton St.
Glann, Charles, A.B.	VI.	*Cortland, N. Y.*	Technology Chambers
Gooding, Percival Poole	X.	*Hyde Park*	101 Glenwood Ave., H. P.
Gordon, Barnett David	X.	*Dorchester*	205 Columbia Rd., D.
Gore, John	X.	*Auburndale*	34 Rowe St., Aub.
Graff, Murray Gensel	VI.	*Denver, Colo.*	316 Huntington Ave.
Gray, Harold Parker	II.	*Melrose*	86 Cedar Park, Mel.
Green, Howard Whipple, A.B.	XI.	*Woonsocket, R. I.*	11 Irvington St.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Gross, Charles Frederick . . .	XIII.	*Baltimore, Md.* .	316 Huntington Ave.
Gruber, Rudolf Edward	X.	*Freiburg, i B, Germany*	114 The Fenway
Guething, Carl Theodore	II.	*Hollis, N. H.* . .	44 The Fenway
Gunts, Robert Fulton	VI.	*Baltimore, Md.* .	65 Astor St.
Guss, Maynard Cameron . . .	I.	*Middleton* . . .	130 St. Botolph St.
Habicht, Elsa Clara	V.	*Chicago*	142 Hemenway St.
Haggkvist, Fred Eric	II.	*Malden*	31 Rockwell St., Mal.
Halberstadt, Alexander Ernst . .	VI.	*New Rochelle, N. Y.*	291 Harvard St., Br.
Hale, Edwin Dudley	X.	*Dorchester* . . .	495 Columbia Rd., D.
Hall, Edward Reynolds	IV.	*Magnolia* .	Charles River Rd., Cam.
Hamilton, William West, U.S.A. .	VI.	*Allston*	36 Glenville Ave., A.
Hand, Carl Nelson, B.S.	X.	*Medina, N. Y.* .	41 Batavia St.
Hands, Howard Albert	VI.	*Lowell*	417 Beacon St., Low.
Hanford, Edgar Francis . . .	XIII.	*Dorchester* . . .	220 Neponset Ave., D.
Harrower, Paul Dexter	II.	*Chelsea*	64 Parkway, Ch.
Hart, Robert Francis	XIII.	*Morristown, N. J.*	260 Newbury St.
Hatch, Paul	II.	*Newton Centre* .	203 Bay State Rd.
Hauman, Earl Leeson	XIV.	*Revere*	144 Malden St., Rev.
Hawes, Clayton Prescott	VI.	*North Dartmouth*	Technology Chambers
Hayden, Edmund McKendree, A.B.	X.	*Brookline* . . .	221 Harvard St., Br.
Hefler, Richard Evans	I.	*Dennis* . . .	414 Massachusetts Ave.
Hepinstall, John	I.	*St. Thomas, Ont.*	194 Huntington Ave.
Hewins, Edward Foster . . .	XIII.	*Hampton, Va.* .	237 Beacon St.
Hickey, John James	XI.	*Brighton*	90 Murdock St., Bri.
Hine, Tredick Kittredge	IV.	*New Britain, Conn.*	283 Newbury St.
Hoffmann, Saul Alexander . . .	X.	*Joliet, Ill.* . . .	5 Stillman St.
Hogan, John Forbes	IV.	*Pawtucket, R. I.* .	17 Beech St., Paw.
Holbrook, Frederick Cabot, A.B.	I.	*Boston*	501 Beacon St.
Holden, Thomas Steele, B.A., M.A.	IV.	*Austin, Tex.* . .	85 Newbury St.
Holmberg, Carl Herbert	I.	*Wakefield* . . .	6 Pleasant St., Wak.
Holmes, Albert	VI.	*Washington, D. C.*	283 Newbury St.
Hood, John Marshall.	V.	*Turners Falls*	20 St. James Ave., W. Som.
Hopkins, Spencer Drummond, A.B.	II.	*Onancock, Va.* .	19 Burroughs St., J. P.
Howard, William Floyd, B.S. . .	IV.	*Fairbanks, Wash.*	19 Upton St.
Hu, Peh Yuan	III.	*Shanghai, China*	247 W. Newton St.
Hudson, Charles Maynard . . .	VI.	*Natick*	44 High St., Na.
Hunneman, John Richard, A.B. .	II.	*Wellesley Hills* .	Abbott Rd., Wel. H.
Husted, Donald Robertson . . .	XIV.	*Winthrop* . . .	18 Temple Ave., Win.
Ingle, John Byron	II.	*San Diego, Cal.* .	112 Newbury St.
Ingraham, Franklin Temple, A.B.	I.	*Wellesley* . . .	Wellesley
Jackson, Harvey Wheeler, A.B. .	IV.	*Herkimer, N. Y.*	250 Newbury St.
Jacobson, David Lyon, B.S. . .	X.	*Jersey City, N. J.*	43 Warren Ave.
Jasionowski, Vitold Adam . .	II, VI.	*Sebastopol, Russia*	69 Westland Ave.
Jenkins, Edward Summers . . .	I.	*East Lynn* . .	72 Coburn St., E. L.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Jewett, Theodore Carter	II.	*Buffalo, N. Y.*	44 The Fenway
Johnson, Everett Bailey	VII.	*Newburyport*	2 Johnson St., Np.
Junkins, Walter Hilton, B.S.	VII.	*Portsmouth, N. H.*	17 Bowker St., Br.
Kaula, Edgar Louis	X.	*Winter Hill*	38 Richdale Ave, W. H.
Kerstein, Benjamin Hoffman	I.	*Boston*	19 N. Russell St.
King, Kenneth Theodore	X.	*Chicago, Ill.*	98 Hemenway St.
Kinthong, Chan, A.B.	I.	*Bangkok, Siam*	497 Huntington Ave.
Kleinert, Albert Emanual, Jr.	I.	*Brooklyn, N. Y.*	108 St. James Ave.
Kniesner, William Tobias	VI.	*Danbury, Conn.*	183 West Brookline St.
Knowland, Richardson Grant	X.	*Newburyport*	43 Green St., Np.
Knowlton, Lauriston Edward, A.B.	I.	*Cambridge*	18 Forest St., Cam.
Krigger, Anselmo	I.	*Cambridge*	21 Mill St., Cam.
Kuehle, Frederick William	VI.	*Baltimore, Md.*	316 Huntington Ave.
Lam, von Fong	XIII.B.	*Canton, China*	156 Huntington Ave.
Lanphier, Basil, A.B.	VI.	*Omaha, Neb.*	45 E. Newton St.
Lapham, Samuel Jr., A.B.	IV.	*Charleston, S. C.*	91 Newbury St.
Larner, Harold	XIII.	*Cambridge*	948 Mass. Ave., Cam.
Lawrance, Charles William	VII.	*Auburndale*	12 Newbury St.
Lawrason, Levering	II.	*St. Francisville, La.*	1004 Beacon St., Br.
Lemmon, Mark, B.A.	IV.	*Dallas, Tex.*	1079 Beacon St., Br.
Lewis, Chester Franklin	I.	*Boston*	56 E. Springfield St.
Liddell, William Andrew	I.	*Lowell*	25 Twelfth St., Low.
Lieber, Albert Carl, Jr.	I.	*Jamaica Plain*	203 Newbury St.
Lipman, Saul Harold	X.	*Roxbury*	45 Lawrence Ave., R.
Little, Thomas Wolcott, B.S.	I.	*Hartford, Conn.*	213 Newbury St.
Littlefield, Walter Berry, A.B.	VI.	*Roxbury*	35 Hutchins St., R.
Long, William Edwin	XIII.	*Rochester, N. Y.*	10 Westland Ave.
Loo, Ping Yok	II.	*Tientsin, China*	316 Huntington Ave.
Loomis, Charles Wheeler	XI.	*Boston*	179 Bay State Rd.
Lord, Charles Rogers	II.	*Newton*	215 Newbury St.
Lovell, Carleton Woodward	I.	*N. Cambridge*	65 Mt. Vernon St., N. Cam.
Lowe, Russell Edmund, B.E.	V.	*New York, N. Y.*	211 Newbury St.
Lucas, Eugene Willett Van Court, Jr.	I.	*Sound Beach, Conn.*	44 The Fenway
McCarthy, Charles Joseph	I.	*Lawrence*	1 Fulton St., Law.
McDevitt, John Newman	II.	*Edgewood, R. I.*	179 Bay State Rd.
McDonald, Kenneth Madison, B.S.	VI.	*Birmingham, Ala.*	53 St. Stephen St.
McDonald, William Cantwell	IV.	*Palmer*	283 Newbury St.
McDowell, John Spotts	III.	*Clearfield, Pa.*	245 W. Newton St.
McKown, Frederick Whittlesey, A.B.	VI.	*Rochester, N. Y.*	1078 Boylston St.
McRae, Donald Marion	III.	*Washington, D. C.*	44 The Fenway
MacRae, Nelson	II.	*Wilmington, N. C.*	44 The Fenway
McSweeney, Thomas Francis	XI.	*Framingham*	1 Salem End Rd., Fram.
Mahlman, Osborne LeBaron	XIV.	*Lubec, Me.*	129 Pembroke St.
Makepeace, Charles Salisbury	II.	*Providence, R. I.*	12 Newbury St.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Marquez, Miguel, Jr.	I.	*Chihuahua, Mex.*	60 Westland Ave.
Martin, Alexander, B.S.	VI.	*Eugene, Ore.*	30 Newbury St.
Maverick, George Madison	X.	*San Antonio, Tex.*	1069 Beacon St., Br.
Mayers, Hadyn Potter, B.S.	I.	*San Antonio, Tex.*	168 Huntington Ave.
Meigs, Joseph Vincent	V.	*Malden*	33 Clinton St., Mal.
Meinzer, Gotthold Holda, B.A.	XIV.	*Ackley, Ia.*	Trinity Hall, Cam.
Mellen, Earl Rufus	VI.	*Lowell*	1141 Bridge St., Low.
Mendelsohn, Herbert, A.B.	X.	*New York, N. Y.*	237 Beacon St.
Merritt, James Charles	VI.	*North Adams*	183 W. Brookline St.
Metz, Charles Walter	II.	*Waltham*	Gore St., Wal.
Millis, Ralph	I.	*Newport, R. I.*	237 Beacon St.
Mills, Ralph Harold	VI.	*Natick*	12 Byron Ave., Na.
Monroe, Merrick Atherton	XI.	*Waltham*	26 Adams St., Wal.
Morrison, Phillips Garrison	VI.	*Andover*	68 Elm St., And.
Morse, Henry Gardner	II.	*Dorchester*	80 Glendale St., D.
Munyan, Arthur Tapley	X.	*Melrose*	1069 Beacon St., Br.
Murdough, James Harold	I.	*Dorchester*	25 Windermere Rd., D.
Naumburg, Robert Elkan, A.B.	II.	*New York, N. Y.*	84 Coolidge St., Br.
Neave, Arthur Stuart, A.B.	X.	*Cincinnati, O.*	11 Irvington St.
Neilson, Halbert Hale, B.S.	VI.	*Lexington, Miss.*	261 Newbury St.
Newton, Burkett Dunlap, A.B.	VI.	*Los Angeles, Cal.*	8 Irvington St.
North, Dexter, B.S.	X.	*Washington, D. C.*	211 Newbury St.
Ober, Shatswell	XIII.	*Arlington H'ts*	22 Oakland Ave., Arl.H.
Ogden, William Lardner, A.B.	II.	*Deadwood, S. D.*	237 Beacon St.
O'Keefe, Philip, A.B.	VI.	*Lynn*	418 Broadway, L.
Ousler, George Walter	VI.	*Pittsburgh, Pa.*	1 Leonard Ave., Cam.
Owen, Knight Barry	II.	*Vineyard Haven*	215 Newbury St.
Owler, Duncan Stewart	VI.	*Providence, R. I.*	279 Bucklin St., Prov.
Pace, Ernest Milton, Jr. U.S.N.	XIII.A.	*Calvert, Tex.*	2 Prescott St., Cam.
Page, Arvin	II.	*Wollaston*	112 Newbury St.
Paine, Charles Graham	II.	*Dover*	Dover
Parsons, Edmund Selinger	II.	*Providence, R. I.*	[illegible]y St.
Parsons, Theodore Dillaway	II.	*Lynn*	[illegible] Newbury St.
Pattee, Elizabeth Greenleaf	IV.	*Quincy*	19 School St., Q.
Peters, Edward Brooks, A.B.	VI.	*Providence, R. I.*	8 Irvington St.
Petit, George Herbert	IV.	*New York, N. Y.*	291 Harvard St., Br.
Pettee, Allen Danforth, A.B.	VI.	*Great Barrington*	820 Mass. Ave., Cam.
Pettibone, Milton Wallace	IV.	*Detroit, Mich.*	203 Bay State Rd.
Phelps, Charlotte Lewis, A.B.	IV.	*Kenilworth, Ill.*	102 The Fenway
Phillips, Luther Savage	IV.	*Northeast Harbor, Me.*	237 Beacon St.
Pitman, Earle Carver, A.B.	X.	*Salem*	260 Lafayette St., S.
Pizzorno, Pedro Paulo	VI.	*Boston*	37 Foster St., Bri.
Pratt, Lewis Howe	IV.	*Brockton*	132 St. Botolph St.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Pyle, Oden Bowie, Jr.	I.	*Baltimore, Md.*	203 Bay State Rd.
Ralston, James Muir	II.	*Allenhurst, N. J.*	16 Exeter St.
Raymond, Thomas Emmons	II.	*Cambridge*	84 Ellery St., Cam.
Reed, Charles Sumner	II.	*Auburndale*	1069 Beacon St., Br.
Reeve Austin Bryant, Ph.B.	II.	*Chicago, Ill.*	16 Exeter St.
Reid, Geoffrey Laurence	II.	*North Andover*	111 Main St., No. And.
Rennie, Roswell Miller	II.	*Los Angeles, Cal.*	16 Exeter St.
Repetti, George William, A.B.	III.	*Washington, D. C.*	16 Exeter St.
Richardson, Chester Northup	XIV.	*East Lynn*	35 Autumn St., E. L.
Richmond, Kenneth Calvin	II.	*Rochester, N. Y.*	327 Huntington Ave.
Robertson, John Douglas	II.	*Taunton*	112 Newbury St.
Rood, Melville Halstead, A.B.	X.	*Marietta, O.*	209 W. Canton St.
Rooney, George Thomas	I.	*Norwood*	437 Walpole St., Nor.
Root, Marshall Jewell, B.S.	II.	*Providence, R. I.*	1451 Tremont St., R.
Rosenberg, Benjamin Robert	I.	*Chelsea*	135 Walnut St., Ch.
Ross, Frank Douglas	IV.	*Hartford, Conn.*	164 Park Ave., Arl. H.
Rowlett, Richard Stewart	II.	*Brookline*	234 Newbury St.
Rubin, Jesse Abraham	I.	*Chelsea*	191 Chestnut St., Ch.
Russell, Harold	II.	*Dorchester*	12 Bodwell St., D.
Saunders, Harold Eugene, U.S.N.	XIII.A.	*Detroit, Mich.*	640 Huntington Ave.
Schabacker, Henry Eric	XIV.	*Erie, Pa.*	261 Newbury St.
Schaefer, August George	II.	*New York, N. Y.*	4 St. Botolph St.
Schur, Milton Oscar	X.	*Boston*	5 Stillman St.
Shepard, Henry Bradbury	II.	*East Derry, N. H.*	12 Newbury St.
Shuey, Arthur Ferguson, A.B.	XI.	*Camden, O.*	215 Newbury St.
Simpson, Stephen Gershom	V.	*Roxbury*	22 Elmore St., R.
Sindler, Jacob	X.	*Baltimore, Md.*	67 Batavia St.
Smith, Harry Bennett	XIV.	*West Somerville*	43 Curtis St., W. Som.
Snyder, Ralph Moser	II.	*Galilee, Pa.*	11 Grant St., Som.
Sommer, Henry Oscar	VI.	*Alameda, Cal.*	6 Blackwood St.
Spaulding, [illegible] Maurice	IV.	*Ionia, Mich.*	203 Bay State Rd.
Spear, [illegible]	I.	*Edgartown*	833 Beacon St.
Spooner, George Ashton	IV.	*Council Bluffs, Ia.*	246 Newbury St.
Sprague, William Griffith	IV.	*Chicago, Ill.*	179 Bay State Rd.
Stafford, John Wesley	II.	*Hackensack, N. J.*	1069 Beacon St., Br.
Stason, Edwin Blythe, B.A.	VI.	*Sioux City, Ia.*	48 Harvard St., Nv.
Steese, George Morris, A.B.	I.	*Harrisburg, Pa.*	11 Irvington St.
Stetson, Bradford	I.	*Dorchester*	23 Dakota St., D.
Stewart, Arthur Knowles	II.	*Lonsdale, R. I.*	80 Bay State Rd.
Stewart, Walter Scott	II.	*Lonsdale, R. I.*	80 Bay State Rd.
Stickney, George Horton, B.S.	II.	*Beverly*	88 Cabot St., Bev.
Stimets, Bruce Negus, A.B.	II.	*Jersey City, N. J.*	112 Newbury St.
Stone, Leonard	II.	*Medford*	30 Summit Rd., Med.
Strangman, Warren Andrews	II.	*Needham*	74 Kingsbury St., Need.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Strieby, Maurice Edward, A.B.	VI.	*Colorado Springs, Colo.*	90 St. James Ave.
Sully, Kenneth Murchison	III.	*Santa Rita, N. Mex.*	1067 Beacon St., Br.
Sutermeister, Frederick	II.	*Wollaston*	285 Belmont St., Wol.
Sutherland, George, A.B.	VI.	*Fort Plain, N. Y.*	89 St. James Ave.
Swain, Winthrop Chester, A.B.	I.	*West Roxbury*	95 Mt. Vernon St., W. R.
Sweet, George Albert	X.	*Milford*	283 Newbury St.
Tai, Shiu Tao	II.	*Hunan Chanteh, China*	107 Oxford St., Cam.
Thomas, Paul Baker	II.	*Keedysville, Md.*	100 St. James Ave.
Thompson, Norman Julien	XIV.	*Melrose*	40 Irving St., Mel.
Thomson, Gerald Whaley	I.	*Cambridge*	14 Center St., Cam.
Tobey, James Alner	IX.	*Roxbury*	136 Blue Hill Ave., R.
Townshend, Bailey	VIII.	*Brookline*	217 Harvard St., Br.
Tuttle, George Woodbury	II.	*Exeter, N. H.*	6 Maybrook St., G. H.
Uhlinger, James Philip	IV.	*Johnstown, N. Y.*	203 Bay State Rd.
Ullian, Hyman Benjamin	I.	*Dorchester*	35 Creston St., D.
Upton, Frederick Pattangall	VIII.	*Washington, D. C.*	18 Claremont Park
Vile, Norman Judd	II.	*Meriden, Conn.*	110 Newbury St.
Wallis, Charles Parker	IV.	*New York, N. Y.*	215 Newbury St.
Walter, Charles, 3d	II.	*Tompkinsville, N. Y.*	4 St. Botolph St.
Wareham, Charles Montgomery	XI.	*Swampscott*	36 Orkney Rd., Br.
Warshaw, Nathaniel	II.	*Quincy*	11 Bedford St., Q.
Waymouth, George William	II.	*San Juan, P. R.*	820 Mass. Ave., Cam.
Webster, Donald Blake	X.	*Malden*	237 Beacon St.
Weissbach, Edward Adolf	II.	*Bond Hill, O.*	55 Astor St.
Wellington, Marshall Symmes	XI.	*Winchester*	102 Huntington Ave.
Wentworth, Wallace Edward	XIV.	*East Lynn*	104 Chatham St., E. L.
White, Harold Eaton	II.	*Reading*	150 High St., Read.
White, Russell Hubbard	I.	*Boston*	234 Newbury St.
Whiting, Edmund Alden	II.	*Montclair, N. J.*	12 Newbury St.
Williams, Allison Ridley	VI.	*Washington, D. C.*	136 Newbury St.
Williams, Edward Hudson, B.S., M.E.	II.	*South Bend, Ind.*	136 Newbury St.
Wilson, LeRoy Waring, B.S.	IV.	*Allendale, S. C.*	44 Francis St., Br.
Wilson, Robert Erastus, Ph.B.	X.	*Wooster, O.*	41 Rutland Sq.
Witherspoon, Andrew Carothers	I.	*Chambersburg, Pa.*	169 W. Newton St.
Wolfe, Walter John	XIV.	*Greenwood*	7 Crystal St., Gr.
Wolk, Moses	VI.	*Malden*	560 Cross St., Mal.
Woodbridge, Donald Eliot	VI.	*Germantown, Pa.*	12 Sacramento St., Cam.
Woodruff, Benjamin Hicks, B.S.	VI.	*Porterdale, Ga.*	316 Huntington Ave.
Woods, John Edgar	XIV.	*Dorchester*	58 Bennett St., Bri.
Woythaler, Max Isaac	V.	*Springfield*	67 Batavia St.
Wu, Hsien	V.	*Foochow, China*	316 Huntington Ave.
Wylde, Wilfred Arthur	X.	*North Adams*	183 W. Brookline St.
Wyman, Alfred Theodore	IV.	*Fitchburg*	1069 Beacon St., Br.

FOURTH YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Wyman, George Whitcombe	VI.	*Brighton*	35 Dustin St., Bri.
Young, Vertrees, B.S.	II.	*Oakmont, Pa.*	213 Newbury St.
Zanetti, Silvio	IV.	*Everett*	8 Bellingham Ave., Ev.
Zeigler, Samuel Jacob, Jr., U.S.N.	XIII.A.	*Shreveport, La.*	10 Avon St., Cam.
Zilliacus, Laurin	X.	*Stamford, Conn.*	32 Linnaean St., Cam.

THIRD YEAR.

NAME.	COURSE.	HOME.	RESIDENCE.
Abels, Charles August	VI.	*Lowell*	43 Nicollet St., Low.
Adams, Carleton Coffin	X.	*West Somerville*	14 Lesley Ave., W. Som.
Allen, Chester King	II.	*Quincy*	34 Avon Way, Q.
Althouse, Alfred Kutz	XI, XV.	*Norristown, Pa.*	535 Newbury St.
Ames, Chester Edward	VI.	*Cambridge*	50 Highland Ave., Cam.
Anderson, James William	XI.	*South Lancaster*	283 Newbury St.
Andrews, George Angell, U.S.N.	XIII. A.	*Grand Haven, Mich.*	11 Stone Rd., Bel.
Angas, William Mack	I.	*Jacksonville, Fla.*	916 Beacon St.
Angeloff, Angel	VI.	*Sistov, Bulgaria*	114 W. Newton St.
Antunez, Ernesto	I.	*Aija, Peru*	80 Gainsborough St.
Astorian, Alexander	IV.	*Boston*	189 Massachusetts Ave.
Atkinson, Charles Edward	I.	*Newburyport*	28 Maxwell Rd., Winc.
Auty, Clarence	VI.	*Andover*	19 Haverhill St., And.
Babbitt, John Hancock	I.	*Northampton*	20 Warland St., Cam.
Bailey, Howard Elliott	XI.	*North Scituate*	N. Scituate
Barnard, Charles Thomas	XI.	*Melrose*	80 Bay State Rd.
Barrows, Stanwood Roy	XV.	*Lynn*	55 Beacon Hill Ave., L.
Basch, Jacob Justin	X.	*Paterson, N. J.*	55 St. Stephen St.
Batchelder, Sidney Spalding	XV.	*Dedham*	Charles River Rd., Cam.
Baxter, Horace Monroe	VI.	*Brighton*	160 Foster St., Bri.
Beadle, Walter Jay	II, XIII.	*Lima, N. Y.*	1069 Beacon St., Br.
Beattie, James Alexander	X.	*Louisville, Ky.*	462 Massachusetts Ave.
Belden, Eduardo Daniel	IV.	*Monterey, Mex.*	60 Westland Ave.
Bell, Dudley Edwards	XV.	*Bristol, Pa.*	1004 Beacon St., Br.
Bell, Kenneth Eldon	X.	*Malden*	129 Hawthorne St., Mal.
Benitez, Eduardo Dehesa	II.	*Oaxaca, Mex.*	8 St. Botolph St.
Best, Tharratt Gilbert, B.S.	VI.	*Utica, N. Y.*	211 Newbury St.
Bickford, Horace Lesley	VI.	*Brookline*	24 Kilsyth Rd., Br.
Bill, Francis Putnam	XV.	*Hartford, Conn.*	1069 Beacon St., Br.
Blanchard, Raymond Hall.	X.	*Malden*	38 Barrett St., Mal.
Blouke, Pierre	IV.	*Chicago, Ill.*	234 Newbury St.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Bond, Benjamin Morris	V.	*Roxbury*	10 Marcella St., R.
Bone, Herbert Lawrie	II.	*Roslindale*	26 Edgemont St., Ros.
Boyd, William Henry, A.B.	I.	*Warrenton, N. C.*	183 St. Botolph St.
Brooks, Arthur Raymond	XIV.	*Framingham*	New Kendall Hotel, Fram.
Brooks, Edward Pennell	XV.	*Westbrook, Me.*	1069 Beacon St., Br.
Brooks, Phillips Nelson	II.	*Haverhill*	302 Harvard St., Br.
Brown, Harvey Huntington, Jr. A.B.	III.	*Cleveland, O.*	Winthrop Hall, Cam.
Brown, Roger Brigham	X.	*Marlboro*	24 High St., Mar.
Brush, Charles Francis, Jr. S.B.	VI.	*Cleveland, O.*	56 Charlesgate E.
Burk, Herbert Grover	VI.	*East Lynn*	34 Ocean Terr., E. L.
Burkhart, Theodore Walpole	II.	*Portland, Ore.*	16 Batavia St.
Butterfield, Frederick Haines, S.B.	X.	*Sioux City, Ia.*	47 St. Stephen St.
Butterworth, Frank Linton	IV.	*Marion, Ind.*	12 Newbury St.
Buttner, Fred Frank	VI.	*Waterbury, Conn.*	70 Astor St.
Cady, Lowell	I.	*New York, N. Y.*	102 St. James Ave.
Campion, William Leo	XI.	*Dorchester*	196 Hamilton St., D.
Canby, Albert Thresher	X.	*Dayton, O.*	1067 Beacon St., Br.
Catlett, Richard Henry, B.A.	X.	*Staunton, Va.*	44 The Fenway
Chang, Yih Tze	X.	*Nanking, China*	79 St. Botolph St.
Chase, Albert Worcester	X.	*Swampscott*	176 Burrill St., Swam.
Childs, Kenneth Mason	II.	*Needham Heights*	Needham Heights
Chisholm, Stanley Leavitt	V.	*Melrose Highl'ds*	128 Melrose St., Mel. H.
Chiu, Chung Yen, B.A.	V.	*Chi Kiang, China*	106 St. Botolph St.
Christison, Leslie	V.	*Andover*	29 Rutland Sq.
Church, Arthur Albert	VI.	*Roxbury*	21 Alaska St., R.
Church, Vallette Stuart, A.B.	VI.	*Washington, Conn.*	1802 Beacon St., Br.
Clark, Edward Leeds, A.B.	VI.	*Oberlin, O.*	Y. M. C. A., Cam.
Clark, Ernest Morton	X.	*Newtonville*	150 Otis St., Nv.
Clark, William Allen	XI.	*Winthrop*	163 Woodside Ave., Win.
Clayman, Samuel	X.	*Dorchester*	3 Nightingale St., D.
Clayton, Henry Comyn	XIV.	*Canton*	160 Newbury St.
Clayton, Lawrence Locke	XIV.	*Canton*	160 Newbury St.
Coakley, Cornelius Cooper	X.	*Lynbrook, L.I., N. Y.*	102 St. James Ave.
Coburn, Charles Lyman	I.	*Lexington*	31 Percy Rd., Lex.
Coffin, John Ruskin	VI.	*West Medford*	24 Hollis Hall, Cam.
Colby, Charles Wilson, A.B.	IV.	*Portland, Me.*	40 Highland Ave., Cam.
Conaty, Francis Sylvester	I.	*Taunton*	20 Rutland Sq.
Cook, Roy Jennings	XIV.	*Brooklyn, N. Y.*	1004 Beacon St., Br.
Craig, Mason Locke Weems, B.S.	VI.	*Columbia, Tex.*	5 Idlewild St., A.
Crane, Frank Norman	I.	*Roxbury*	6 Pickering Ave., R.
Cribben, Leo Thomas	II.	*Dorchester*	35 Mt. Vernon St., D.
Crisp, Frederick Grafton, U.S.N.	XIII A.	*Baltimore, Md.*	10 Dana St., Cam.
Cristal, Philip Nahm, A.B.	I.	*Bowling Green, Ky.*	203 Bay State Rd.
Crosby, Gordon Eugene	I.	*Allston*	33 Boulevard Terr., A.
Dana, Leo Isadore	VIII.	*Roxbury*	34 Lawrence Ave., R.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Davis, Franklin Breckenridge, A.B.	X.	*Cambridge*	33 Arlington St. Cam.
Davis, Lawrence	II.	*Auburndale*	234 Newbury St.
Dean, Carlton Miles	X.	*Woburn*	21 Franklin St., Wo.
DeBell, John Milton	X.	*Great Barrington*	261 Newbury St.
deMars, Paul Alva	VI.	*Lawrence*	43 Vine St., Law.
Dodge, Barnett Fred	X.	*Akron, O.*	179 Bay State Rd.
Dodson, Frederick William	XIV.	*Washington, D. C.*	179 Bay State Rd.
Donovan, George William	II.	*Andover*	86 Chestnut St., And.
Donovan, Harold Alsus	VI.	*Brookline*	56 Walter Ave., Br.
Doon, James William	XV.	*Natick*	42 West Central St., Na.
Dowell, Arthur Edward	VI.	*Washington, D. C.*	1069 Beacon St., Br.
Drake, Frank Ellsworth	II.	*Stoughton*	186 Seaver St., Stou.
Dunham, Atwood Packard	II.	*Brockton*	12 Newbury St.
du Pont, Francis Victor	IX.	*Wilmington, Del.*	44 The Fenway
Eastman, Harold French, S.B.	VI.	*Cambridge*	89 Trowbridge St., Cam.
Eaton, Irving Cutts	XIV.	*Magnolia*	Magnolia Ave., Magnolia
Eaton, Roland Hurlbut	II.	*South Sudbury*	So. Sudbury
Eaton, William West, A.B., A.M.	VI.	*Hamilton, N. Y.*	211 Newbury St.
Eddy, Harrison Prescott, Jr.	XI.	*Newton*	12 Newbury St.
Enright, Earle Francis, U.S.N.	XIII. A.	*McCook, Neb.*	953 Mass'etts Ave., Cam.
Erb, Robert Curtis	XV.	*Dorchester*	7 Fenelon St., D.
Fales, William Thurber	VII.	*Malden*	65 Bellvale St., Mal.
Farr, Walter Greene	II.	*Wenonah, N. J.*	30 Newbury St.
Ray, Richard Dudley, A.B.	VI.	*Nahant*	65 Fresh Pond Pkwy., Cam.
Ferretti, Alfred John	II.	*Lynn*	27 Chauncy Place, J. P.
Fine, Harry	X.	*Malden*	135 Bowdoin St., Mal.
Flagg, Paul Maxwell, B.S.	II.	*Philadelphia, Pa.*	316 Huntington Ave.
Ford, Wendell Bradford	IV.	*New Bedford*	132 Glenville Ave., A.
Foss, Frederic Dearborn	XI.	*Haverhill*	106 Pembroke St.
Freethy, William Stanley	II.	*Ansonia, Conn.*	1004 Beacon St., Br.
French, Herbert Nichols, A.B.	VI.	*Brookline*	40 Gardner Rd., Br.
Gager, Charles Cotter, Ph.B.	XIII.	*Derby, Conn.*	84 St. James Ave.
Gamage, Frederick Luther, Jr.	VI.	*Pawling, N. Y.*	8 Newbury St.
Gannett, Robert	II.	*Washington, D. C.*	56 Westland Ave.
Gardner, Chester Russell	I.	*Somerville*	11 Spring Hill Terr., Som.
Gardner, Hartley Burton	VI.	*Cambridge*	13 Bigelow St., Cam.
Gardner, Joseph Paul	IV.	*Los Angeles, Cal.*	84 North St., T. C.
Gaus, Gilbert Herman	II, VI.	*Brooklyn, N. Y.*	16 Exeter St.
Gayhart, Everett LeRoy, U.S.N.	XIII. A.	*Toledo, O.*	10 Dana St., Cam.
Gillespie, Kingsley Alexander	X.	*Stamford, Conn.*	16 Exeter St.
Gilliard, Charles Thomas	II.	*Lawrence*	55 Woodland St., Law.
Gilmour, Arthur Emerson	II.	*Cambridge*	26 Upland Rd. Cam.
Gilt, Carl Mitchell, A.B.	VI.	*Rochester, N. Y.*	47 Rutland Sq.
Goldsmith, Henry Friedberger, A.B.	X.	*Philadelphia, Pa.*	38 Stedman St., Br.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Goodale, Francis	XI.	*Marlboro*	Marlboro
Gorfinkle, Louis	I.	*Boston*	35 N. Russell St.
Goudey, Raymond Freeman	XI.	*Everett*	8 Forest Ave., Ev.
Gramstorff, Emil Anton	IV.	*Everett*	145a Belmont St., Ev.
Gray, Guy Augustus	VI.	*Cleveland, O.*	237 Beacon St., Br.
Hall, Benjamin Taylor	II.	*Norwich, Conn.*	138 St. Botolph St.
Hannah, Thomas Ewing	I.	*Fitchburg*	138 St. Botolph St.
Hansberry, Thomas William	I.	*East Milton*	Waldeck Rd., E. Mil.
Hanson, Edwin Robert	VI.	*Dorchester*	6 Carson St., D.
Harlow, Foster Chichester	I.	*Mattapan*	89 Blue Hill Pkwy., Mat.
Harper, John, A.B.	VI.	*New York, N. Y.*	12 Claverly Hall, Cam.
Harper, Kenneth Leroy	XIV.	*Meadville, Pa.*	16 Exeter St.
Hartman, Henry Frederick George	III.	*Waltham*	59 Lexington St., Wal.
Harvey, Clarence Wardwell	VI.	*Medford*	35 Hillside Ave., Med.
Hatch, Forrest Meldon	II.	*Malden*	38 Ferry St., Mal.
Hawes, Calvin Wesson	XV.	*Wakefield*	20 Avon St., Wak.
Hayes, Olin Henry	II.	*Lawrence*	209 Jackson St., Law.
Heath, Carl Jeffrey	II.	*Stockbridge*	150 Otis St., Nv.
Heath, Elmer Hinckley, Jr.	VII.	*Neponset*	72 Minot St., Nep.
Henderson, George Winslow	I.	*Kendal Green*	Kendal Green
Hills, Leander Herbert	XIV.	*Gloucester*	13 Trask St., G.
Holden, Dudley Furber	XV.	*Winter Hill*	153 Central St., W. H.
Holt, Clarence Gilliland	VI.	*Melrose*	26 Trenton St., Mel.
Holt, Osgood Wellington	II.	*Arlington*	16 Pleasant St., Arl.
Holton, John Hill	X.	*Dorchester*	10 Warner St., D.
Hopkins, Henry Deming, B.S.	VI.	*Granville, O.*	67 St. Botolph St.
Hou Te Pang	X, II.	*Foochow, China*	79 St. Botolph St.
Houghton, Seymour Phillips, A.B.	XV.	*Tarrytown, N. Y.*	316 Huntington Ave.
Howard, Frank Charles	X.	*Haverhill*	45 St. Botolph St.
Hulse, Fernald Everett, S.B.	XI.	*Cambridge*	26 Hurlbut St., Cam.
Hunter, William Brown	X.	*Fall River*	291 Harvard St., Br.
Igleheart, George Priest	II.	*Berkeley, Cal.*	112 Newbury St.
Johnson, William Trimble, Jr.	VII.	*Washington, D. C.*	7 Atlantic St., Win.
Keach, Leon	IV.	*Roxbury*	1 Weldon St., R.
Keating, Arthur Elmer	II.	*Bridgeport, Conn.*	31 St. Botolph St.
Keene, Horatio Nelson	XV.	*Hyde Park*	1074 River St., H. P.
Kelly, Joyce Raymond, A.B.	VI.	*Portland, Ore.*	33 St. Botolph St.
Kenigsberg, Alexander Harry	I.	*Framingham*	9 Waverley St., Fram.
Kingman, Allen Frederick	VI.	*New Bedford*	28 Claverly Hall, Cam.
Kittredge, George Davis	I.	*Yonkers, N. Y.*	234 Newbury St.
Knapp, Harold Anthony	X.	*Newbury*	26 East High St., New.
Knight, Arthur Raymond	X.	*Newburyport*	13 Bromfield St., Np.
Kuhn, Samuel Louis	I.	*Cincinnati, O.*	24 Marlborough St.
Lane, Kenneth Mortimer	XI.	*Winchester*	261 Newbury St.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Lane, Stanley Mayall	X.	*Brookline*	82 Evans Rd., Br.
Lansil, Clifford Earl	VI.	*Waverley*	33 Burnham St.,Wav.
Lauer, Luther Michael, A.B.	X.	*Thomasville, Pa.*	18 Westland Ave.
Lebby, Thomas Dotterer, Jr., A.B.	II.	*Summerville, S. C.*	30 Newbury St.
Lennox, Frank Joseph, B.S.	X.	*Woonsocket, R. I.*	916 Beacon St.
Levi, Elijah	II.	*Roxbury*	24 Lambert St., R.
Lewis, Benjamin Ireson	XIII.	*Lynn*	535 Newbury St
Li, Yung Ching	XIII.	*Anhui, China*	497 Columbus Ave.
Ling, Homer Chuen, B.A.	VI.	*Amoy, China*	177 St. Botolph St.
Littlefield, Walter Joseph	XV.	*New York, N. Y.*	Matthews Hall, Cam.
Logan, Richard Whiting	II.	*West Medford*	50 Brooks St.,W.Med.
Lovejoy, George Montgomery, Jr.	II.	*Hartford, Conn.*	16 Exeter St.
Low, Charles Endicott	XV.	*Norwood*	784 Washington St., Nor.
Lowengard, Richard Otto	XV.	*New York, N. Y.*	Hotel Hemenway
Lyons, Richard Thomas	III.	*East Weymouth*	76 Middle St., E. Wey.
McDonald, Harold Joseph	I.	*Cambridge*	31 Holyoke St., Cam.
McManus, Joseph Delee	XIV.	*Marlboro*	75 Warren Ave., Mar.
McNeill, Winfield Irving	XV.	*Wakefield*	25 Lafayette St.,Wak.
McQuaid, Howard Stafford	XIV.	*Webster*	12 Cumberland St.
Maeder, Raymond Aloysius	II.	*Holliston*	Charles St., Holliston
Mann, Howard Grover	XV.	*Boston*	193 Huntington Ave.
Martin, Richard Penberthy, Jr. A.B.	VI.	*Hartford, Conn.*	101 St. James Ave.
Martinez, John Miguel, A.B.	V.	*New York, N. Y.*	64 Charlesgate East
Mason, Stephen Spalding	IV.	*Keene, N. H.*	78 Westland Ave.
Medding, Walter Lyman	XV.	*Malden*	206 Ferry St., Mal.
Meloy, Thomas Kronenberg, A.B.	I.	*New York, N. Y.*	402 Craigie Hall, Cam.
Miller, Charles Gideon, B.S.	VI.	*Richmond, Va.*	5 Idlewild St., A.
Miller, Henry Lafayette	VI.	*Manchester, N. H.*	22 Myrtle St., J. P.
Miller, Robert Anderson, Jr. A.B.	X.	*Pelham Manor, N.Y.*	316 Huntington Ave.
Moulton, Robert Selden, P.S.	II.	*Poughkeepsie, N.Y.*	210 Newbury St.
Moxon, Harold Adam	X.	*Cambridge*	11 Green St., Cam.
Mulliken, Robert Sanderson	V.	*Newburyport*	6 Harris St., Np.
Newell, Willard Bigelow	II.	*West Newton*	803 Watertown St., W. N.
Newhall, Ralph Perkins, S.B.	VI.	*Cambridge*	37 Kirkland St., Cam.
Nielsen, Otto Elias	VI.	*Helsingor, Denmark*	327 Huntington Ave.
Noyes, Linwood Irving	IV.	*Marinette, Wis.*	234 Newbury St.
Nute, Alden Davis	X.	*Fall River*	76 St. James Ave.
O'Brien, James Sherry	X.	*Winthrop*	78 Washington Ave., Win.
O'Brien, Thomas Francis	II.	*Dorchester*	38 Mt. Vernon St., D.
O'Hara, Francis Patrick	II.	*Charlestown*	13 Ashford St., A.
Panettiere, Vincent	II.	*Baltimore, Md.*	64 Huntington Ave.
Parker, Dean Huntington	X.	*Waban*	34 Collins Rd., Waban
Parsons, John Langdon	V.	*Rye, N. H.*	11 Newbury St.
Patten, David Longfellow	I.	*Brighton*	19 South St., Bri.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Paul, Arthur Hiram, Jr.	I.	*Wakefield, N. H.*	106 Pembroke St.
Payne, Edward Benedict	VI.	*Nashville, Tenn.*	33 St. Botolph St.
Peacock, Frank Edward	I.	*Rockford, Ill.*	535 Newbury St.
Pearson, Earle Fletcher	VI.	*W. Somerville*	208 Morrison Ave., W.Som.
Peterson, Oscar Rudolph	I.	*Dorchester*	16 Playstead Rd., D.
Pierce, Alfred	I.	*Attleboro*	56 Westland Ave.
Pierce, David Eugene, Ph.B.	X.	*West Middlesex, Pa.*	47 Rutland Sq.
Pollard, Edward Vaughn	II.	*Lynn*	9 Grover St., L.
Poteat, John Robinson, B.A.	VI.	*Greenville, S. C.*	182 W. Brookline St.
Pouchain, René Augustin	VII.	*Marblehead*	34 Pond St., Marb.
Powers, Harold Frederick Lawrence	II.	*Campello*	17 Otto St., Camp.
Proctor, Charles Dix	II.	*Detroit, Mich.*	16 Exeter St.
Proctor, Joseph Worthen	II.	*Cambridge*	109 Pearl St., Cam.
Pryor, Willard Lettarett	II.	*Rochester, N. Y.*	327 Huntington Ave.
Putnam, Roger Lowell, A.B.	II.	*Manchester*	49 Beacon St.
Ramsbottom, John Raymond	VI.	*Fall River*	535 Newbury St.
Randolph, Frank Harrison, A.B.	II.	*Rahway, N. J.*	49 Rutland Sq.
Reese, Raymond Castle	I.	*Pittsfield*	23 Clarkwood St., Mat.
Reynolds, Edwin Drew	VII.	*Danvers*	4 Warren Ave., Dan.
Rizzo, Frank Salvatore	II, XIII.	*Albi, Italy*	8 Lafayette St., Arl.
Roberts, Claudius Henry Mastin	XIV.	*Washington, D. C.*	1069 Beacon St., Br.
Robertson, Stanley Stuart	X.	*Framingham*	15 Lincoln St., Fram.
Robinson, Russell King, A.B.	I.	*Ashtabula, O.*	85 Westland Ave.
Roper, George, Jr.	III.	*Steubenville, O.*	44 The Fenway
Ross, Charles Everett	VI.	*Watertown*	86 Fayette St., Wat.
Ross, Ralph Hersey	VI.	*St. Johnsbury, Vt.*	291 Harvard St., Br.
Ross, William Byron, B.Sc.	X.	*Uhrichsville, O.*	47 Rutland Sq.
Rounds, Edward Wadsworth	II, VI.	*Tacoma, Wash.*	261 Newbury St.
Rowe, Philip Nicholas	III.	*Boston*	41 Mt. Vernon St.
Ryan, Thomas William, Jr.	I.	*Concord Junction*	365 Main St., Con. Jct.
Sada, Francisco Ge, Jr.	XV.	*Monterey, Mex.*	8 St. Botolph St.
Sarafian, Haigh Henry	XIV.	*Lawrence*	594 Tremont St.
Sarti, Eduardo Emilio	IV.	*San Felipe, Guatemala*	327 Huntington Ave.
Sawyer, Charles Baldwin, A.B.	XIV.	*Cleveland, O.*	56 Charlesgate East.
Sawyer, Enos Clifford	VI.	*Cambridge*	7 Clinton St., Cam.
Sawyer, Ralph Henry	II.	*Framingham*	24 Clinton St., Fram.
Scannell, Robert Henry, Litt.B.	IV.	*Cambridge*	Felton Hall, Cam.
Schlaffhorst, Harold Anderson	X.	*Cambridge*	96 Ellery St., Cam.
Schoonmaker, Lucas Elmendorf	VI.	*Orange, N. J.*	484 Columbus Ave.
Searles, Thomas M., U.S.N., S.B	XIII.A.	*Allston*	1384 Com'nwealth Ave., A.
Senter, Erasmus Gilbert, Jr.	XV.	*Dallas, Tex.*	Y. M. C. A., Cam.
Sewall, Samuel	II.	*Minneapolis, Minn.*	Stoughton Hall, Cam.
Seymour, William Henry	II.	*Winthrop*	6 Lewis Ave., Win.
Sidelinger, Roy LeVan	XV.	*Quincy*	238 Hemenway St.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Smainis, George Abraham, B.A.	VI.	*Larnaca, Cyprus*	4 Yarmouth St.
Smith, Carroll Cummings	III.	*Barre, Vt.*	316 Huntington Ave.
Smith, Winfred Wenner, B.S.	VI.	*Lehighton, Pa.*	85 Newbury St.
Solakian, Haig Nerses, B.A.	III.	*Kilis, Turkey*	57 Waltham St.
Stahl, Theodore Erasmus	XIII.	*Naugatuck, Conn.*	Technology Chambers
Stearns, Frederick Arlington	II.	*Melrose*	143 Rowe St., Mel.
Stebbins, George Hobart	XIII.	*Fall River*	535 Newbury St.
Stevens, George Radcliffe	VI.	*Brookline*	1834 Beacon St., Br.
Stevens, Raymond Sawtell	XV.	*Nashua, N. H.*	261 Newbury St.
Stewart, Howard Raitt	XV.	*Worcester*	80 Bay State Rd.
Stockmann, Erling Brynjulf	XV.	*Milton*	300 Central Ave. Mil.
Storrow, James Jackson, Jr. A.B.	VI.	*Lincoln*	417 Beacon St.
Strong, Walter Burroughs	VI.	*Goshen, N. Y.*	16 Exeter St.
Sullivan, Alan Porter	XIV.	*Terryville, Conn.*	261 Newbury St.
Sullivan, William Aloysius	IV.	*Lawrence*	160 So. Broadway, Law.
Swain, Robert Burrough, A.B.	II.	*Pomfret Center, Conn.*	64 Charlesgate East
Swan, LeRoy Amos	II.	*Norwich, Conn.*	1004 Beacon St., Br.
Sylvander, Roy Cornelius	II.	*Taunton*	277 Winthrop St., T.
Tarpley, Donald Greene	IV.	*Portland, Ore.*	215 Newbury St.
Thornton, Irving Taylor, A.B. A.M.	X.	*Buffalo, N. Y.*	530 Massachusetts Ave.
Tierney, Harold Joseph	VI.	*Roxbury*	42 Round Hill St., R.
Tonry, Albert Joseph	XI.	*Winthrop*	146 Lincoln St., Win.
Toole, Harry Sylvester	XV.	*Cambridge*	298 Harvard St., Cam.
Tu, Hin Yung	XIII. B.	*Canton, China*	39 St. Botolph St.
Tutein, Dexter Arthur	X.	*Winchester*	33 Lloyd St., Winc.
Tuttle, William Fletcher	XI.	*Arlington*	11 Pelham Terr., Arl.
Twomey, Edward Francis	XI.	*Lynn*	66 Rockaway St., L.
Tyler, John Cowperthwaite, A.B.	II.	*Brooklyn, N. Y.*	Hemenway Hotel
Waite, David Everett	V.	*Worcester*	283 Newbury St.
Wallis, James Erastus, Jr.	XV.	*Cambridge*	11 Bigelow St., Cam.
Watson, Philip Bickford	X.	*Brighton* 1872	Commonwealth Ave., Bri.
Wells, Benjamin Slocum	I.	*Dorchester*	44 Tuttle St., Dor.
Wells, Everett Deane, B.S.	XV.	*Nashua, Ia.*	47 St. Stephen St.
Westbrook, Leon Russell	V.	*Haverhill*	6 Ivy St.
Weston, Timothy Herbert	I.	*Broad Cove, Me.*	149 Birch St., Ros.
Wheatley, Russell Holbrook	XIV.	*North Abington*	North Abington
Wheeler, Evan Rupert, B.S., A.M.	VI.	*Waterville, Me.*	45 St. Botolph St.
Whetzel, Joshua Clyde, B.S.	X.	*Martinsburg, W. Va.*	101 St. James Ave.
Whitman, Walter Gordon	X.	*Winthrop*	364 Winthrop St., Win.
Whitney, Richard Thompson	XI.	*Glassboro, N. J.*	12 Newbury St.
Williams, Lester Albert	II.	*Boston*	34 Bickerstaff St.
Wilson, Dustin Whittier	V.	*Dover, Me.*	17 Pinckney St.
Wood, Walter Albert	XV.	*Concord*	1004 Beacon St., Br.
Woodward, Paul Gilbert	X.	*Washington, D. C.*	179 Bay State Rd.

THIRD YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Wrigley, Paul Pickering, A.B.	VI.	*Brooklyn, N. Y.*	121 Newbury St.
Wu, Tai, Ming	XIII. B.	*Canton, China*	7 Follen St.
Yeh, Chi Foo	XIII. B.	*Canton, China*	7 Follen St.

SECOND YEAR.

NAME.	COURSE.	HOME.	RESIDENCE.
Adams, Myron Whitlock, A.B.	VI.	*West Roxbury*	4 Rutledge St., W. R.
Allen, Howard Brigham	VI.	*Mexico City, Mex.*	1069 Beacon St., Br.
Alvaré, Nemesio Faustino, B.S.	II.	*Sagua la Grande, Cuba*	6 St. Botolph St.
Angell, Cyril Matthew	VIII.	*Attleboro*	1067 Beacon St., Br.
Atwell, Harold Vivian	XIV.	*Hopedale*	124 Cypress St., Wat.
Avery, Julian Miles	V.	*Framingham*	52 Lincoln St., Fram.
Ballantine, Benjamin Darling	II.	*Fitchburg*	490 Columbia Rd., D.
Barber, Henry Miller	XI.	*Beaver Falls, Pa.*	124 St. Botolph St.
Barron, Samuel	X.	*Roxbury*	66 Clifford St., R.
Bassett, Clarence Eustus	X.	*Taunton*	8 King St., T.
Beattie, Challen Morton	II.	*Quincy*	151 Elm St., Q.
Bellis, Clifford Brown	X.	*Waltham*	9 Brown St., Wal.
Berman, Eli	VI.	*Boston*	71 Phillips St.
Betts, Erving Goodwin	VI.	*Newburyport*	31 St. Botolph St.
Bevins, Henry Dana	II.	*Andover*	16 Exeter St.
Bickford, Willis John, Jr.	II.	*Munich, Germany*	85 Homer St., N. C.
Biggar, Walter Thomas	I.	*Dorchester*	18 Windermere Rd., D.
Blaisdell, Sidney Briggs	II.	*Providence, R.I.*	164 Strathmore Rd., Bri.
Blanchard, Carleton Woodman	XV.	*Abington*	308 Linwood St., Ab.
Blanchfield, Paul Edward	X.	*Chicopee*	53 St. Stephen St.
Bonnell, Willard Everett	II.	*Hyde Park*	11 Walter St., H. P.
Boyd, Stuart Macleod	X.	*Malden*	67 Converse Ave., Mal.
Bradley, Donald George	IV.	*Edmonton, Alberta*	12 Newbury St.
Braislin, John Cameron	XIII.	*Brooklyn, N. Y.*	137 Newbury St.
Brewer, George Selden, A.B.	X.	*Westfield, N. Y.*	261 Newbury St.
Brosnahan, Thomas Vincent	XV.	*Cambridge*	32 Locke St., Cam.
Browne, Donald	VIII.	*Malden*	31 Wolcott St., Mal.
Buchanan, Douglas Riley	XIII.	*Lowell*	40 Aberdeen St., Low.
Buck, Walter Francis	VI.	*Stafford Springs, Conn.*	104 St. Botolph St.
Bugbee, James Marion	III.	*Winchester*	15 Foxcroft Rd., Winc.
Burke, Arthur Edward	VII.	*Watertown*	76 Spruce St., Wat.
Burke, Francis Carroll	IV.	*Watertown*	76 Spruce St., Wat.
Burton, Oliver Donn	X.	*Asbury Park, N. J.*	5 Park Vale, Br.
Bushee, Ralph John	XI.	*Newburyport*	1 Kelly St., Np.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Cannon, Georgius Young	IV.	*Salt Lake City, Utah*	Strathcona Apts., Cam.
Carr, Percy Wolcott	X.	*Lawrence*	302 Harvard St., Br.
Catlin, Nino Tesher	II.	*New Haven, Conn.*	291 Harvard St., Br.
Caust, Morris Leonard	XIV.	*Brockton*	243 Crescent St., Brock.
Chamberlain, Samuel Harrison, Jr.	II.	*Boston*	16 Exeter St.
Chamberlain, Samuel Vance	IV.	*Aberdeen, Wash.*	100 Huntington Ave.
Chen, Chun-yang	III.	*Shanghai, China*	123 St. Botolph St.
Childs, Frederick William	II.	*Holyoke*	155 Massachusetts Ave.
Chow, Kun Lian	VI.	*Foo-Chow, China*	120 Huntington Ave.
Clark, Donald Simonton	VI.	*Belfast, Me.*	49 Rutland Sq.
Cleveland, Byron Redmond	II.	*Lawrence*	33 Farnham St., Law.
Clogher, Eaton James	VI.	*Dorchester*	8 Nottingham St., D.
Coleman, Francis Thomas	II.	*Campello*	2 St. Botolph St.
Collins, Earl Preston	X.	*Cambridge*	973 Massachusetts Ave., Cam.
Collins, William Lovejoy	VI.	*Newton Highlands*	44 Carver Rd., N. H.
Conner, Lester Carlton	X.	*Malden*	72 Medford St., Mal.
Costelloe, William Henry	VI.	*Saginaw, Mich.*	285 Newbury St.
Craighead, Philip Brooks	I.	*Malden*	18 Hancock St., Mal.
Crosby, Ralph Joseph	II.	*Hartford, Conn.*	749 Saratoga St., E. B.
Cutts, George Belcher	II.	*Brookline*	105 Aspinwall Ave., Br.
Cyr, Howard Mason	XV.	*Malden*	52 High St., Mal.
Dagnall, Clarence Herschel	VI.	*Oak Bluffs*	11 Irvington St.
Damon, John Warren	XV.	*Plymouth*	127 Newbury St.
D'Arcy, Francis George	VI.	*Cambridge*	131 Huron Ave., Cam.
Dawson, Norman	XI.	*Needham H'ts*	314 Webster St., Need. H.
Dearden, Raymond Henry	IV.	*Fall River*	76 St. James Ave.
Dennen, William Llewellyn	III.	*Gloucester*	4 Trowbridge Pl., Cam.
Dennison, Edward Stanford	I.	*Mexico City, Mex.*	74 Reservoir St.,Cam.
Dimock, Charles Everett	I.	*North Andover*	102 Pleasant St., N. And.
Dinkins, Philip Moss	X.	*Montclair, N. J.*	44 The Fenway
Donnelly, Thomas Joseph, Jr.	I.	*Arlington*	63 Brattle St., Arl.
Donovan, Joseph Augustine	X.	*Cambridge*	9 Greenough Ave., Cam.
Dow, Charles Warren	V.	*Lynn*	117 Eastern Ave., L.
Dowsley, Felix Raymond	II.	*Boston*	687 Boylston St.
Drake, Allen Fairchild	IV.	*Whitman*	Whitman
Drummey, William Wolftone	IV.	*Dorchester*	916 Beacon St.
Drury, Eric William	IV.	*Victoria, B. C.*	33 St. Botolph St.
Dunning, Stanley Covert	XV.	*Cambridge*	12 Newbury St.
Dyer, Herbert Arthur	II.	*Schenectady, N. Y.*	Y. M. C. A., Cam.
Eales, Malcolm Alfred Lancelot	VI.	*Melrose*	4 Chestnut Park, Mel.
Ekwall, George Olof	X.	*Waltham*	30 Fairmont Ave., Wal.
Elliott, Stuart Ellis, A.B.	VI.	*Osterville*	30 Holyoke St., Cam.
Ellis, Clarence Meredith, A.B.	IV.	*North Attleboro*	38 Bennington St., N.
Eveleth, Frederic Cooley	I.	*Windsor Locks, Conn.*	308 Newbury St.
Fiske, Carlyle Darracott	II.	*West Roxbury*	94 Corey St., W. R.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Fitch, Harold Warner	II.	*Dorchester*	46 Pearl St., D.
Fletcher, Saxton Woodbury	II.	*Andover*	12 Newbury St.
Flett, Lawrence Hugo	V.	*Melrose*	154 Youle St., Mel.
Folsom, Rolfe Ames	XIV.	*Malden*	76 Rockland Ave., Mal.
Ford, Karl Leonard	XIV.	*Salem*	4 Plymouth St., S.
Foster, William Chapman	VI.	*Westfield, N. J.*	291 Harvard St., Br.
Franklin, Stanley Hamilton	X.	*Providence, R. I.*	120 Huntington Ave.
Frazier, Walter Stephen	IV.	*Aurora, Ill.*	85 Newbury St.
Freeman, Oliver Francis	VI.	*Winchester*	12 Mystic Ave., Winc.
Friery, John Wetherell	I.	*Jamaica Plain*	169 Chestnut Ave., J. P.
Fuller, Clarence Chisholm	XIV.	*Mansfield*	50 High St., Mans.
Fuller, John Ransom	XIV.	*Canaan, Conn.*	36 Webster St., Br.
Gaillac, Emile Bertrand	II.	*Chelsea*	113 Blossom St., Ch.
Garza, Roberto	XV.	*Monterey, Mex.*	8 St. Botolph St.
Gelinas, Maurice Edward	VI.	*Lowell*	666 Merrimack St., Low.
Goodman, Aaron	VI.	*Boston*	106 Union Park St.
Goodwin, Thomas Lawrence, Jr.	II.	*Newton Highlands*	26 Aberdeen St., N. H.
Goss, Donald Chapin	IV.	*Lynn*	535 Newbury St.
Gray, Charles Harry Grace	VI.	*Dorchester*	36 Alpha Rd., D.
Greely, Benjamin Morrill, Jr.	X.	*Dorchester*	10 Ainsley St., D.
Grohe, Robert Ferdinand	VI.	*Roxbury*	3 Westerly St., R.
Grunsfeld, Ernest Alton, Jr.	IV.	*New York, N. Y.*	91 Newbury St.
Guilbert, Horace Moss, A.B.	II.	*Southport, Conn.*	3 Revere St., J. P.
Gustin, Ernest Ellis	II.	*Somerville*	3 Virginia St., Som.
Hamilton, Norman Ray	VIII.	*Cambridge*	43 Upland Rd., Cam.
Hanley, John Merrill	I.	*Dorchester*	29 Romsey St., D.
Harrall, Edwin Russell	I.	*Providence, R. I.*	144 Huntington Ave.
Hatch, Herbert Willard	IV.	*Brockton*	24 Clinton Ave., Broc.
Hegenberger, Albert Francis	I.	*South Boston*	685 Seventh St., S. B.
Henry, Walter Joseph	VI.	*Neponset*	23 Water St., Nep.
Herman, Ervine Olney	VIII.	*Allston*	21 St. Luke's Rd., A.
Hewitt, Perry Anderson	V.	*Montgomery, Ala.*	246 Newbury St.
Hinckley, Nelson Crosby	XV.	*Vineyard Haven*	178 Huntington Ave.
Holmes, James Hill, Jr., B.S.	IV.	*Charleston, S. C.*	52 Ivy St.
Holt, Wilfred Reynolds	X.	*East Haven, Conn.*	33 St. Botolph St.
Hooper, Benjamin Morris	II.	*Wollaston*	112 Beach St., Wol.
Hopkins, Frank Herbert	I.	*Rockland*	85 W. Water St., Roc.
Howe, Julian Cheever	XV.	*Cohasset*	203 Bay State Rd.
Hoye, Stephen Aloysius	XV.	*Dorchester*	1016 Washington St., D.
Hsu, Yun-chung	XIV.	*Nanking, China*	123 St. Botolph St.
Huang, Han Ho	III.	*Amoy, China*	177 St. Botolph St.
Huckins, Edgar Wolcott	XV.	*Roxbury*	20 Elm Hill Park, R.
Hugo, Ottomar Gay	II, VI.	*San Antonio, Tex.*	64 Charlesgate E.
Hutchings, George Bradfield, Jr.	II.	*Stamford, Conn.*	16 Exeter St.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Irwin, James Clark, Jr.	X.	*Newtonville*	43 Highland Ave., Nv.
Jacobs, Sidney Joseph	X.	*Richmond Hill, N. Y.*	86 St. James Ave.
Johnson, Arthur Sanborn	XIV.	*Newburyport*	50 Woodland St., Np.
Johnson, Gardner Endicott	XV.	*Danvers*	95 Center St., Dan.
Johnson, Roy Luther	II.	*Randolph, Vt.*	86 St. James Ave.
Jones, William Alfred	I.	*Cambridge*	42 Bigelow St., Cam.
Judge, Charles Eric	VI.	*Concord Jct.*	188 Com'wealth,Con.Jct.
Kaiser, Karl Herman	IV.	*Boston*	18 Haviland St.
Kaler, Harold Vincent LeRoy	I.	*Sharon*	535 Newbury St.
Kelley, Joseph Aloysius	XIV.	*Haverhill*	9 Hawthorne St., Hav.
Kelly, Thomas Patrick	X.	*Jamaica Plain*	15 Pond St., J. P.
Kemkemian, Bedros, B.A.	II.	*Cairo, Egypt*	316 Huntington Ave.
Kennard, John Willian Bennett	VI.	*Dorchester*	15 Folsom St., D.
Kennard, Richmond Parry	VI.	*Brookline*	Charles River Rd., Cam.
Kennedy, Charles Thomas	XI., I	*Boston*	38 Batavia St.
Kennedy, Parker Henry	II.	*Middleboro*	2 Alden St., Mid.
Kilgore, Harold Dustin	I.	*Gloucester*	20 Exchange St., G.
Kingsbury, Chester Lyman	XV.	*Keene, N. H.*	1069 Beacon St., Br.
Kline, Franklin Latimore, B.A.	IV.	*Chattanooga, Tenn.*	44 The Fenway.
Knowland, Thomas Millbury	X.	*Newburyport*	43 Green St., Np.
Krasnoff, Nathaniel	VI.	*Union, S. C.*	74 Reservoir St., Cam.
Lacey, Henry Richard	I.	*Somerville*	20 Sargent Ave., Som.
Lane, Frederic Allen	VI.	*Gloucester*	7 Madison Ave., G.
Langley, Harold Edward	I.	*Haverhill*	1898 Centre St., W. R.
Larner, Herbert Beamish	VII.	*Cambridge*	948 Massachusetts Ave.,Cam.
Legge, Elmer Earle	II.	*Brockton*	44 The Fenway
Leonard, Paul Cooledge	XV.	*Lakeville*	1067 Beacon St., Br.
LeVine, Harry Carl	II.	*Melrose*	25 Holbrook Ct., Mel.
Levine, Leonard Isaac	II.	*Dorchester*	5 Nottingham St., D.
Lindgren, Carl Alfon	VI.	*Hathorne*	Hathorne
Linscott, Chester Earl	V.	*Roxbury*	479 Dudley St., R.
Long, Francis Leroy	II.	*Lawrence*	28 Union St., Law.
Longley, James Edward	I.	*Gobleville, Mich.*	35 St. Botolph St.
Longley, John Robert	I.	*Gobleville, Mich.*	35 St. Botolph St.
Lorenz, Otto Carl	IV.	*Scranton, Pa.*	137 Newbury St.
Lovenberg, Albert Michael	XIV.	*Providence, R. I.*	55 St. Stephen St.
Luce, Joseph Arthur	X.	*New Bedford*	42 Norton St., D.
Lufkin, Olvin Garland	XV.	*Arlington*	17 Trowbridge St., Arl.
McAllister, Paul	XIV.	*Auburndale*	94 Central St., Aub.
MacArdle, Donald Wales	V.	*Roslindale*	27 Sherwood St., Ros.
MacAskill, Donald	IV.	*Salem Depot, N. H.*	Salem Depot, N. H.
Mac Gregory, Sherman Albert	I.	*Brockton*	31 Silver Rd., Brock.
Macheca, George Michael, A.B.	VI.	*New Orleans, La.*	421 Marlborough St.
McIvor, Carlisle Chandler	VI.	*Brookline*	15 Euston St., Br.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
McLaughlin, Carl Patrick	II.	*Portland, Me.*	96 Rogers Ave., Som.
McLaughlin, George Edward	II.	*Brookline*	112 Davis Ave., Br.
McLaughlin, Harold Clarke, A.B.	IV.	*Sedalia, Mo.*	176 Newbury St.
MacLeod, William Rodney	XV.	*Lowell*	44 Swan Ave., Low.
McNally, Edwin Mongan	II.	*Chelsea*	140 Clark Ave., Ch.
McNally, Leo Augustine	IV.	*Fall River*	2666 No. Main St., F. R.
McVickar, Lansing	I.	*New York, N. Y.*	Charles River Rd., Cam.
Madancy, Sarkis Mardiros	I.	*Chelsea*	274 Spruce St., Ch.
Magoun, Frederick Alexander	II.	*Cambridge*	70 Kirkland St., Cam.
Mahany, Walter Thompson	I.	*West Medford*	23 Boston Ave., W. Med.
Mahony, Ralph Gerard	II.	*Sterling*	3 Summer St., Cam.
Malley, George Francis	I.	*Adams*	2 St. Botolph St.
Manter, Elwood McElwain	II.	*Auburndale*	219 Melrose St., Aub.
Manuelian, Hamazasb Der	VI.	*Lowell*	291 Central St., Low.
Markham, John Raymond	VI.	*Cambridge*	91 Thorndike St., Cam.
Marshall, Lawrence Parsons	XV.	*Everett*	71 Summer St., Ev.
Marshall, Leslie Howard	X.	*Waltham*	298 Crescent St., Wal.
Martin, George Rainsford	III.	*Rye, N. Y.*	44 The Fenway
Merrick, Bentley Almerin Gleed	VI.	*Johnstown, N. Y.*	203 Bay State Rd.
Merrill, Donald Godfrey	II.	*Taunton*	27 Ingell St., T.
Meyer, Alfred Werner	V.	*Chicago, Ill.*	119 St. Botolph St.
Miller, Alan	VII.	*Gloucester*	166 Neshobe Rd., Wab.
Miller, Alan Baldwin	XIV.	*Elizabeth, N. J.*	261 Newbury St.
Miller, Harold Lionel	II.	*Needham*	35 Dedham Ave., Need.
Miller, Raymond Percy	II.	*Swampscott*	76 Middlesex Ave., Swamp.
Morrill, Harold Bell	XV.	*Roxbury*	19 Highland Ave., R.
Mumford, Albert Russell	XIV.	*Boston*	827 Boylston St.
Murray, Albert Francis, B.A.	VI.	*New Decatur, Ala.*	21 Norway St.
Murray, George Sutherland	XIII.	*Milton*	12 Spafford Rd., Mil.
Nangle, Charles Joseph	X.	*Somerville*	42 Richdale Ave., Som.
Neumann, Harold Carl	IV.	*Des Moines, Ia.*	136 Newbury St.
Norris, Olen Carter	XV.	*Brockton*	154 W. Bartlett St., Brock.
Norton, Frederick Harwood	VIII.	*Boston*	39 Chestnut St.
Norton, John Torrey	VIII.	*Boston*	39 Chestnut St.
O'Daly, Bernard	XV.	*Dorchester*	11 Stockton St., D.
Orlady, George Phillips, B.A.	II.	*Huntingdon, Pa.*	100 Mt. Vernon St.
Owen, Frederick Ernest	I.	*Waverley*	28 Holt St., Wav.
Palmer, Gretchen Abigail	V.	*Milton*	51 Houston Ave., Mil.
Parker, Henry Godwin, A.B.	VII.	*Portsmouth, Va.*	96 St. Botolph St.
Pearson, Frank Cogswell	II.	*Keene, N. H.*	170 Huntington Ave.
Pena Polo, Jorgē	I.	*Bogotá, Colombia*	57 Westland Ave.
Philbrick, Frederick Brueton	VI.	*So. Weymouth*	189 Randolph St., S. Wey.
Pinkerton, Henry	VII.	*Randolph*	Randolph
Pinkham, Bernard Orville	II.	*Roxbury*	33 Wabon St., R.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Pope, Arthur Wilson, Jr.	II.	*Geneva, Ill.*	85 Newbury St.
Porter, Garnett Hartle	X.	*Cambridge*	15 Pleasant Place, Cam.
Pray, Alfred Newell	X.	*New York, N. Y.*	8 Irvington St.
Purves, John Coleman	I.	*Philadelphia, Pa.*	Charles River Rd., Cam.
Read, Clifford Sheldon	II.	*Cambridge*	32 Lee St., Cam.
Read, Mahlon Milton	VI.	*Cambridge*	69 Mt. Vernon St., Cam.
Reid, Kenneth	IV.	*Dorchester*	15 Chase St., D.
Richards, Clarence Earl, Jr., Ph.B.	IV.	*Columbus, O.*	84 St. James Ave.
Richards, Henry Edward	VI.	*Lynnfield Center.*	Lynnfield Center
Richardson, Judson Cromwell	XV.	*Leominster*	580 Commonwealth Ave.
Rimbach, Richard	I.	*New York, N. Y.*	92 Pembroke St.
Robertson, Walter Harrison	I.	*Dorchester*	56 Wellesley Pk., D.
Robinson, Wirt Russell	I.	*West Point N. Y.*	Charles River Rd., Cam.
Roper, Kenyon	IV.	*Steubenville, O.*	44 The Fenway
Rossman, Edwin Forrest	II.	*St. Louis, Mo.*	95 St. Botolph St.
Rowe, James Everett	II.	*Pawtucket, R. I.*	59 Mulberry St., Paw.
Rubin, David Nathan	I.	*Holyoke*	56 Westland Ave.
Russell, Arthur Litchfield	VI.	*Roxbury*	57 Circuit St., R.
Russert, Walter Richard Carl	III.	*Roxbury*	14 Hillside St., R.
Ryan, William Patrick	X.	*West Medway*	45 Pemberton St., N. Cam.
Sackett, George Arthur	X.	*Revere*	45 Barrett St., Rev.
Salah, John Solomon, A.B.	II.	*Palestine, Turkey*	4 Yarmouth St.
Sanger, Alan Bridgman	III.	*Dorchester*	8 Merlin St., D.
Saunders, Albert Abraham	II.	*Malden*	10 Henry St., Mal.
Sawyer, Albert Francis	II.	*Haverhill*	70 Batavia St.
Scott, Warren Joseph	XI.	*Cambridge*	1423 Cambridge St., Cam.
Seltzer, Max	X.	*Lexington*	495 Massachusetts Ave., Lex.
Sibley, Dean Sheridan	II.	*North Newport, N. H.*	283 Newbury St.
Simonds, Howard Messinger	I.	*Marlboro*	52 Shawmut Ave., Mar.
Simpson, Roy Merton	II.	*West Somerville*	19 Walker St., W. Som.
Smith, Granville Byam	VI.	*New York, N. Y.*	291 Harvard St., Br.
Smith, Richard Harbert, B.S.	XV.	*Dillsboro, Ind.*	80 Gainsborough St.
Smyth, Ralston Blackburn	II.	*Dorchester*	21 Larchmont St., D.
Spooner, Frederick Carroll	II.	*Furnace*	169 West Newton St.
Stagg, Joseph Henry, Jr.	XV.	*Bridgeport, Conn.*	234 Newbury St.
Starr, Daniel Laurence	XI.	*Cambridge*	55 Sacramento St., Cam.
Stewart, Earle Reynard	XV.	*Wakefield*	Fairmount Ave., Wak.
Stockman, Charles Currier, 2nd	VII.	*Newburyport*	153 High St., Np.
Stuart, Wallis E, Jr.	IV.	*Cambridge*	363 Washington St., Cam.
Sturtevant, Harold Vaughan	II.	*East Lynn*	153 Chatham St., E. L.
Swan, Horace Gilbert, B.S.	XV.	*Rochester, N. Y.*	371 Harvard St., Cam.
Thomas, George Washington	I.	*Lowell*	40 West 6th St., Low.
Travers, Frank Alva	XIV.	*Haverhill*	66 Howard St., Hav.
Trombla, Daniel Courtright	X.	*Amesbury*	19 Congress St. Ames.

SECOND YEAR (*continued*).

NAME.	COURSE.	HOME.	RESIDEMCE.
Tucker, Carlton Everett	VI.	*Whitman*	136 School St., Whit.
Turner, William Hugh	III.	*Hyde Park*	211 Newbury St.
Underwood, Harold Ray	II.	*Swampscott*	54 Redington St., Swam.
Van Kirk, Robert Woods, Jr.	X.	*Chicago, Ill.*	237 Beacon St.
Wang, Hsi-Chang	III.	*Foochow, China*	316 Huntington Ave.
Warner, Donald Dann	XV.	*Allston*	1251 Commonwealth Ave., A.
Watt, Charles Henry	III.	*Lexington*	14 Hill St., Lex.
Weber, Harold Christian	X.	*Mattapan*	160 Brook Rd., Mat.
Weiscopf, Marcus William	II.	*Brookline*	1782 Beacon St., Br.
Wells, Franklin Henry	II.	*Winthrop*	60 Sea View Ave., Win.
Wells, Harold Curtis	IV.	*Watertown*	34 Bates Rd., Wat.
Whitcomb, Ralph Leslie	II.	*Sharon*	So. Main St., Sharon
White, Joris MacDonald	I.	*Basking Ridge, N. J.*	44 The Fenway
Whitmore, John Thoreau	IV.	*Springfield*	37 Chestnut St., Br.
Whorf, Benjamin Lee	X.	*Winthrop*	94 Somerset Ave., Win.
Wiley, Sumner Kennard	IV.	*Winter Hill*	25 Fenwick St., W. H.
Wilkins, Richard Alfred	X.	*Brookline*	97 St. Paul St., Br.
Williams, John Albert	IV.	*Baltimore, Md.*	316 Huntington Ave.
Wills, Royal Barry	IV.	*Melrose*	53 Oakland St., Mel.
Wilson, Walter Chadbourne	XV.	*Lowell*	34 Thirteenth St., Low.
Windle, Arthur Elmer	II.	*Montello*	104 St. Botolph St.
Wirt, Harrison Loring	XIII.	*Brookline*	1053 Beacon St., Br.
Woodland, Lester Northrup	IV.	*Melrose Highl'ds*	204 Franklin St., Mel.H.
Woolley, Charles Hildreth	XI.	*Winchester*	283 Newbury St.
Wright, Theodore Paul, B.S.	IV.	*Cambridge*	72 Fayerweather St., Cam.
Wyman, Louis Ernst	XI.	*Cambridge*	55 Magazine St., Cam.

FIRST YEAR

NAME.	HOME.	RESIDENCE.
Adams, Edmund Chancey	*Concord, N. H.*	282 Columbus Ave.
Adams, Franklin Stanley	*Stockbridge*	33 St. Botolph St.
Alfaro-Moran, Agustin, B.A.	*Ahuachapan, Salvador*	179 Bay State Rd.
Ames, Aubrey Payson	*Camden, Me.*	129 Pembroke St.
Atwood, Lewis Johnson, Jr.	*Newbury*	1 High St., New.
Azadian, Harry Panos	*Boston*	25 Curve St.
Bailey, Wayland Solon	*Cambridge*	1569 Massachusetts Ave., Cam.
Baker, Frederic Alson	*Rockland*	215 Market St., Roc.
Baldes, Raymond Charles	*Cambridge*	112 Trowbridge St., Cam.
Balfour, Marshall Coulter	*Marlboro*	86 Shawmut Ave., Mar.
Banks, William Howard, Jr.	*Roslindale*	205 Beech St., Ros.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Barney, Frederick Waldo	*Providence, R. I.*	144 Huntington Ave.
Bartlett, Ray Hayward	*Lowell*	370 Beacon St., Low.
Bassett, William Hastings, Jr.	*Cheshire, Conn.*	203 Bay State Rd.
Bates, Clarence Westinghouse	*Medford*	14 Paris St., Med.
Baum, George Lockhart	*Washington, Pa.*	203 Bay State Rd.
Beaulieu, Leo Edward	*Holyoke*	35 St. Botolph St.
Beers, Gilbert Francis	*Taunton*	52 Cedar St., T.
Bennett, William Francis, Jr.	*Somerville*	24 Spring St., Som.
Berkowitz, Morris	*Roxbury*	2 Hutchings St., R.
Best, Herbert	*New York, N. Y.*	291 Harvard St., Br.
Blood, Roderic Miller	*Newton Center*	20 Orient Ave., N. C.
Blumberg, Henry Bernard	*Roxbury*	64 Brunswick St., R.
Blye, Paul Woodbury	*Haverhill*	460 Water St., Hav.
Bolan, Robert Stuart	*Dorchester*	19 Stonehurst St., D.
Boley, Frederick William	*Buenos Aires, Argentina*	1069 Beacon St., Br.
Bond, George Raynolds, Jr.	*Springfield*	237 Beacon St.
Bonneval, Henry Anthony de, B.S.	*New Orleans, La.*	112 Newbury St.
Bott, Thomas Henry, Jr.	*Salem*	23 Andrew St., S.
Braverman, Jacob	*Raynham*	103 Bridge St., Ray.
Breed, Stanton Holway	*Framingham*	535 Newbury St.
Brehaut, Clarence Stewart	*Wellesley*	21 Howe St., Wel.
Brennan, Céleste Johnson	*Boston*	Hotel Westminster
Bristol, Benjamin Hiel, 2nd	*Foxboro*	916 Beacon St.
Britton, Frederick Schall	*Lexington*	8 Bedford St., Lex.
Brown, Daniel Hyman	*Lawrence*	46 Melvin St., Law.
Brown, Malcolm Cotton	*Hinsdale, Ill.*	12 Newbury St.
Brunelle, Samuel Albert	*Holyoke*	35 St. Botolph St.
Bruno, Henry Joseph	*Brookline*	101 Coolidge St., Br.
Bryant, Eliot Hoxie	*Woonsocket, R. I.*	8 Highland St., Woon.
Bryne, Perry Bush	*Allston*	1056 Commonwealth Ave., A.
Burbank, Roy Lyman	*Somerville*	39 Tennyson St., Som.
Burbank, Wilbur Swett	*Amesbury*	10 Oxford St., Cam.
Butler, James Henry, Jr.	*Norwood*	16 Prospect Ave., Nor.
Campbell, Dugald Wylie	*Lawrence*	239 Bailey St., Law.
Cann, George William	*Lynn*	Kernwood Drive, L.
Cannell, Joseph Elliot	*Everett*	6 Foster St., Ev.
Carter, John Stanley	*Malden*	231 Cross St., Mal.
Cartwright, Ralph Arthur	*Cambridge*	147 Magazine St., Cam.
Cashin, Richard Francis, Jr.	*Cambridge*	31 Blackstone St., Cam.
Chadwick, Noel	*Boston*	360 Marlborough St.
Chayne, Charles Augustine	*Harrisburg, Pa.*	84 Huntington Ave.
Claflin, Frederick Evarts	*Marlboro*	15 Park St., Mar.
Clark, Myron Harrison	*Concord*	Lexington Rd., Con.
Clark, Waldo Bishop	*W.Somerville*	21 Westminster St., W.Som.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Cohen, Bernard Simpson	*Boston*	30 Eliot St.
Colby, Lawrence Carlton	*Beverly*	132 Dodge St., Bev.
Coldwell, John Sharples	*South Swansea*	179 Bay State Rd.
Contieri, Anthony William	*Cambridge*	17 Holworthy Place, Cam.
Corthell, Huron D.	*Laramie, Wy.*	94 St. Botolph St.
Cosgrove, John Thomas	*East Lexington*	13 Maple St., E. Lex.
Coyne, Francis James	*Cambridge*	60 Holworthy St., Cam.
Curran, John Thomas	*Lawrence*	16 Willow St., Law.
Curry, Margaret Alice	*Fall River*	3907 Washington St., Ros.
Dalton, Laurance Melvin	*Portland, Me.*	12 Newbury St.
Daube, Harold Jack	*Chicago, Ill.*	110 Newbury St.
Davidson, Kenneth Seymour Moorhead	*Buffalo, N. Y.*	427 Marlborough St.
Davidson, Victor	*Malden*	74 Upham St., Mal.
Davis, Cutter Pierce	*Dorchester*	71 Waldeck St., D.
Deane, Andrew	*Wollaston*	853 Hancock St., Wol.
Dehon, Theodore, Jr.	*Spartanburg, S. C.*	Trinity Ct.
Denison, Horace Webster	*Chelsea*	60 Garland St., Ch.
Derby, Henry Staniford	*Somerville*	81 Oxford St., Som.
DeSalvo, Leopold	*Dedham*	Fairbanks Pk., Ded.
Dias, Moacyr Rodrigues	*Sao Paulo, Brazil*	90 Curtis St., Som.
Dillion, Frank Henry	*Malden*	93 Russell St., Mal.
Donovan, Charles Stephen	*West Medford*	538 High St., W. Med.
Doten, Everett Fitz	*Somerville*	115 Glenwood Rd., Som.
Duffy, Herbert Lewis	*Taunton*	9 East Britannia St., T.
Durland, Robert Walcott	*Lynn*	83 Chestnut St., L.
Edgarton, Lewis Stearns	*Cambridge*	41 Granite St., Cam.
Elliott, John Telford	*Newburyport*	18 Washington St., Np.
Elwell, Fenton Groves	*Waltham*	30 Crafts St., Wal.
Erving, John Middleton	*Andover*	59 Salem St., And.
Everit, Richard Sturtevant	*Barre*	Wellesley Farms.
Fairbanks, Robert Dow	*Newton Highlands*	21 Carver Rd., N. H.
Farist, Charles Joel	*Cheshire, Conn.*	226 Newbury St.
Farrand, Edmund Goldthorpe	*Penacook, N. H.*	89 Trowbridge St., Cam.
Farrisee, William James	*Cambridge*	817 Somerville Ave., Cam.
Fassitt, Andrew Jackson, Jr.	*Cambridge*	27 Walden St., Cam.
Fisher, James Russell	*Cambridge*	42 Antrim St., Cam.
Flather, Ralph Francis	*Nashua, N. H.*	261 Newbury St.
Fleming, George Grimes	*Washington, D. C.*	1067 Beacon St., Br.
Flynn, Edmund Joseph	*Taunton*	112 Broadway, T.
Ford, Arthur Roland	*Salem*	6 Plymouth St., S.
Freeman, Wilbur Herbert	*Dorchester*	8 Humphreys Place, D.
Friedlich, Robert Emanuel	*Rochester, N. Y.*	127 Newbury St.
Fulreader, Oscar John	*Rochester, N. Y.*	615 Washington St., Br.
Garnsey, Arlo Ellsworth	*White Plains, N. Y.*	1069 Beacon St., Br.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Gaylord, Wynn	*Beverly*	34 Baker Ave., Bev.
Gibson, James Wallace	*West Newton*	80 Bigelow Rd., W. N.
Gilbert, Ralph Hallett	*Needham*	709 Webster St., Need.
Giles, Henry Cunning	*Anchorage, Ky.*	1295 Com'wealth Ave.,A.
Gillon, John Francis	*Taunton*	48 Broadway, T.
Given, Frederick James	*Woburn*	116 Bedford St., Wo.
Goldstein, Louis Julius	*Hartford, Conn.*	263 Talbot Ave., D.
Gomez, Alfonso Javier	*Medellin, Colombia*	171 Newbury St.
Goodridge, Maurice Elmer	*Melrose*	148 E. Foster St., Me.
Gould, Joseph Herbert, Jr.	*Dorchester*	15 Bruce St., D.
Griebel, Frederick William	*Somerville*	353 Highland Ave., Som.
Griffin, Arthur Ernest	*Dorchester*	1067 Beacon St., Br.
Guppy, Joseph Seaverns	*Melrose*	52 Stratford Rd., Mel.
Hackett, Robert Prescott	*West Roxbury*	108 Corey St., W. R.
Hagan, William James, Jr.	*Athens, Ala.*	48 Boylston St., Cam.
Hall, Daniel Clifton	*Arlington*	62 Fairmont St., Arl.
Hall, Roger Tryon	*Arlington*	62 Fairmont St., Arl.
Hamilton, Russell	*Brookline*	165 Thorndike St., Br.
Hannigan, Ralph Joseph	*Brockton*	71 Ellis St., Brock.
Hartman, Lewis Evans	*Lancaster, Pa.*	1069 Beacon St., Br.
Haverty, James Joseph, Jr., B.S.	*Atlanta, Ga.*	Trinity Ct.
Hawkes, James Roberts	*S. Portland, Me.*	Technology Chambers
Hayden, Maurice Leeland	*Cambridge*	57 Wendell St., Cam.
Hayes, Stuart Jackson	*Everett*	95 Bradford St., Ev.
Haynes, Russell Abel	*Waltham*	80 Washington Ave., Wal.
Hedin, Conrad Hanson	*Cambridge*	367 Harvard St., Cam.
Herrick, Charles Merton	*Ward Hill*	I St., Ward Hill
Herzog, Herman Alfred	*Lawrence*	221 Prospect St., Law.
Hewes, Frederick Roy	*Hyde Park*	1841 Hyde Pk. Ave., H. P.
Heyman, Samuel	*Concord Junction*	2 Pond St., Con. Jct.
Higgins, Ernest Russell	*Milton*	303 Pleasant St., Mil.
Higgins, Joseph	*Cambridge*	17 Marie Ave., Cam.
Hirsch, George	*Newark, O.*	124 Chandler St.
Hoffman, Alfred George	*Bolton*	1109 Saratoga St., E.B.
Hoffmann-Pinther, Lincoln	*Mexico City, Mex.*	1096 Beacon St., Br.
Holt, James	*Somerset*	11 Irvington St.
Homer, Joseph Warren, Jr.	*Brookline*	38 Webster Place, Br.
Hopkinson, Frederick James	*Dayton, O.*	1067 Beacon St., Br.
Hough, Alfred William	*East Braintree*	152 Hayward St.,E.Brain.
Howes, Homer Vernon	*Boston*	496 Massachusetts Ave.
Hu, Kuang-piao	*Peking, China*	81 Dartmouth St.
Huang, Chi Yen	*Canton, China*	135 Appleton St.
Hubbard, Eben Russell	*Newton*	65 Washington St., N.
Hunter, Frederick Lincoln, Jr.	*El Paso, Texas*	100 St. James Ave.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Ilsley, Charles Hale	*Melrose Highlands*	42 North Ave., Mel. H.
Inglis, George Andrew	*Fall River*	33 St. Botolph St.
Jackson, Leslie Allerton	*Lawrence*	63 Bigelow St., Law.
Jacobs, Jay Edwin	*Boston*	57 Copeland St.
James, Locke LeBaron	*Brockton*	678 Pleasant St., Brock.
Jewett, Harry Parker	*Finderne, N. J.*	241 W. Newton St.
Jones, Bertram Francis	*Boston*	637 Shawmut Ave.
Kahn, George	*Boston*	117 Chambers St.
Kaiser, John Harold	*Marietta, O.*	484 Columbus Ave.
Karg, Everett Earl	*Johnstown, N. Y.*	Technology Chambers
Karmire, John Leefers	*Shelbyville, Ind.*	1073 Beacon St., Br.
Kaufman, Joseph	*Dorchester*	12 Browning Ave., D.
Kaufman, Samuel Albert	*Malden*	34 Newton St., Mal.
Kaupe, Arthur Friedrich	*New York, N. Y.*	Technology Chambers
Keith, Scott	*Newton Highl'ds*	20 Hartford St., N. H.
Kelley, Leo Alexis	*Arlington*	30 Cleveland St., Arl.
Kelsey, Alton Stuart	*Winthrop*	24 James Ave., Win.
Kenison, Arthur Cilley	*Lexington*	45 Parker St., Lex.
Kenison, Ervin Montague	*Lexington*	45 Parker St., Lex.
Kennard, Irving	*Melrose*	23 Cass St., Mel.
Kimball, Wirt Fuller	*Brookline*	210 Winthrop Rd., Br.
Kitchin, Donald Wentworth	*Methuen*	203 Bay State Rd.
Knobel, Max	*Walpole*	Walpole
Krebs, Carlos	*Jamaica Plain*	31 Robinwood Ave., J. P.
Landy, John	*Dorchester*	67 Claxton St., D.
Langille, Wilfred Otto	*Jamaica Plain*	Peter Brigham Hospital, Br.
Leahy, William Joseph	*Randolph*	Randolph
Lee, Frederic Montgomery	*Glen Ridge, N. J.*	Charles River Rd., Cam.
Lee, Kuangtao Tsufan	*Shanghai, China*	135 Appleton St.
Leland, Roger Maxwell	*Wellesley Hills*	6 Arlington Rd., W.H.
Lewis, Robert Fairn	*Lynn*	137 Newbury St.
Little, Charles Edmund	*Melrose*	95 Malvern St., Mel.
Lockwood, Ralph Cooper	*Brookline*	12 Kent St., Br.
Long, Wilfred Joseph	*North Cambridge*	156 Elm St., N. Cam.
Lundquist, Arthur	*Dorchester*	146 Draper St., D.
McCarten, George Clyde	*Lancaster, N. H.*	1067 Beacon St., Br.
McClintic, Howard Hale, Jr.	*Pittsburgh, Pa.*	60 Charlesgate East
McCloskey, Lawrence Charles	*Dorchester Center*	14 Ashmont St., D.Ctr.
McCreery, George William	*Fall River*	102 St. James Ave.
McGowan, Andrew Joseph	*Lawrence*	39 Bennington St., Law.
McIntosh, Harold Wales	*Needham*	431 Great Plain Ave., Need.
Mackay, William Roy	*Boston*	19 Batavia St.
McKenney, Walter Raymond	*Bridgeport, Conn.*	31 St. Botolph St.
McKinley, Malcolm Robertson	*Lowell*	474 Beacon St., Low.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
McLaughlin, Eugene Reginald	*Holbrook*	So. Franklin St., Hol.
McMorran, Alexander Morrison	*Oak Hill, N. B.*	76 St. James Ave.
Magraw, George Frederick	*Lynn*	13 Lookout Terr., L.
Maizlish, Israel	*Lynn*	40 Blossom St., L.
Maloy, Charles Barney	*St. Louis, Mo.*	1069 Beacon St., Br.
Mandelbaum, Isadore	*Lawrence*	29 Spruce St., Law.
Mardoian, Haroutune Hagop	*Aintab, Turkey*	71 Montgomery St.
Marshall, Harold Francis	*Cranford, N. J.*	127 Newbury St.
Martinez, José Félix, B.A.	*Santa Ana, Salvador*	7 Albemarle St.
Martinson, Oscar Sigfrid	*Barre, Vt.*	316 Huntington Ave.
Maxon, Ray Spencer	*Blackstone*	2 St. Botolph St.
May, Elliot Darwin	*Winchendon*	70 Austin St., Cam.
Mayer, David Oscar	*New York, N. Y.*	Technology Chambers
Maynard, Warren Alston	*Rutherford, N. J.*	88 St. James Ave.
Mead, Francis Leo	*Milford*	43 Jefferson St., Milf.
Means, Robert Snow	*Somerville*	5 Austin St., Som.
Merrill, Leland Hawthorne	*Melrose*	15 Warren St., Mel.
Milliken, James Roscoe	*Cambridge*	30 Newbury St.
Minard, David P.	*Aberdeen, S. D.*	11 Irvington St.
Miner, Henry Albert	*Bellows Falls, Vt.*	52 Ivy St.
Mirabelli, Eugene	*Dorchester*	20 Pleasant St., D.
Mitchell, Robert Williamson	*Taunton*	15 Prospect St., T.
Moberg, Harold Carl	*Campello*	126 Leyden St., Camp.
Morse, George Albert Armstrong	*Auburndale*	132 South Ave., Aub.
Moylan, Lawrence John	*Dorchester*	1023 Dorchester Ave., D.
Müller, Adolf Lancken	*Brooklyn, N. Y.*	179 Bay State Rd.
Murphie, Harold Hubbard	*Dorchester*	42 Shepton St., D.
Murray, Harold James	*Brockton*	37 May Ave., Brock.
Newell, Joseph Shipley	*Springfield*	107 St. Botolph St.
Noyes, Mason Shaw	*Taunton*	94 Dean St., T.
Nutter, Karl Locke	*Newton Upper Falls*	1174 Boylston St., N.U.F.
Nutting, Clarence Leighton	*West Roxbury*	54 Lassell St., W. R.
O'Connor, Austin Joseph	*Ashmont*	55 Welles Ave., Ash.
O'Donnell, Aloysius Francis	*Natick*	3 Kimball Ct., Na.
Page, Sherwood	*Melrose Highlands*	20 Pearl St., Mel. H.
Palmer, Russell Smith	*Somerville*	93 Central St., Som.
Parker, Benjamin	*Weston*	Conant Rd., Wes.
Parker, Frederick Andrew	*Brookline*	3 Walnut Terr., Br.
Parsons, Charles Jewett	*Brooklyn, N. Y.*	179 Bay State Rd.
Paterson, Ellsworth George Daniel	*Melrose Highlands*	976 Main St., Mel. H.
Patterson, Webb Counce	*Waterville, Me.*	30 Newbury St.
Peach, Harry Lawrence	*Malden*	47 Walnut St., Mal.
Pease, Ralph Hotchkiss	*Torrington, Conn.*	16 Exeter St.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Peltier, Paul Desnoyers	*New York, N. Y.*	Technology Chambers
Perkins, Ernest Frederic	*Melrose*	153 E. Emerson St., Mel.
Phelps, Carl Wright	*Springfield*	1395 Commonwealth Ave., A.
Philbrook, Frank Leon	*Boston*	124 St. Botolph St.
Pierce, Edward Franklin, Jr.	*Melrose Highl'ds*	46 Clifton Park, Mel.H.
Pike, William Kenneth	*Andover*	4 Chapman Ave., And.
Polson, Carl Gottfred Leonard	*Campello*	22 Edson St., Camp.
Pratt, Harold Gilbert	*Clinton*	126 St. Botolph St.
Prescott, Amos Neal	*Passaic, N. J.*	16 Exeter St.
Priest, Holden Chouteau	*Brookline*	101 Abbottsford Rd., Br.
Quick, Lansing Mott	*Yonkers, N. Y.*	70 Astor St.
Rasmussen, Frederick Jessen	*Quincy*	125 Greenleaf St., Q.
Reis, James Ward, Jr.	*New Castle, Pa.*	1067 Beacon St., Br.
Reynolds, Albert Barnes	*Atlantic City, N.J.*	212 Huntington Ave.
Reynolds, Frank Percival	*Malden*	46 Boston St., Mal.
Richards, Alan Gerard	*Dorchester*	37 Burgess St., D.
Richards, Arklay Seymour	*Cambridge*	22 Bigelow St., Cam.
Richardson, Edward Adams	*Evanston, Ill.*	37 Lee St., Cam.
Richardson, Harold Moulton	*West Acton*	129 Mt. Auburn St., Cam.
Riegel, John Lawrence	*New York, N. Y.*	12 Newbury St.
Roberts, Arthur	*Philadelphia, Pa.*	31 Newbury St.
Roberts, Walter Carlyle	*Newton Center*	1569 Mass. Ave., Cam.
Rodgers, Karl Freeman	*West Somerville*	96 Pearson Rd., W. Som.
Rommer, Henry	*Malden*	596 Cross St., Mal.
Root, Burritt Alaric	*New Britain, Conn.*	316 Huntington Ave.
Root, George Wells	*Hartford, Conn.*	316 Huntington Ave.
Russell, Warren King	*Dorchester*	13 Allston St., D.
Sanford, Davis Curtis, Jr.	*Bridgeport, Conn.*	44 The Fenway
Santos, Alexander Hevia	*Summit, Pa.*	Charles River Rd., Cam.
Savage, Russell Heath	*Greenwood*	Oak St., Gr.
Scheeline, Paul Daniel	*San Francisco, Cal.*	Garrison Hall
Schefer, Albert Philip	*Taunton*	40 East Britannia St., T.
Schindler, Ernest Francis	*Cambridge*	21 Orchard St., Cam.
Schur, Albert Paul	*Boston*	84 Salem St.
Schwartz, Ernest Lincoln	*Franklin, N. H.*	31 St. Botolph St.
Scofield, Edward Ellis	*Oconto, Wis.*	234 Newbury St.
Scott, Robert Wesley	*Dorchester*	38 Esmond St., D.
Scranton, Charles Wallace	*Washington, N. J.*	12 Park Drive, Br.
Searles, Howard Hall	*Marlboro*	27 Norwood St., Marl.
Selya, Hyman Philip	*Brookline*	31 Perry St., Br.
Seymour, Cecil Russell	*South Lancaster*	112 Magnolia St., D.
Shaw, Philip Martin	*Colorado Springs, Colo.*	138 Newbury St.
Shea, Timothy Edward	*Wellesley Hills*	49 Worcester St., Wel. H.
Shedlovsky, Theodore	*Boston*	38 Falmouth St.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Sherman, Benjamin Howland	*Newport, R. I.*	8 Ashford St., A.
Sherman, Edward Mowry	*Marlboro*	Marlboro
Sherman, Samuel Alfred	*Stamford, Conn.*	52 Falmouth St.
Shippey, Webster Batcheller	*Chicago, Ill.*	234 Newbury St.
Shultz, Edwin Chester	*Montclair, N. J.*	30 Newbury St.
Silloway, Ralph Marston	*Newburyport*	314 High St., Np.
Sloan, Howard Backus	*Swampscott*	179 Redington St., Swam.
Slotnik, Isidor	*Chelsea*	10 Lawrence St., Ch.
Smith, Archer Greenlaw	*Brooklyn, N. Y.*	30 Newbury St.
Smith, Edgar Reynolds	*Wilmington, Del.*	203 Bay State Rd.
Smith, Frederick Gorham Clark, Jr.	*Greenwich, Conn.*	1004 Beacon St., Br.
Smith, James Henry	*Gloucester*	1376 Commonwealth Ave., A.
Smith, Leighton Bruerton	*Auburndale*	158 Central St., Aub.
Smith, Merritt Parker	*North Scituate, R. I.*	92 St. James Ave.
Smith, Morton Arthur	*Great Barrington*	393 Broadway, Cam.
Smith, Russell Storer	*Arlington*	853 Massachusetts Ave., Arl.
Snow, Leon Isaac	*Brookline*	35 Beals St., Br.
Snow, William Bradlee	*Newton Center*	11 Devon Rd., N. C.
Soars, Everett Alexander	*Newburyport*	394 Marlborough St.
Sorenson, Loyd Raymond	*Dorchester*	19 Boyden St., D.
Southwick, Bertram Holden	*Lynn*	126 Bowler St., L.
Spector, Hyman	*Boston*	13 Oswego St.
Staubach, Arnold Baldwin	*Highland Park, Mich.*	4 Trowbridge Pl., Cam.
Stebbins, Everett Gardner	*Melrose*	99 Malvern St., Mel.
Stehle, Richard Brehm	*Philadelphia, Pa.*	372 Metropolitan Ave., Ros.
Stewart, Chester Cameron	*Medford*	8 Sumner Ave., Med.
Stiller, Harry	*Roxbury*	96 Harrishof St., R.
Strang, James MacLaren	*Auburndale*	348 Central St., Aub.
Strobridge, James Gordon	*Cincinnati, O.*	173 St. Botolph St.
Stuart, Kimberly	*Neenah, Wis.*	1004 Beacon St., Br.
Stubenrauch, Edgar Albert	*Sheboygan, Wis.*	34 Gardener St., A.
Svenson, Carl Louis	*Mattapan*	303 Wood Ave., Mat.
Thomas, Carl Edison	*Waverley*	37 Holt St., Wav.
Tillson, Elwood Morse	*Middleboro*	141 So. Main St., Mid.
Tribou, Ralph Ellsworth	*Montello*	956 No. Main St., Mont.
Untersee, Maximilian	*Brookline*	161 Davis Ave., Br.
Upham, Donald Baxter	*New York, N. Y.*	7 Willow St.
van Zelm, Louis Franklin	*New Rochelle, N. Y.*	215 Newbury St.
Walworth, Walter Frederick	*Lowell*	48 Crawford St., Low.
Warner, Frederick Laurence	*Salem*	13 Mason St., S.
Warren, Alfred Lockhart	*Lowell*	210 Huntington Ave.
Way, Donald Dickinson	*New York, N. Y.*	291 Harvard St., Br.
Webber, Eaton	*Newton*	199 Hunnewell Terr., N.
Webster, Dean Kingman, Jr.	*Lawrence*	225 Newbury St.

FIRST YEAR (*continued*).

NAME.	HOME.	RESIDENCE.
Welch, William Grow	*Milford*	21 Purchase St., Milf.
Wells, Robert Kirk	*Winthrop*	60 Sea View Ave., Win.
Westland, Charles Edward	*Somerville*	4 Aldrich St., Som.
Weymouth, Henry Stanley	*Dexter, Me.*	102 St. James Ave.
Whaley, John Staton	*Snow Hill, Md.*	203 Bay State Rd.
White, Horace Dyball	*Cambridge*	67 Yerxa Rd., Cam.
Whiton, Henry Rogers	*Hingham Centre*	Hingham Centre
Willey, Dean Frederick	*Manchester, N. H.*	30 Newbury St.
Williams, Abraham	*Choluteca, Honduras*	64 Huntington Ave.
Williams, Ralph Gunter	*New Bedford*	78½ Robbins St., Wal.
Williams, Russell Estes	*Taunton*	62 Tremont St., T.
Wilson, Henry Everett	*Ipswich*	79 County Rd., Ips.
Winebaum, Arthur	*Lawrence*	4 Stanwood Terr., R.
Winkfield, Holley Stetson	*Braintree*	186 Pearl St., Som.
Winslow, Alan Francis	*River Forest, Ill.*	84 Huntington Ave.
Winter, Donald Brigham	*Fall River*	385 Weetamoe St., F.R.
Wiswall, George Henry, Jr.	*Watertown*	259 Newbury St.
Wolff, Louis	*Revere*	23 Dana St., Rev.
Wood, Kenneth Fuller	*Framingham*	26 Pleasant St., Fram.
Wright, Kenneth Andrews	*Dorchester*	54 Kenwood St., D.
Wright, Stuart Eldridge	*Taunton*	11 Union St., T.
Wyse, Francis Octavus	*Toronto, Ont.*	44 The Fenway
Yeh, Tek-Chên	*Shanghai, China*	135 Appleton St.
Young, Herbert Franklin	*Buffalo, N. Y.*	80 Bay State Rd.

SPECIAL STUDENTS

NAME	COURSE	HOME	RESIDENCE
Abbot, George, 2nd, B.A., B.S.	VI.	*Laramie, Wyo.*	127 Newbury St.
Allen, Robert McClanahan, B.S.	IV.	*Roanoke, Va.*	1079 Beacon St., Br.
Atkinson, Henry Morrell, Jr., A.B.	VI.	*Atlanta, Ga.*	6 Story St., Cam.
Bache-Wiig, John, B.S.	X.	*Portland, Me.*	16 Exeter St.
Baker, Norman Dean, A.B.	III.	*Providence, R. I.*	350 Olney St., Prov.
Barker, Stanley Truman, A.B.	XI.	*Cambridge*	34 Shepard St., Cam.
Barnes, Arthur Henry	V.	*Meriden, Conn.*	101 St. James Ave.
Bartlett, Leslie Raymond	VII.	*Holliston*	Holliston
Bealer, William Porter	IV.	*Darien, Ga.*	261 Newbury St.
Beard, William Cloyce, B.S.	IV.	*Washington, Ia.*	522 Massachusetts Ave.
Beckanstin, Harry Hyman	IV.	*Hartford, Conn.*	7 Myrtle St.
Boatwright, Walter P., U.S.A., B.S.	VI.	*Allston*	1277 Commonwealth Ave.,A.
Bradley, John Ruskin, M.D.	VII.	*King Ferry, N. Y.*	162 Huntington Ave.
Brandt, Maurice Frankland, S.B.	V.	*Trenton, N. J.*	45 St. Botolph St.
Brown, David Mungall	IV.	*Lawrence*	47 St. Stephen St.
Cabot, James Jackson, A.B.	II.	*Cambridge*	16 Highland St., Cam.
Caldwell, James Robert, B.S.	IV.	*Coleman, Tex.*	316 Huntington Ave.
Chase, Nelson Chauncy	IV.	*Lowell*	174 Lexington Ave., Cam.
Christensen, Abby Winch, A.B.	IV.	*Beaufort, S. C.*	24 Follen St., Cam.
Chun, Yen-Shou, Ch. E.	X.	*Canton, China*	28 Mellen St., Cam.
Clark, Edmund, B.S., M.S.	VII.	*West Medford*	37 Warren St., W. Med.
Colleary, William Bartholomew,A.B.	IV.	*Jamaica Plain*	300 Hyde Pk. Ave., J. P.
Cousens, Marion Louise, A.B.	VII.	*Winter Hill.*	12 Thurston St., W. H.
Cronin, John Timothy, A.B.	IV.	*Spokane, Wash.*	44 The Fenway
Davis, Vivian Bruce	IV.	*Waltham*	247 Moody St., Wal.
Day, Dorothy Scofield, B.A.	VII.	*Lawrenceville, Pa.*	214 Newbury St.
Escher, Erwin	IV.	*Trieste, Austria*	316 Huntington Ave.
Favrot, Henri Mortimer, B.E.	IV.	*New Orleans, La.*	175 St. Botolph St.
Flaherty, James Charles	IV.	*Dorchester*	29 Monadnock St., D.
Gigger, Augustus George, M.D.	VII.	*Chatham*	Chatham
Gomez Arzapalo, Ernest	I.	*Mexico City, Mex.*	47 St. Botolph St.
Hafner, Victor Leonard Simon	IV.	*Boston*	34 Appleton St.
Haggard, Roy Snow, B.S.		*Watertown*	127 Barnard Ave., Wat.
Horms, Henry William, U.S.A.	XIII.	*San Diego, Cal.*	Hotel Westminster
Hiraoka, Michiya	III.	*Tokio, Japan*	88 St. James Ave.
Hodgson, Maurice Lee	XV.	*Newton*	96 Shornecliffe Rd., N.
Holland, Maurice	VI.	*Boston*	89 St. Botolph St.
Holmes, Edward Otis, Jr., A.B.		*Malden*	31 Greystone Rd., Mal.

SPECIAL STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Horan, Charles Francis	VII.	*Johnstown, Pa.*	Box 86, Wat.
Hoyt, Robert Nelson, S.B.	VII.	*Wellesley Hills*	Wel. H.
Hsieh, En Tseng, M.D.	VII.	*Peking, China*	316 Huntington Ave.
Iasigi, Marie Victoire	IV.	*Brookline*	46 Gorham Ave., Br.
Ingham, Edward Alexander, S.B.	VII.	*Brookline*	299 Tappan St., Br.
James, Linda, B.A.	VII.	*St. Paul, Minn.*	2 Divinity Ave., Cam.
Jenney, Paul Gmelin	I.	*Weston*	Weston
Jones, Byron Quimby, U.S.A.	XIII.	*Boston*	Hotel Westminster
Jones, David Morris, B.A.	VI.	*Wabasha, Minn.*	820 Mass. Ave., Cam.
Jorgensen, Virgil Williams	IV.	*Cambridge*	1619 Mass. Ave., Cam.
Kallejian, Robert Mugerdich	V.	*Hartford, Conn.*	24 Westland Ave.
Knox, Cornelius Van Santwood, A.B.	I.	*New Brunswick, N.J.*	100 Huntington, Ave.
Kraft, Eliss	VII.	*Brookline*	2 Summit Ave., Br.
Leighton, John Robert	I.	*Everett*	100 Winslow St., Ev.
Lindgren, Ray Harrison, B.S.		*Manchester, N. H.*	139 Jewett St., Man.
Loo, Pang Chieh, B.S.	III.	*Shanghai, China*	6 St. Botolph St.
McAdams, William Henry, B.S., M.S.	X.	*Lexington, Ky.*	316 Huntington Ave.
Mackler, Max Joseph	VII.	*New Bedford*	643 Huntington Ave., Br.
McLaughlin, Thomas Stephen	IV.	*Providence, R. I.*	821 Beacon St.
Mears, Edward N. K., A.B., M.D.	VII.	*Lowville, N. Y.*	48 Brattle St., Cam.
Mudge, Arthur Warren, Jr.	V.	*Jamaica Plain*	194 Pond St., J. P.
Neff, Edwin Wallace	IV.	*Pasadena, Cal.*	Copley Square Hotel
Nichols, William R., U.S.A., B.S.	VI.	*Allston*	1277 Commonwealth Ave., A.
O'Connell, Regina Josephine, A.B.	VII.	*Marlboro*	24 Fairmount St., Mar.
Paine, George Thomas, B.S.	I.	*Warwick, R. I.*	41 Bickerstaff St.
Paugh, Charles Thomas, A.B.	II.	*Athens, O.*	11 Newbury St.
Paul, George Philip, M.D.	VII.	*Round Lake, N. Y.*	187 St. Botolph St.
Pond, Walter Franklin, B.S.	III.	*Greenfield*	8 Irvington St.
Pratt, Aaron Paul, A.B.	VII.	*Cambridge*	2 Arnold Circle, Cam.
Reed, David Allen, Jr.	IV.	*Springfield*	1464 Beacon St., Br.
Reidy, Maurice Altons	I.	*Astoria, N. Y.*	101 Tremont St.
Riddell, Willard Bruce	IV.	*Hamilton, Ont.*	125 Pleasant St., Dor.
Robinson, Clark	IV.	*Bangor, Me.*	52 St. Stephen St.
Robinson, Edgar Steel, A.B.	VI.	*Evanston, Ill.*	1069 Beacon St., Br.
Robinson, Walter Josephus	IV.	*Oakland, Cal.*	Trinity Court
Roth, Ernest Charles, A.B.	II.	*Peru, Ill.*	41 Perkins Hall, Cam.
Samper, Bernardo, B.A., M.D.	VII.	*Bogota, Colombia*	84 The Fenway
Shimizu, Giichi		*Miyeken, Japan.*	15 Ellery St., Cam.
Shogenji, Kazu	II.	*Tokio, Japan*	10 Hamilton St., D.
Smith, Russell Gilman, B.S.	VI.	*Chicago, Ill.*	174 St. Botolph St.
Smith, Sophia Lyman, A.B.	VII.	*Portland, Me.*	Newton Hospital, N. L. F.
Stuart, Sidney Edwin, Jr.	II.	*Wilmington, Del.*	5 Linden St., Cam.
Sung, Chien Hsun	XIII.B.	*Foochow, China*	177 St. Botolph St.
Tayntor, Lewis Olds	VII.	*Montclair, N.J.*	1727 Cambridge St., Cam.

SPECIAL STDUENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Wallace, Edwin S., B.A., M.A. . .	V.	*Springfield, O.*	Technology Chambers
Washburn, George Henry Thomas	IV.	*Ottawa, Kan.* . .	277 Harvard Ave., A.
Wellman, Harvey Elijah, A.B. . .	V.	*Providence, R. I.*	16 Exeter St.
Whittier, Ross, A.B.	XV.	*Milton* . . .	48 Claverly Hall, Cam.
Woo, Sien Ming, A.B., M.D. . .	VII.	*Chang Chow, China*	119 Hemenway St.
Wright, Henry Wagner, A.B. . .	IV.	*Danvers*	241 Locust St., Dan.
Yokoyama, Wakamaten	III.	*Port Arthur, Japan*	25 Cortes St.
Yoshikawa, Hiroshi		*Tokio, Japan* .	113 Thorndike St., Br.
Zamore, Birger Verner, S.B. . .	I.	*Cambridge* .	11 Wadsworth House, Cam.

UNCLASSIFIED STUDENTS.

(The numeral immediately following the name indicates the year of the major subjects taken by the student.)

NAME.	COURSE.	HOME.	RESIDENCE.
Adams, Carl Edwin[2]	V.	*Franklin*	65 Cottage St., F.
Adams, Fred. Arthur[2]		*Hyde Park*	Dana Ave., H. P.
Ahearn, William Joseph[3]	II.	*Everett*	80 Foster St., Ev.
Allen, James Hale[1]		*Lawrence*	31 Washington St., Law.
Appleton, Frank Hollis[2]	I.	*Newton*	132 Church St., N.
Atkins, Willard Eugene[2]	II.	*Toronto, Ont.*	99 Phillips St., Wol.
Atwater, David[2]	VII.	*Westfield*	Charles River Rd., Cam.
Ayer, Gordon Whittier[1]		*Newton Highl'ds*	23 Lakewood Rd.,N.H.
Baker, Arthur DeWint[2]	V.	*Brooklyn, N. Y.*	234 Newbury St.
Barnes, Dana Avery	IV.	*Evanston, Ill.*	31 Newbury St.
Barnicoat, Frederick Marshal[1]		*Quincy*	1 Independence Ave., Q.
Barrios, Charles Joseph[1]		*New York, N. Y.*	12 Newbury St.
Barry, Edwin Fry, B.S.[3]	VI.	*Marshall, Tex.*	41 St. Botolph St.
Battis, Joseph Talmage Woodruff[3]	II.	*Salem*	Charles River Rd., Cam.
Becker, James Howard[1]		*Clyde, O.*	102 St. James Ave.
Beckett, Minor Milliken[1]		*Hamilton, O.*	234 Newbury St.
Benson, Arthur Francis[3]	II.	*Wenonah, N. J.*	193 St. Botolph St.
Bent, Roderic Leslie[1]		*Gardner*	1069 Beacon St., Br.
Bernard, Frederick[3]	VII.	*Hartford, Conn.*	1069 Beacon St., Br.
Bertelsen, Paul Jens[3]	XV.	*Winthrop*	30 Newbury St.
Besly, Leonard[3]	XV.	*Denver, Colo.*	1067 Beacon St., Br.
Black, Charles Miller[4]	I.	*Denver, Colo.*	916 Beacon St.
Blackwood, Walter Ainslie[3]	XV.	*Roxbury*	126 Zeigler St., R.
Blake, Arthur Henry[1]		*Wollaston*	261 Safford St., Wol.
Blank, Henry Millet[2]	XV.	*Glen Ridge, N. J.*	234 Newbury St.
Blodgett, Leo Stanislaus[2]	XIII.	*Portland, Me.*	138 W. Canton St.
Blount, Harold Nicholson[2]	XV.	*Everett*	169 Hancock St., Ev.
Boice, Frank Seymour, A.B.[3]	II.	*Pasadena, Cal.*	Walter Hastings Hall, Cam.
Bolotin, Jacob Joseph[2]	VI, II.	*Youngstown, O.*	533 Newbury St.
Bond, Nelson Arthur[2]	XI.	*Roxbury*	71 Waverly St., R.
Boright, William Nelson[1]		*Mansonville, Que.*	12 Howlett St., Cam.
Brandegee, Morris Marius, A.B.[4]	X.	*Plainfield, N. J.*	1004 Beacon St., Br.
Brayton, Harold Morgan[3]	II.	*Cold Brook, N. Y.*	94 St. Botolph St.
Brock, Malcolm Cameron[3]	XV.	*Newton Center*	228 Langley Rd., N. C.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Brooks, Ralph Frederick Fleming[3]	I.	*Roxbury*	47 Julian St., R.
Brosnahan, Thomas Hardesty[2]	VI.	*Lowell*	796 Lawrence St., Low.
Brown, Edward[2]	II.	*Dorchester*	243 Harvard St., D.
Brown, Louis Joseph[1]		*Roxbury*	133 Warren St., R.
Brownie, Percy Watts[2]	III.	*Seattle, Wash.*	196 St. Botolph St.
Bruton, Leonard Marshall[1]		*Baltimore, Md.*	Hotel Oxford
Buford, Albert Walter[3]	I.	*Forrest City, Ark.*	1067 Beacon St., Br.
Bulifant, Theodore Adolph[4]	X.	*Philadelphia, Pa.*	11 Irvington St.
Burckett, Douglas Mellen[1]		*Somerville, N. J.*	160 St. Botolph St.
Butler, Harold Bernard[2]	X.	*Brookline*	316 Harvard St., Br.
Butter, Harold Martin[1]		*Roxbury*	23 Wabon St., R.
Caird, Alexander Winton[2]	I.	*Northampton*	316 Huntington Ave.
Caldwell, Stuart Hill[2]	II.	*Newtonville*	11 Jenison St., Nv.
Cameron, Edwin John[2]	VII.	*Cambridge*	99 Garden St., Cam.
Cammann, Oswald, Jr.[1]		*Dayton, O.*	1067 Beacon St., Br.
Camp, Harry Upson[2]	VI.	*Easthampton*	Y. M. C. A., Cam.
Campbell, Joel William[3]	I.	*Fullerton, Neb.*	64 Rutland St.
Campbell, Tristram Joseph[2]	VIII.	*Dorchester*	123 Ashmont St., D.
Carlton, Arthur Clifford[3]	III.	*Baltimore, Md.*	84 Huntington Ave.
Carson, Frank Somerville[3]	IV.	*Halifax, N. S.*	261 Newbury St.
Carter, Arthur Alfred[3]	VI.	*Woburn*	51 Montvale Ave., W.
Carter, James Walter[2]	III.	*Coalwood, W. Va.*	Garrison Hall
Cassidy, Henry Leo[2]	X.	*Holyoke*	155 Massachusetts Ave.
Cassidy, John Edward[2]	VI.	*Roxbury*	6 Carmel St., R.
Castor, Amasa Hungerford[1]		*Manchester, N. H.*	26 Holborn St., R.
Chandler, Charles Hallstrom[3]		*West Newton*	51 Winthrop St., W. N.
Chandler, Lester Van Deventer[1]		*Plainfield, N. J.*	30 Rutland Sq.
Chase, Chester Edward[2]		*Lowell*	18 Windsor St., Low.
Checa, Vicente Felipe[3]	I.	*Piura, Peru*	1213 Beacon St., Br.
Chen, Kao Chien[3]	VI.	*Foochow, China*	7 Follen St.
Chisholm, Harold Vincent[3]	II.	*Dorchester*	93 Brook Ave., D.
Cianciolo, Philip Joseph[3]	I.	*Boston*	15 So. Margin St.
Clark, James Lomax[2]	XV.	*Newton*	80 Claremont St., N.
Clark, John Alston[2]	II.	*Clarksdale, Miss.*	1067 Beacon St., Br.
Clarkson, John Wheeler[2]		*Newburyport*	1067 Beacon St., Br.
Clarkson, Joseph Jennings[3]	II.	*New Haven, Conn.*	30 Newbury St.
Cochrane, Clarence[3]	II.	*Melrose*	63 Howard St., Mel.
Coes, Marion Louise[2]	X.	*Whitinsville*	250 Newbury St.
Coffin, William Earle[3]	XI.	*Newburyport*	272 High St., Np.
Coke, William Gaston, A.B.[2]	II.	*Auburn, Ky.*	203 Bay State Rd.
Cole, George Harlos, B.S.[4]	VI.	*Yazoo City, Miss.*	79 St. Botolph St.
Collier, Robert Thach[2]	XI.	*Salt Lake City, Utah.*	172 Huntington Ave.
Collins, Harold Ebert[2]	XV.	*Newton Highlands*	44 Carver Rd., N. H.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Conniers, Norman Douglas[1]		*Boston*	Wadsworth Hotel
Connors, Myles Francis[1]		*Washington, D.C.*	35 Van Winkle St.,Ash.
Cook, Charles Cheveau[1]		*Washington, D. C.*	418 Newbury St.
Coombs, Richard Horace[1]		*Waltham*	Forest Grove, Wal.
Cooper, Stanley Knox[3]	II.	*Malden*	275 Fellsway E., Mal.
Corbett, Francis Patrick[2]	IV.	*Lowell*	14 Burns St., Low.
Couch, Edward Seguin[3]	IV.	*Cromwell, Conn.*	15 Norfolk Rd., C. H.
Coyne, Harry John[2]	I.	*Cambridge*	60 Holworthy St., Cam.
Creedon, Frank Reardon[2]	I.	*Brockton*	285 Moraine St., Brock.
Creedon, Walter Jeremiah[1]		*Brockton*	285 Moraine St., Brock.
Creighton, Samuel Henry, Jr.[3]	II.	*Rockville Centre, N. Y.*	102 St. James Ave.
Crosby, Irving Ballard[2]	XII.	*Jamaica Plain*	9 Park Lane, J. P.
Crowell, Christopher Chase[3]	IV.	*Campello*	19 South St., Camp.
Crowley, Daniel Napoleon, Jr.[1]		*Danvers*	5 Ridgely Hall, Cam.
Cummings, Stanley Robinson[2]	II.	*Wollaston*	123 Winthrop Ave., Wol.
Cunningham, Lawrence, A.B.[3]	VI.	*Brookline*	135 Ivy St., Br.
Curtin, Enos Wettlaufer[2]	XV.	*New York, N. Y.*	1067 Beacon St., Br.
Curtis, Brian Cutler, A.B.[3]	I.	*New York, N. Y.*	234 Newbury St.
Curtis, Ingraham		*Corning, N. Y.*	80 Bay State Rd.
Dasso, Luis[2]	IV.	*Lima, Peru*	93 St. Botolph St.
Davis, Guy Hammett[1]		*El Paso, Tex.*	179 Bay State Rd.
Davis, Israel Wolffe[1]		*Boston*	27 Lowell St.
Dean, William Franklin[3]		*Johnstown, N.Y.*	Technology Chambers
DeLong, Charles Edward[2]		*Malden*	12 Clement St., Mal.
Demeritt, John Edgar[3]	VI.	*Newmarket, N. H.*	157 Hemenway St.
Demond, Daniel Bradford[2]	X.	*North Adams*	237 Beacon St.
Derrah, Robert Vincent[2]	II.	*Salt Lake City, Utah*	172 Huntington Ave.
Dexter, Franklin Closson[3]	VI.	*Brookline*	129 Dean Rd., Br.
Dickson, Arthur Donohue[3]	I.	*Cambridge*	149 Austin St., Cam.
Dixon, Enslo Smith[2]	V.	*Roxbury*	25 Hulbert St., R.
Dodge, William Waldo, Jr.[4]	IV.	*Washington, D. C.*	85 Pinckney St.
Doherty, Joseph Edmund[4]	V.	*Newton*	45 Waban St., N.
Douglas, Angus Dearborn[1]		*Cambridge*	23 Trowbridge St., Cam.
Dow, Lewis Morrill[3]		*St.Petersburg, Fla.*	149 Magazine St. Cam.
Drobisch, Raymond Wessells[3]	II.	*Decatur, Ill.*	316 Huntington Ave.
Dudley, Paul Fenno[3]	VI.	*Milton*	185 School St., Mil.
Dumit, Michael Jaber, B.A.[3]	X.	*Beyrout, Syria*	4 Yarmouth St.
Earl, John Howard[2]	I.	*Doylestown, Pa.*	1004 Beacon St., Br.
Eastman, William, Jr.[3]	II.	*Evanston, Ill.*	203 Bay State Rd.
Edson, Albert Lovell[1]		*East Braintree*	316 Huntington Ave.
Edwards, Earl Albert[2]	II.	*Malden*	158 Maple St., Mal.
Ellis, Charles Thomas[3]	X.	*Towner, N. D.*	33 St. Botolph St.
Ely, Dinsmore[2]	IV.	*Winnetka, Ill.*	535 Newbury St.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Elz, George Adolph[2]	VI.	*Jamaica Plain*	86 Orchard St., J. P.
Engelbrecht, Walter Bernard[2]	X.	*Tompkinsville, N. Y.*	53 St. Stephen St.
Ennis, George Henry[2]	VII.	*Derby, Conn.*	96 St. Botolph St.
Estes, Frederick Marion[2]	V.	*Brookline*	27 Englewood Ave., Br.
Evelev, Yale[2]	VI.	*South Boston*	21 Middlesex St.
Fales, Herbert Gordon[1]		*West Newton*	145 Highland St., W. N.
Farnsworth, Augustus Page[3]	X.	*Hyde Park*	30 Newbury St.
Fehr, Gordon[4]	XI.	*Cape Town, So. Africa*	11 Irvington St.
Fellows, Richard Charles[3]	VI.	*West Somerville*	771 Broadway, W. Som.
Fennessey, Elizabeth Mary, S.B.[3]	V.	*Boston*	25 Decatur St.
Fields, Edwin Simon, Jr.[2]	I.	*Dorchester*	9 Maybrook St., D.
Fisher, William Perin, Jr.[2]	X.	*Glen Ridge, N. J.*	85 Newbury St.
Flanders, Talbot, A.B.[4]	II.	*Brookline*	49 Longwood Ave., Br.
Fleckenstein, Jackson[1]		*Ionia, Mich.*	203 Bay State Rd.
Flint, James Arthur[2]	II.	*Denver, Colo.*	44 N. Beacon, St. A.
Fogarty, Thomas Smith[2]	XV.	*Plymouth*	90 Gainsborough St.
Ford, Frederic Leslie[3]	IV.	*New Bedford*	132 Glenville Ave., A.
Fowler, Francis Malcolm[1]		*Salem*	16 Shore Ave., S.
Fowler, William Herbert[2]	XV.	*Melrose*	176 E. Foster St.,Mel.
Freed, Samuel[3]	V.	*Cambridge*	40 Market St., Cam.
Freeman, Edward Emery[3]	VI.	*Boston*	9 Wayne St., G. H.
French, George Franklin[1]		*New Rochelle, N. Y.*	12 Newbury St.
Friend, Donald Osborne[3]	X.	*Brooklyn, N. Y.*	80 Bay State Rd.
Fuller, Samuel[2]	I.	*East Bridgewater*	East Bridgewater
Gagnebin, William Becar[1]		*Brookline*	41 Carlton St., Br.
Gagnon, Jules[3]	VII.	*Newburyport*	18 Broad St., Np.
Gallagher, Anthony Joseph[1]		*Framingham*	111 Union Ave., Fram.
Gargan, Joseph Aloysius[3]	XV.	*Roxbury*	110 Winthrop St., R.
Gartner, Walter Christian Frederick[3]	I.	*Jamaica Plain*	283 Newbury St.
Gauger, Raymond Richard[3]	IV.	*St. Paul, Minn.*	261 Newbury St.
Gay, Robert Neil, A.B.[3]	VI.	*Waco, Tex.*	215 Newbury St.
Geisler, Hugo Paul[2]	VI.	*Saginaw, Mich.*	285 Newbury St.
Gibbons, Thomas Manning[3]	I.	*Milton*	61 Warren Ave., Mil.
Gidley, Robert Titus[2]	IV.	*Springfield*	7 Berwick Pk.
Giles, Ernest Palmer[3]	IV.	*San Antonio, Tex.*	181 Huntington Ave.
Gillett, Laurence Arnold[2]	XI.	*Newburyport*	70 Bromfield St., Np.
Gilmore, Robert Lee[1]		*Boston*	464 Huntington Ave.
Giuranovich, Arthur Joseph, Jr.[2]	I.	*Boston*	471 Columbus Ave.
Gleason, Harold Low[2]	VI.	*Dorchester*	8 Peacevale Rd., D.
Gleason, Robert Winfred[2]	IV.	*Framingham*	3 Summit St., Fram.
Gokey, Noah Webster[3]	XIII.	*Jamestown, N. Y.*	535 Newbury St.
Goldstein, Edwin Jacob[4]	X.	*Hartford, Conn.*	316 Huntington Ave.
Gomez, Crescencio Fausto[2]	II.	*Tegucigalpa, Honduras*	270 W. Newton St.
Goodwin, George Iverson[3]	VI.	*Brownwood, Tex.*	217 Newbury St.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Gould, Gardner Seabury[2]	II.	*Fitchburg*	1069 Beacon St., Br.
Gray, William Ayres, Jr.[3]	III.	*Elizabeth, N. J.*	261 Newbury St.
Greenleaf, Earl Austin[3]	I.	*Woburn*	11 South St., Wo.
Grosscup, Henry Arthur[1]		*Camden, N. J.*	534 Boylston St.
Grossman, Alfred Paul[2]	III.	*Melrose*	18 Holbrook Ct., Mel.
Groves, Leslie Richard, Jr.[3]	I.	*Fort Lawton, Wash.*	127 Newbury St.
Halfacre, George Frederick[2]	III.	*Boston*	63 St. Germain St.
Hall, Horace Edward[4]	X.	*Colorado Springs, Colo.*	12 Newbury St.
Hall, Irving Gilmore, Jr.[2]	II.	*Somerville*	30 Newbury St.
Hamilton, Arthur Leo[2]	II.	*Boston*	718 Commonwealth Ave.
Hancock, Grenville Laing[2]	IV.	*Fargo, N. D.*	234 Newbury St.
Hannafin, William George[2]	XV.	*Lowell*	15 Sargent St., Low.
Hardwick, Richard[2]	VII.	*Malden*	32 Concord St., Mal.
Harrington, Walter[3]	XI.	*Plainfield, N. J.*	12 Newbury St.
Hastie, Frank Bowman[4]	I, XI.	*Passaic, N. J.*	1067 Beacon St., Br.
Hatch, Freeman Clark[3]	II.	*Wollaston*	201 Warren Ave., Wol.
Hathaway, Mortimer Delano, Jr.[2]	XV.	*Rochelle, Ill.*	26 Beals St., Br.
Haviland, Theodore Z[3]	II.	*Norwich, Conn.*	1004 Beacon St., Br.
Helrich, Carl Sanfrid[2]	I.	*Everett*	139 Buckman St., Ev.
Herbert, Servall[3]	XV.	*Bayonne, N. J.*	80 Bay State Rd.
Herfurth, Walter Robert[2]	XIII.	*Boston*	70 Batavia St.
Hibbard, Lyman Charlton[2]	IV.	*Plainfield, N. J.*	131 Newbury St.
Hickman, Ernest Trammel[2]	II.	*Lake Wales, Fla.*	149 Hancock St., Cam.
Hill, Lucius Tuttle[3]	XV.	*Brookline*	291 Harvard St., Br.
Hoffman, Leslie Albert[3]	II.	*Roslindale*	886 Canterbury St., Ros.
Holta, Johan[2]	VI.	*Skien, Norway*	225 Newbury St.
Horton, Earle Woodman[2]		*East Walpole*	23 Coney St., E. Walp.
Horton, Freeman Hudson[2]	I.	*Bradentown, Fla.*	12 Newbern St., J. P.
Howard, Alan Frank[2]	XV.	*Woburn*	48 Nashua St., Wo.
Howard, Paul Henry[2]	XV.	*Woburn*	48 Nashua St., Wo.
Howlett, Walter Maynard[1]		*Cambridge*	170 Lexington Ave., Cam.
Hoyt, Frank Clark[1]		*Chicago, Ill.*	110 Newbury St.
Hsu, Chuan Yuan[2]	I.	*Pekin, China*	316 Huntington Ave.
Hubbard, Frank Simmons[4]	I.	*Concord*	1004 Beacon St., Br.
Hubbell, Richard Van Arsdale[1]		*Lexington*	6 Parker St., Lex.
Hughes, Thomas Joseph[1]		*Newton*	181 Cabot St., N.
Hulburd, Philip Edwin[3]	IV.	*Boston*	234 Newbury St.
Hulseman, Giles Daniel[2]	VI.	*Kansas City, Mo.*	261 Newbury St.
Hunt, Gilbert Agnew[3]	I.	*Washington, D. C.*	56 Westland Ave.
Hutchinson, Edward Howard[3]	IV.	*Brighton*	10 Sparhawk St., Bri.
Hyde, Charles Winthrop[1]		*Brookline*	35 Winchester St., Br.
Ireland, Harold Kent[2]	VII.	*Newburyport*	80 High St., Np.
Irwin, George Alexander[1]		*Lawrence*	80 Bay State Rd.
Janson, John Charles, Jr.[2]	XV.	*Lawrence*	239 W. Newton St.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE
Jerman, Herbert Foster[2]	XIV.	*Stamford, Conn.*	316 Huntington Ave.
Jewett, Thomas Green, Jr.[2]	I.	*Dorchester*	558 W. Park St., D.
Johansen, Charles John Christian[3]	VI.	*Ashmont*	42 Pierce Ave. Ash.
Johns, Alfred Augustus, A.B.[2]	XI.	*Rochester, N. Y.*	47 Rutland Sq.
Johnson, Arthur Kimbal[2]	VII.	*Andover*	838 E. Second St., S. B.
Johnson, Elmer[2]		*Roxbury*	52 Atherton St., R.
Johnson, William Frank[3]	I.	*Utica, N. Y.*	55 St. Stephen St.
Johnston, Archibald Borhek, Ph.B.[4]	III.	*Bethlehem, Pa.*	137 Newbury St.
Johnston, Norwood Paxton[1]		*Pittsburgh, Pa.*	60 Charlesgate E.
Jones, Charles Edward, Ph.B.[3]	X.	*Pittsfield*	137 Newbury St.
Joslin, Asher Winthrop[2]	I.	*West Roxbury*	134 Stratford St., W. R.
Justheim, Clarence Irving[2]	I.	*Roslindale*	67 Walworth St., Ros.
Kayser, Wendell Howard[2]	II.	*San Diego, Cal.*	16 Westland Ave.
Keeler, Harold Young[2]	XV.	*Ridgefield, Conn.*	44 The Fenway
Keith, Stewart[3]	I.	*Brewster*	179 Bay State Rd.
Kennedy, Grafton Sherwood, A.B.[3]	II.	*Dayton, O.*	11 Irvington St.
Kenney, Frederick Stimpson[2]	II.	*Weston*	12 Hampden Hall, Cam.
Kilduff, John West[2]	XI.	*Boston*	354 Columbus Ave.
Kiley, John Timothy[2]	VI.	*Somerville*	11 Morton St., Som.
Killorin, Francis O'Loughlin[2]	I.	*San Francisco, Cal.*	13 Bond St.
Kimball, Henry Maxwell[3]	IV.	*Amherst*	19 Upton St.
Kimball, Russell Gerry[2]	I.	*Haverhill*	70 Batavia St.
Knudsen, Rolf[2]	XIV.	*Borgestad, Norway*	225 Newbury St.
Krug, Frank Stanley, Jr.[3]	VI.	*Cincinnati, O.*	234 Newbury St.
Kuhns, Austin, B.A.[3]	X.	*Middletown, Conn.*	371 Harvard St., Cam.
Kuljian, Harry Asdour[2]	VI.	*Aintab, Turkey*	73 Montgomery St.
Kwan, Sung-sing[2]	IV.	*Tientsin, China*	79 Montgomery St.
Lake, Herrmon Rafael[3]	IV.	*Fresno, Cal.*	16 River St.
Laskey, William Gallup[3]	VI.	*Boston*	Hotel Puritan
Lavine, Harry Louis[4]	X.	*Boston*	242 Shawmut Ave.
Law, Granville Raymond[1]		*Fort Madison, Ia.*	1376 Com'wealth Ave., A.
Layng, Edward Crippen[2]	III.	*Short Hills, N. J.*	291 Harvard St., Br.
Leach, William Butler, Jr., S.B.[4]	X.	*Hubbard Woods, Ill.*	9 Follen St.
Lee, Marshall Baldwin[1]		*Clinton*	1758 Beacon St., Br.
Lehrman, Samuel Leo[2]	VI.	*East Boston*	72 Lexington St., E. B.
Lemp, Boudy[2]	IV.	*Erie, Pa.*	201 Clarendon St.
Leonard, Julian Tobey[2]	XV.	*Boston*	1004 Beacon St., Br.
Leonard, Ralph Stanley[2]	I.	*Melrose*	70 Gooch St., Mel.
Lewis, Earl Carleton[3]	II.	*East Lynn*	12 Eutaw Ave., E. L.
Lewis, Samuel Oliver, B.S.[3]	VI.	*Houston, Tex.*	5 Idlewild St., A.
Lichauco, Mariano Fausto[1]		*Manila, P. I.*	39 Channing St., N.
Litchfield, Allyne Cushing[3]	VI.	*New Rochelle, N. Y.*	535 Newbury St.
Littlefield, Leland Howard[3]	VI.	*St. Louis, Mo.*	535 Newbury St.
Liu, Gee Call[2]	I.	*Hong Kong, China*	Y. M. C. A., Cam.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Lo, Sen-pi[2]	X.	*Kui-chan, China*	123 St. Botolph St.
Lobdell, Harold Edward[3]	IV.	*Watervliet, N. Y.*	Technology Chambers
Loomer, Harold Nelson[1]		*Beverly*	103 Lovett St., Bev.
Loomis, Phillips Wainwright[2]	VI.	*Providence, R. I.*	31 St. Botolph St.
Loucks, Milton Albert[2]	VI.	*Gloversville, N. Y.*	6 St. Botolph St.
Lowe, Carroll Henry[2]		*Alton, N. H.*	Dana Ave., H. P.
Lunn, John Aleck, B.S.[3]	IV.	*Fort Collins, Colo.*	82 Huntington Ave.
MacAlister, Alexander Goodall, Jr.[2]	VI.	*Camden, N. J.*	209 W. Canton St.
McCann, Russell Bowen[2]	XIII.	*North Attleboro*	176 Elm St., N. At.
McCarthy, Edward Benedict[2]	XIV.	*Scituate*	Willow St., Sc.
McCausland, John Woods[3]	II.	*Chicago, Ill.*	211 Newbury St.
McClellan, James Lewis[2]	XIV.	*Dorchester*	83 Esmond St., D.
McCurdy, Ainsley Carlyle[3]	VI.	*Sydney, N. S.*	107 Chandler St.
McDaniel, Irving Barry[4]	IV.	*Los Angeles, Cal.*	234 Newbury St.
McDill, Bruce Magaw, A.B.[3]	XI.	*Oxford, O.*	543 Boylston St.
McDonald, Raymond Emmett[3]	X.	*Natick*	13 Grant St., Na.
McDougall, James Greenwood[4]	IX.	*Franklin, N. H.*	283 Newbury St.
McFarland, David Meconkey[2]	X.	*West Chester, Pa.*	19 Garrison St.
McGrady, Leon Lempert[3]	XV.	*Fall River*	1067 Beacon St., Br.
McGreenery, Paul Aloysius[2]	II.	*Winchester*	32 Calumet Rd., Winc.
McGuire, Waldemar Stanwood[2]	X.	*Revere*	78 Highland St., Rev.
McIntosh, Alan Henderson[1]		*West Roxbury*	29 Westover St., W.R.
Mackay, Robert Alexander[2]	II.	*Dorchester*	90 Neponset Ave., D.
Mackay, Robert Angus Dudley[2]	II.	*Ocala, Fla.*	38 Westland Ave.
McKechnie, Donald[1]		*Canton*	Canton
McKeon, James Joseph[2]		*Worcester*	46 Harlem St., Wor.
McLaughlin, Richard Joseph[3]	XV.	*Boston*	462 Audubon Rd.
McLellan, Douglas Hull[3]	IV.	*Los Angeles, Cal.*	246 Newbury St.
McNary, Herbert Louis[2]	XV.	*South Boston*	566 Seventh St., S.B.
MacPherson, Kenneth William[3]	V.	*Palmyra, N. Y.*	11 Irvington St.
Maguire, James Francis, Jr.[3]	V.	*Allston*	27 Glenville Ave., A.
Mann, Samuel[2]	VI.	*Plainfield, N. J.*	79 Glenville Ave., A.
Manny, Constantine Christ[1]		*Koritza, Albania*	85 Waltham St.
Markham, Stephen James, Jr.[3]	III.	*Fitchburg*	46 Park St., N.
Marsh, Arthur James[2]	IV.	*Boston*	11 Holyoke St.
Marsilius, Neuman Marius[3]	XV.	*Beverly*	202 Bridge St., Bev.
May, James deGrier[2]	X.	*Brooklyn, N. Y.*	93 Newbury St.
Mead, Edward Adams[2]	X.	*Arlington*	1004 Beacon St., Br.
Mead, George Jackson[3]	II.	*Winchester*	27 Church St., Winc.
Meader, John[1]		*Brooklyn, N. Y.*	35 St. Botolph St.
Means, Leland Munger[3]	XV.	*Shreveport, La.*	44 Francis St., Br.
Mehaffey, William Chambers[3]	II.	*Chambersburg, Pa.*	44 N. Beacon St., A.
Mertz, John Mercer[3]	VIII.	*Wilmington, Del.*	86 St. James Ave.
Miao, En-chao[3]	I.	*Kiangsü, China*	145 Warren Ave.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Michaels, Maurice Alpiner[1]		*Marion, Ind.*	434 Massachusetts Ave.
Michelson, George[1]		*Roxbury*	80 Holworthy St., R.
Milford, Thomas Fry		*St. Louis, Mo.*	127 Newbury St.
Miller, Arthur Merkel[4]	I.	*Rochester, N. Y.*	327 Huntington Ave.
Miller, Frank Oliver, B.S.C.E.[3]	XI.	*Athens, Ga.*	535 Newbury St.
Miskovsky, Robert Joseph[3]	VI.	*Omaha, Neb.*	56 Westland Ave.
Moffatt, Edward Hopkins[2]	VI.	*Boston*	80 St. Botolph St.
Montgomery, Donald Hugh[1]		*Rutland, Vt.*	1067 Beacon St., Br.
Moody, Alvah Edgar[3]	XV.	*Golden, Colo.*	97 Ocean St., L.
Moody, Edward Gass[1]		*Cambridge*	41 Roseland St., Cam.
Moore, Clinton Douglas[2]	X.	*Allston*	227 Harvard Ave., A.
Moore, James Rhodes[1]		*Brookline*	1339 Beacon St., Br.
Moore, Walter Allan, Jr., B.S.[3]	IV.	*Charleston, S. C.*	52 Ivy St.
Moran, Francis Aloysius[2]	I.	*Taunton*	47 Friend St., T.
Morse, Harold Everett[3]	I.	*Swampscott*	108 Essex St., Swam.
Morton, Adelbert Robbins[2]	VI.	*Dorchester*	79 Lonsdale St., D.
Mullowney, John Mansfield, Jr.[2]	VI.	*Brookline*	298 Boylston St., Br.
Murphy, Henry Russell[1]		*Lawrence*	246 Broadway, Law.
Murphy, John Joseph, Jr.[1]		*Dorchester*	23 Park St., D.
Murphy, William Matthew[1]		*Dorchester*	33 Bicknell St., D.
Nelson, John Heisler[1]		*Roxbury*	51 Fenwood Rd., R.
Neuberg, William Doye[3]		*Westwood, N. J.*	120 Huntington Ave.
Newton, Edwin Meade[2]	VI.	*Brookline*	88 University Rd., Br.
Nichols, Bruce Salyers[3]	VI.	*St. Louis, Mo.*	44 Beck Hall, Cam.
Nightingale, Winthrop Eliot, A.B.[3]	I.	*Boston*	13 James St.
Niles, Alfred Salem, A.B.[3]	I.	*Baltimore, Md.*	Hotel Oxford
Oakley, Hurdus Groves[2]	XIII.	*Evansville, Ind.*	63 Astor St.
Obert, Arthur Aloysius[2]	X.	*Erie, Pa.*	603 River St., Mat.
O'Brien, James William, Jr.[2]	II.	*Cambridge*	10 Howland St., Cam.
Ochoa-Vizcaino, Alfonso[3]	IV.	*Guadalajara, Mex.*	47 St. Botolph St.
O'Connor, Arthur Maxwell[1]		*Revere*	138 Kimball Ave., Rev.
O'Connor, Frank Joseph[2]	II.	*Cambridge*	30 Ellsworth Ave., Cam.
Olson, Frank[2]	VI.	*Arlington*	35 Cleveland St., Arl.
Omelich, Felix Louis[1]		*Wilmington, Del.*	9 Margaret Rd., N. H.
Osborn, Charles Marcus, III[3]	IV.	*Indianapolis, Ind.*	Hotel Hemenway
Page, Arthur Ellsworth[1]		*Medford*	42 Marion St., Med.
Parker, John Acton[2]	VI.	*Somerville*	246 Broadway, Som.
Parker, Meredith Francis[2]	X.	*Long Branch, N. J.*	316 Huntington Ave.
Parkhurst, Winslow Smith[2]		*Gloucester*	7 Allen St., G.
Parkinson, Donald Berthold[2]	IV.	*Los Angeles, Cal.*	215 Newbury St.
Parks, George Urbane[1]		*Salt Lake City, Utah*	30 Newbury St.
Parsons, Arthur Maxwell[2]	XI.	*Gloucester*	183 St. Botolph St.
Pasos-Diaz, José[3]	I.	*Managua, Nicaragua*	201 St. Botolph St.
Passell, Sol.[1]		*Youngstown, O.*	533 Newbury St.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Pearson, Joseph Keighley[3]	VI.	*Lawrence*	236 Farnham St., Law.
Pero, Donald Cary[1]		*Indian Orchard*	557 Massachusetts Ave.
Pfohl, Roswell Edward Louis[3]	IV.	*Buffalo, N. Y.*	86 Huntington Ave.
Pickett, Earle Robinson[2]	VII.	*Georgetown*	24 Andover St., Gtn.
Pierce, Carl Hilton[1]		*West Somerville*	15 Chester Pl., W. Som.
Pierce, George Randall[2]	XV.	*Nashua, N. H.*	12 Newbury St.
Pinkney, William, Jr.[1]		*Rowayton, Conn.*	1004 Beacon St., Br.
Piza, Pedro Antonio[1]		*San Juan, Porto Rico*	57 Fenwood Rd., R.
Platt, John Cheney, Jr.[3]	XV.	*Montclair, N.J.*	Charles River Rd., Cam.
Polley, Edgarton Goldthwaite[3]	II.	*Waltham*	37 Banks St., Wal.
Proctor, Harold Eugene[4]	VI.	*Watertown*	25 Chester St., Wat.
Putnam, Harold Marshall[2]	I.	*Lowell*	36 Marlboro St., Low.
Ray, Leslie Sewall[3]	II.	*Topsfield*	Topsfield
Raymond, Edward Hayward[3]	I.	*Roxbury*	69 Walnut Ave., R.
Reycroft, Arthur Greely[3]	III.	*Cambridge*	18 Buena Vista Pk., Cam.
Ricketts, James Laws[2]	II.	*Cincinnati, O.*	Charles River Rd., Cam.
Robertson, Erskine Herman, B.S.[2]	X.	*Conde, S. D.*	79 Montgomery St.
Roessler, Hans Friedrich Bernhard[2]	X.	*Perth Amboy, N. J.*	237 Beacon St.
Rogal, Edward[2]	VI.	*Boston*	111 Mountfort St.
Rogers, Chester Arthur[3]	II.	*Brookline*	40 Kent St., Br.
Rogers, Frank Claxton[3]	I.	*Waterbury, Conn.*	94 St. Botolph St.
Rogers, Herman Livingston, A.B.[3]	I.	*Hyde Park-On-Hudson, N.Y.*	5 Story St., Cam.
Rogers, Jesse Andrew, Jr.[3]	II.	*Newton*	36 Park St., N.
Rogers, Robert Wells[2]	III.	*Chicago, Ill.*	23 St. Botolph St.
Role, Morris[1]		*Boston*	34 B. N. Russell St.
Roy, George Louis[3]	IV.	*Springfield*	158 St. Botolph St.
Russell, Whitney Allen[2]	XV.	*Hyde Park*	237 Fairmount Ave., H. P.
Ryan, Dennis Francis[4]	VII.	*Cambridge*	390 Washington St., Cam.
Ryan, Edmund Joseph[2]		*Houston, Tex.*	1595 Beacon St., Br.
Sache, Edward Leslie[1]		*Winchester*	19 Glengarry St., Winc.
St. John, Laurence Darius[1]		*New Canaan, Conn.*	52 Falmouth St.
Salisbury, DeRoss[2]	II.	*Glendale, Cal.*	29 Marlborough St.
Sanborn, Lewis Parker[3]	X.	*East Saugus*	62 Lincoln Ave., E. Sau.
Sanchez, Federico Guillermo[3]	II.	*Santa Lucia, Cuba*	28 Westland Ave.
Sandell, Harry Niles[3]	IV.	*Dorchester*	9 Grampian Way, D.
Sargent, Ralph[2]	II.	*Glencoe, Ill.*	215 Newbury St.
Sattels, Joseph Tillou[2]	XV.	*Plainfield, N. J.*	283 Newbury St.
Saunders, William Llewellyn, Jr.[1]		*St. Louis, Mo.*	136 Newbury St.
Schroeder, Rolf Alwin[3]		*Brookline*	53 Westbourne Terr. Br.
Schwartz, Leonard Arthur[2]	IV.	*Boston*	316 Huntington Ave.
Searles, Willett Freer[2]	II.	*Cripple Creek, Colo.*	Technology Chambers
Seifert, Edgar Frank Karl[1]		*Lawrence*	34 Kendall St., Law.
Sewall, Edward Dennis[3]	II.	*Waltham*	81 Dale St., Wal.
Shakespeare, William MacIntyre[4]	XI.	*East Orange, N. J.*	1069 Beacon St., Br.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Shand, Robert Gordon[3]	XV.	*Lynn*	14 Mace Place, L.
Shelton, Philo Sherwood[2]	VI.	*Bridgeport, Conn.*	137 Newbury St.
Siegel, Samuel[3]	X.	*Chelsea*	278 Chestnut St., Ch.
Sims, Walter[3]	II.	*Saylesville, R. I.*	31 Magnolia St., U. C.
Slator, Grover Cleveland[2]	VI.	*Bracketville, Tex.*	65 Astor St.
Small, Frank Sylvester[4]	III.	*East Boston*	149 Lexington St., E. B.
Smith, Arthur[2]	X.	*Port Chester, N.Y.*	205 W. Newton St.
Smith, Frederick Bradford, Jr.[3]	II.	*Detroit, Mich.*	218 Newbury St.
Smith, Gregory Hardy[1]		*Mobile, Ala.*	Technology Chambers
Smith, Malcolm Howard[2]	VI.	*Gloucester*	115 Prospect St., G.
Smith, Maynard Long[2]	XV.	*Bay City, Mich.*	215 Newbury St.
Smith, Raymond Slack[3]	I.	*Freehold, N. J.*	535 Newbury St.
Smith, Robert Farquharson[2]	V.	*Des Moines, Ia.*	316 Huntington Ave.
Smyser, Frederic Hawley[1]		*Harwich*	219 Harvard St., Br.
Soble, Ellis Barnet, A.B.[3]		*Elmira, N. Y.*	170 Cambridge St., Cam.
Southwick, Arthur Maurice[2]	X.	*Waban*	176 Waban Ave., Wa.
Spear, George Dana[3]	VI.	*Walpole*	32 Common St., Walp.
Spencer, Edmund[2]	VI.	*Boston*	80 Bay State Rd.
Spengler, Ralph Allen[4]	VI.	*Gates Mills, O.*	143 Warren Ave.
Stam, Jesse[1]		*New York, N. Y.*	1477 Beacon St., Br.
Stearns, Harry Chandler[3]		*Oakland, Cal.*	62 Sycamore St., Wav.
Stein, Mark Henry[2]	I.	*Passaic, N. J.*	86 St. James Ave.
Stephens, Henry Caldwell[2]	III.	*Wheeling, W. Va.*	179 Bay State Rd.
Sterner, Harold[2]	IV.	*New York, N. Y.*	Charles River Rd., Cam.
Stetler, Marvin Mayfield[2]	IV.	*Dallas, Tex.*	234 Newbury St.
Stevens, Louis Waldo[3]	XV.	*Marlboro*	394 Riverway
Stewart, Leslie Allan[2]	II.	*Buffalo, N. Y.*	234 Newbury St.
Stowell, Raymond Miles[4]	IV.	*Walpole*	122 St. Botolph St.
Strang, Peter MacDonald[2]	XV.	*Auburndale*	348 Central St., Aub.
Stribling, Simpson Ridley, B.S.[3]	VI.	*Waco, Tex.*	168 Huntington Ave.
Strout, Henry Elmer, Jr.[3]	XV.	*Roxbury*	11 Westerly St., R.
Sullivan, Charles Raymond[1]		*Newport, R. I.*	134 W. Newton St.
Sullivan, James Henry, Jr.[2]	XV.	*Lynn*	41 Ocean St., L.
Taber, Sherwood Holmes[2]	X.	*Canton*	299 Washington St., Can.
Tapley, Warren Leonard[3]	XV.	*Newtonville*	308 Cabot St., Nv.
Tavener, Charles Howell[2]	II.	*Mattapan*	1525 Blue Hill Ave., Mat.
Thompson, Phil Richmond[1]		*Dorchester*	111 Wheatland Ave., D.
Thorpe, Leslie Aaron[2]	II.	*Rochester, N. Y.*	115 Gainsborough St.
Thrasher, William Erland[3]	XI.	*Roslindale*	5 Ainsworth St., Ros.
Thresher, Brainerd Alden[2]	XV.	*Dayton, O.*	1067 Beacon St., Br.
Timanus, Clarence Sydney[2]	I.	*Kansas City, Mo.*	6 St. Botolph St.
Todd, James Madison[2]	X.	*Lexington, Ky.*	117 St. Botolph St.
Tooley, Joseph Hicks[1]		*El Paso, Tex.*	179 Bay State Rd.
Tourtellotte, Neal Everett[3]	IV.	*Boise, Idaho*	179 Bay State Rd.
Trease, Harold William, S.B.[2]	IV	*Newton, Ia.*	5 DeWolfe St., Cam.

UNCLASSIFIED STUDENTS (*continued*).

NAME.	COURSE.	HOME.	RESIDENCE.
Tu, Yu Ching[3]	I.	*Hupeh, China*	145 Warren Ave.
Tutein, Chester Robinson[2]	III.	*Winchester*	33 Lloyd St., Winc.
Tuttle, Albert Edward[3]	VI.	*Cambridge*	350 The Esplanade, Cam.
Van Da Linda, Lloyd Britton[2]	XV.	*Brookline*	1067 Beacon St., Br.
Van Nesté, Raphael[1]		*Dorchester*	28 Algonquin St., D.
Vignolles, Arthur Hutton[1]		*Newton Center*	234 Newbury St.
Wales, Arthur Edward[1]		*Brookline*	73 Davis Ave., Br.
Walker, Sibyl[2]	III.	*Salt Lake City, Utah*	84 The Fenway
Wall, Francis James[3]		*Dorchester*	557 Dudley St., D.
Wallace, Stuart Gilbert[2]	V.	*Jamaica Plain*	625 Centre St., J. P.
Wanamaker, Elmer Milton, A.B.[4]	III.	*Melrose Highlands*	24 Thayer Hall, Cam.
Wanser, Le Roy[3]	XV.	*Cranford, N. J.*	127 Newbury St.
Ward, John Robertson[1]		*Easton, Pa.*	Charles River Rd., Cam.
Warner, Edward Pearson[3]	II.	*Concord*	23 Westmorly Ct., Cam.
Wasgatt, Harold Clinton[1]		*Everett*	180 Hancock St., Ev.
Wasgatt, Helen Stuart[2]	IV.	*Everett*	180 Hancock St., Ev.
Washburn, Frederick Arthur[2]	VIII.	*Dorchester*	1 S. Sydney St., D.
Watrous, Earl G, Jr.[2]	XI.	*Chicago, Ill.*	51 Beals St., Br.
Webber, Porter Clifton[4]	XI.	*Milford*	171 Main St., Mil.
Weber, William[2]	IV.	*Seattle, Wash.*	535 Newbury St.
Wellcome, Hubert Eugene[2]	II.	*Waltham*	11 Charles St., Wal.
Wells, Burling Dinant[3]	II.	*Danbury, Conn.*	20 Rutland Sq.
Wenzel, Adolphe Helck[4]	VI.	*Middletown, N. Y.*	12 Newbury St.
Wheeler, Herbert Blish[2]	I.	*Cambridge*	1654 Mass. Ave., Cam.
Whitaker, Murray Morrison[1]		*Hamilton, O.*	113 St. Botolph St.
Whitcomb, Howard Lyman[1]		*Clinton*	535 Newbury St.
White, Charles Eaton Browning[1]		*Toledo, O.*	820 Mass. Ave., Cam.
White, Frederick William, Jr.[2]	XV.	*Hartford, Conn.*	234 Newbury St.
White, George Roland[2]	XV.	*Steelton, Pa.*	64 Charlesgate East
Williams, Amory Leland[2]	IV.	*Woodstock, Vt.*	Hotel Hemenway
Williams, Jesse Wight[3]	II.	*Lebanon, Pa.*	84 Huntington Ave.
Williamson, Herbert Charles[1]	IV.	*Rochester, N. Y.*	327 Huntington Ave.
Winslow, Edward Nicholas[2]	IV.	*Elizabeth, N. J.*	Garrison Hall.
Wisnew, Louis Lewellyn[4]	II.	*Passaic, N. J.*	6 St. Botolph St.
Wood, Walter Cromwell[3]	X.	*Edgewood, R. I.*	1004 Beacon St., Br.
Woodward, Edwin Mortimer[3]	IV.	*Odin, Ill.*	234 Newbury St.
Woodward, John Blossom[2]	IV.	*Nassau, N. Y.*	1004 Beacon St., Br.
Wooten, James Councill, 2d[2]	III.	*Columbia, Tenn.*	179 Bay State Rd.
Works, Nelson Clark[3]	III.	*Cleveland, O.*	1067 Beacon St., Br.
Wu, Ching-Lieh[3]	X.	*Chekiang, China*	106 St. Botolph St.
Young, Ira Randolph[2]	II.	*Waverley*	74 Agassiz Ave., Wav.
Young, Irving Walker, Jr.[3]	XV.	*Boston*	80 Bay State Rd.
Young, Jacob[2]	VI.	*Winthrop*	65 Johnson Ave., Win.
Zinderstein, Norton Morris[4]	II.	*West Newton*	257 Prince St., W. N.
Zubiria S., Alfredo de[2]	X.	*Cartagena, Columbia*	237 Beacon St.

SUMMARY.

Resident Fellows	4	Graduate Students	331
Non-Resident Fellow	1	Classified Students, 4th year	346
Candidates for the Degree of Doctor of Engineering	5	" " 3d year	299
Candidates for the Degree of Doctor of Philosophy	10	" " 2d year	281
Candidates for the Degree of Master of Science	51	" " 1st year	342
		Special Students	91
		Unclassified Students	474

Total	2235
Names counted more than once	335
Total Registration	1900

Alphabetical List of Officers and Students

Abbreviations.—Prof. = Professor; Assoc. Prof. = Associate Professor; Asst. Prof. = Assistant Professor; Inst. = Instructor; Asst. = Assistant; Res. Assoc. = Research Associate; Res. Asst. = Research Assistant; S. H. O. = School for Health Officers; F. = Non-Resident Fellow; Sp. = Special Student; U. = Unclassified Student. Numerals denote the year of classified students. For list of officers see pages 14 to 38. For list of students see pages 514 to 578.

Abbot, G. 2d . . . . . Sp.
Abels, C. A. 3
Abrams, A. . . . . *Asst.*
Adams, C. A. . . . *Prof.*
Adams, C. C. 3
Adams, C. E. . . . . U. 2
Adams, E. C. 1
Adams, F. S. 1
Adams, F. A. . . . . U. 2
Adams, M. W. 2
Adams, R. G. . . . *Inst.*
Affel, H. A. . . *Res. Asst.*
Ahearn, R. L. 4
Ahearn, W. J. . . . . U. 3
Aiken, W. S. 4
Albers, H. . . . . . *Lect.*
Aldridge, B. G. 4
Alfaro-Moran, A. . . . 1
Alfaro-Moran, R. . . . 4
Alger, P. L. . . . . *Asst.*
Allen, C. F. . . . . *Prof.*
Allen, C. K. 3
Allen, H. B. 2
Allen, J. H. . . . . U. 1
Allen, R. M. . . . . Sp.
Althouse, A. K. 3
Alvare, N. F. 2
Ames, A. P. 1
Ames, C. E. 3
Anderson, J. W. 3
Andrews, G. A. 3
Andrews, P. K. 4
Angas, W. M. 3
Angell, C. M. 2
Angeloff, A. 3
Antunez, E. 3
Appleton, F. H. . . . . U. 2
Arnold, R. . . . . . *Lect.*
Aronson, M. 4
Astorian, A. 3
Atchison, T. C. 4
Atkins, W. E. . . . . U. 2
Atkinson, C. E. 3
Atkinson, H. M., Jr. . . Sp.
Atwater, D. . . . . U. 2
Atwell, H. V. 2
Atwood, F. C. . . . *Asst.*
Atwood, L. J., Jr. . . . 1
Austin, P. P., Jr. 4
Auty, C. 3
Avery, J. M. 2
Aydelotte, F. . . . *Prof.*
Ayer, G. W. . . . . U. 1
Ayer, H. E. 4
Azadian, H. P. 1

Babbitt, J. H. 3
Bache-Wiig, J. . . . . Sp.
Bagby, R. B. 4
Bailey, F. H. . . . . *Prof.*
Bailey, H. E. 3
Bailey, L. H. . . . . G
Bailey, W. S. 1
Baker, A. D. . . . . U. 2
Baker, F. A. 1
Baker, N. D. . . . . Sp.
Baker, P. C. 4
Baldes, R. C. 1
Baldrey, R. W. . . . . G.
Balfour, M. C. 1
Ball, E. L. 4
Ballantine, B. D. . . . 2
Balyozian, N. 4
Banks, W. H., Jr. . . . 1
Bannister, A. E. 4
Barber, H. M. 2
Barker, J. M. . . . *Inst.*
Barker, J. W. 4
Barker, S. T. . . . . Sp.
Barnard, C. T. 3
Barnes, A. H. . . . . Sp.
Barnes, D. A. . . . . U. 2
Barney, E. J. 4
Barney, F. W. 1
Barnicoat, F. M. . . . U. 1
Barrett, L. W. 4
Barrett, W. J. 4
Barrios, C. J. . . . . U. 1
Barron, S. 2
Barrows, H. K. *Assoc. Prof.*
Barrows, S. R. 3
Barry, E. F. . . . . U. 3
Barry, E. H. 4
Barss, W. R. . . . *Inst.*
Bartlett, D. P. . . . *Prof.*
Bartlett, L. R. . . . . Sp.
Bartlett, R. H. 1
Basch, J. J. 3
Bassett, C. E. 2
Bassett, W. H., Jr. . . . 1
Basu, K. C. . . . . G.
Batchelder, S. S. . . . 3
Batchelor, C. C. . . *Inst.*
Bates, A. . . *Prof. (absent)*
Bates, C. W. 1
Battis, J. T. W. . . . . U. 3
Baum, G. L. 1
Baxter, H. M. 3
Beadle, W. J. 3
Bealer, W. P. . . . . Sp.
Beard, W. C. . . . . Sp.
Beattie, C. M. 2
Beattie, J. A. 3
Beaulieu, L. E. 1
Beckanstin, H. H. . . . 3
Becker, J. H. . . . . U. 1
Beckett, M. M. . . . . U. 1

Beers, G. F. 1
Belcher, D. . . . . *Asst.*
Belden, E. D. 3
Bell, D. E. 3
Bell, K. E. 3
Bellis, C. B. 2
Benitez, E. D. 3
Bennett, H. R. 4
Bennett, W. F., Jr. . . . 1
Benson, A. F. . . . . U. 3
Bent, R. L. . . . . U. 1
Berger, R. G. 4
Berkowitz, M. 1
Berman, E. 2
Bernard, F. . . . . U. 3
Berrigan, T. A. 4
Berry, C. W. . *Assoc. Prof.*
Bertelson, P. J. . . . . U. 3
Besly, L. . . . . U. 3
Best, H. 1
Best, L. E. 4
Best, T. G. 3
Betts, E. G. 2
Bevins, H. D. 2
Bickford, H. L. 3
Bickford, W. J., Jr. . . . 2
Bigelow, L. A., Jr. *Asst.*
Bigelow, R. P.
Assoc. Prof. and Libr.
Biggar, W. T. 2
Bill, F. P. 3
Binger, W. D. 4
Bird, J. E. . . . . . *Inst.*
Blachstein, J. . . . *Inst.*
Black, C. M. . . . . U. 4
Blackall, R. M. 4
Blackwood, W. A. . . . U. 3
Blaine, E. 4
Blaisdell, S. B. 2
Blake, A. H. . . . . U. 1
Blakeley, G. W. . . *Asst.*
Blanchard, A. A. *Assoc. Prof.*
Blanchard, C. W. 2
Blanchard, R. H. . . . 3
Blanchfield, P. E. . . . 2
Blank, H. M. . . . . U. 2
Blank, W. H. 4
Bliss, M. W. 4
Blodgett, C. A. 4
Blodgett, L. S. . . . . U. 2
Blood, R. M. 1
Blouke, P. 3
Blount, H. N. . . . . U. 2
Blumberg, H. B. . . . 1
Blye, P. W. 1
Boatwright, W. P. . . . Sp.
Boice, F. S. . . . . U. 3
Bolan, R. S. 1
Boley, F. W. 1
Bolling, G. E. . . . *Lect.*
Bolotin, J. J. . . . . U. 2
Bolton, M. 4
Bond, B. M. 3
Bond, G. R., Jr. 1
Bond, N. A. . . . . U. 2
Bone, H. L. 3
Bonnell, W. E. 2
Bonneval, H. A. de . . . 1
Boright, W. N. . . . . U. 1
Bott, T. H., Jr. 1
Boulton, B. C. 4
Boyd, S. M. 2
Boyd, W. H. 3
Bradley, D. G. 2
Bradley, H. C. . *Asst. Prof.*
Bradley, J. R. . . . . Sp.
Braislin, J. C. 2
Brandegee, M. M. . . . U. 4
Brandt, M. F. . . . . Sp.
Braverman, J. 1
Brayton, H. M. . . . . U. 3
Breed, C. B. . . . . *Prof.*
Breed, S. A. . . . . *Inst.*
Breed, S. H. 1
Brehaut, C. S. 1
Brennan, C. J. 1
Bresth, A. 4
Brewer, G. S. 2
Bristol, B. H., 2d . . . 1
Britton, F. S. 1
Broas, C. L. . . . . G.
Brock, M. C. . . . . U. 3
Brooks, A. R. 3
Brooks, E. P. 3
Brooks, P. N. 3
Brooks, R. F. F. . . . U. 3
Brophy, T. D. 4
Brosnahan, T. H. . . . U. 2
Brosnahan, T. V. . . . 2
Brown, A. L. . . . . *Asst.*
Brown, D. H. 1
Brown, D. M. . . . . Sp.
Brown, E. . . . . U. 2
Brown, F. A. . . . . *Inst.*
Brown, H. H., Jr. . . . 3
Brown, H. W. . . . *Asst.*
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Brown, W. E. . . . *Inst.*
Brown, W. C. 4
Brown, W. F. *Assoc. Prof.*
Brown, W. G. 4
Browne, D. 2
Brownie, P. W. . . . . U. 2
Brunelle, S. A. 1
Bruno, H. J. 1
Brush, C. F., Jr. 3
Brush, M. C. . . . . *Lect.*
Bruton, L. M. . . . . U. 1
Bryant, E. H. 1
Bryant, F. C. 4
Bryne, P. B. 1
Buchanan, D. R. . . . 2
Buck, W. F. 2
Bucknam, F. W. . . . 4
Buford, A. W. . . . . U. 3
Bugbee, W. E. . *Asst. Prof.*
Bugbee, J. M. 2
Bulifant, T. A. . . . . U. 4
Bullard, B. S. . . . . G.
Burbank, J. A. 4
Burbank, R. L. 1
Burbank, W. S. 1
Burckett, D. M. . . . . U. 1
Burk, H. G. 3
Burke, A. E. 2
Burke, F. C. 2
Burkhart, T. W. . . . 3
Burnap, R. S. 4
Burnham, R. G. . . . *Inst.*
Burrage, C. W. . . . *Asst.*
Burrison, H. K.
Asst. Prof. (*retired*)
Burtner, E. . . . . *Asst.*
Burton, A. E. *Dean and Prof.*
Burton, O. D. 2
Bush, V. . . . . G.
Bushee, R. J. 2
Butler, H. B. . . . . U. 2
Butler, J. H., Jr. . . . 1
Butter, H. M. . . . . U. 1
Butterfield, F. H. . . . 3
Butterworth, F. L. . . . 3
Buttner, F. E. 3
Butz, G. R. . . . . *Asst.*
Buxton, P. H. 4
Byrne, L. R. 4

Cabot, J. J. . . . . Sp. 3
Cady, L. 3
Caird, A. W. . . . . U. 2
Calder, C. H. . . . *Asst.*
Caldwell, A. P., Jr. . . 4
Caldwell, J. R. . . . . Sp.
Caldwell, S. H. . . . . U. 2
Cameron, E. J. . . . . U. 2
Cammann, O., Jr. . . . U. 1
Camp, G. D. 4
Camp, H. U. . . . . U. 2

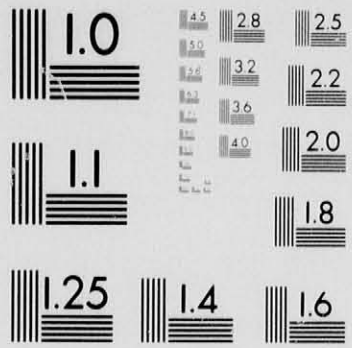
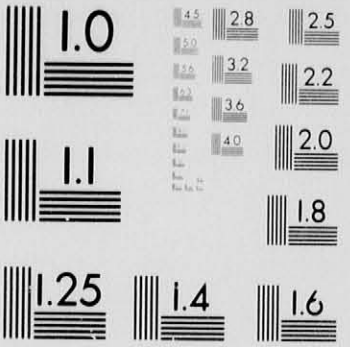
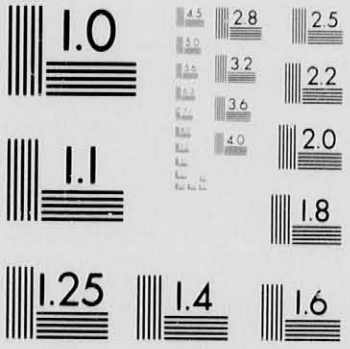
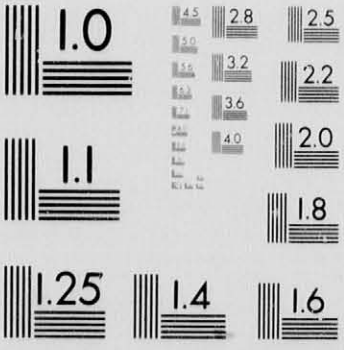
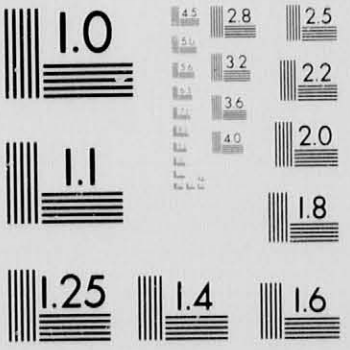
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Campion, W. L. 3
Canby, A. T. 3
Cann, G. W. 1
Cannell, J. E. 1
Cannon, G. Y. 2
Carlson, H. N. . . . *Asst.*
Carlton, A. C. . . . . U. 3
Carr, J. B. 4
Carr, P. W. 2
Carson, F. S. . . . . U. 3
Carstens, C. E. 4
Carter, A. A. . . . . U. 3
Carter, J. W. . . . . U. 2
Carter, J. S. 1
Cartwright, R. A. . . . 1
Cashin, R. F., Jr. . . . 1
Caskey, L. D. . *Asst., Lect.*
Cassidy, H. L. . . . . U. 2
Cassidy, J. E. . . . . U. 2
Castor, A. H. . . . . U. 1
Catlett, R. H. 3
Catlin, N. T. 2
Caust, M. L. 2
Cebrian, H. deL. . . . G.
Cellarius, C. F. 4
Chadwick, N. 1
Chalatow, L. S. 4
Chamberlain, A. B. *Asst.*
Chamberlain, S. H., Jr. . 2
Chamberlain, S. V. . . 2
Chand, D. N. 4
Chandler, C. H. . . . . U. 3
Chandler, F. D. 4
Chandler, F. W. *Prof. Emer.*
Chandler, L. VanD. . . U. 1
Chang, T. . . *Res. Asst.*
Chang, Y. T. 3
Chapin, C. V. . . . *Lect.*
Chapin, E. W. . *Res. Asst.*
Chase, A. W. 3
Chase, C. E. . . . . U. 2
Chase, N. C. . . . . Sp.
Chayne, C. A. 1
Checa, V. F. . . . . U. 3
Chen, C. Y. 2
Chen, K. C. . . . . U. 3
Childs, F. W. 2
Childs, K. M. 3
Chisholm, H. V. . . . . U. 3
Chisholm, S. L. 3
Chiu, C. Y. 3
Chow, K. L. 2
Chow, M. . . . . G.
Christensen, A. W. . . Sp.
Christison, L. 3
Chu, C. C. 4
Chu, T. S. . . . . G.
Chun, Y. S. . . . . Sp.
Church, A. A. 3
Church, V. S. 3
Cianciolo, P. J. . . . . U. 3
Claflin, F. E. 1
Clark, D. S. 2
Clark, E. . . . . Sp.
Clark, E. L. 3
Clark, E. M. 3
Clark, G. H. . . . . *Inst.*
Clark, J. L. . . . . U. 2
Clark, J. A. . . . . U. 2
Clark, M. H. 1
Clark, W. A. 3
Clark, W. B. 1
Clarke, B. A. 4
Clarkson, E. H., Jr. . . 4
Clarkson, F. 4
Clarkson, J. J. . . . . U. 3
Clarkson, J. W. . . . . U. 2
Claussen, H. P. 4
Clayman, S. 3
Clayton, H. C. 3
Clayton, L. L. 3
Cleveland, B. R. . . . 2
Clifford, H. E. . . . *Prof.*
Clogher, E. J. 2
Coakley, C. C. 3
Coburn, C. L. 3
Cochrane, C. . . . . U. 3
Coes, M. L. . . . . U. 2
Coffin, J. R. 3
Coffin, W. E. . . . . U. 3
Cohen, B. S. 1
Coke, W. G. . . . . U. 2
Colby, C. W. 3
Colby, L. C. 1
Coldwell, E. S. . . . . G.
Coldwell, J. S. 1
Cole, E. T. . . . . . *Prof.*
Cole, G. H. . . . . U. 4
Coleman, C. A. 4
Coleman, F. T. 2
Colleary, W. B. . . . . Sp.
Collester, C. H. . . *Inst.*
Collier, R. T. . . . . U. 2
Collins, E. P. 2
Collins, H. E. . . . . U. 2
Collins, W. L. 2
Comiskey, D. L. 4
Comstock, D. F. *Asst. Prof.*
Conaty, F. S. 3
Conklin, O. E. . . . *Asst.*
Conner, L. C. 2
Conniers, N. D. . . . . U. 1
Connolly, J. I. 4
Connors, M. F. . . . . U. 1
Contieri, A. W. 1
Cook, A. A. . . . . G., *Asst.*
Cook, C. G. . . . . *Inst.*
Cook, C. C. . . . . U. 1
Cook, R. J. 3
Coombs, R. H. . . . . U. 1
Cooper, S. K. . . . . U. 3
Corbett, F. P. . . . . U. 2
Cornelius, C. O. . . . 4
Correia, J. N. 4
Corthell, H. D. 1
Cosgrove, J. T. 1
Costelloe, W. H. 2
Couch, E. S. . . . . U. 3
Cousens, M. L. . . . . Sp.
Cousineau, A. 4
Cowdrey, I. H. . . . *Inst.*
Cowles, M. W. . . . *Asst.*
Coyne, F. J. 1
Coyne, H. J. . . . . U. 2
Craig, M. L. W. 3
Craighead, P. B. . . . 2
Cram, R. A. . . . . *Prof.*
Crandall, W. R. 4
Crane, F. N. 3
Creedon, F. R. . . . . U. 2
Creedon, W. J. . . . . U. 1
Creighton, S. H., Jr. . . U. 3
Cribben, L. T. 3
Crisp, F. G. 3
Cristal, P. N. 3
Cronin, J. T. . . . . Sp.
Crosby, G. E. 3
Crosby, I. B. . . . . U. 2
Crosby, R. A. 4
Crosby, R. J. 2
Crosby, W. O. *Prof.* (*retired*)
Crosier, C. L. 4
Cross, C. R. . . . . *Prof.*
Crowell, C. C. . . . . U. 3
Crowell, G. I. 4
Crowell, H. R. 4
Crowley, D. N., Jr. . . U. 1
Cummings, S. R. . . . U. 2
Cunningham, L. . . . . U. 3
Curran, J. T. 1
Currier, C. F. A. . . *Prof.*
Currier, L. W. . . . *Asst.*
Curry, M. A. 1
Curtin, E. W. . . . . U. 2
Curtis, B. C. . . . . U. 3
Curtis, B. S. 4
Curtis, I. . . . . U. 1

Curtis, T. S. 4
Cutts, G. B. 2
Cyr, H. M. 2

Dagnall, C. H. 2
Dalton, J. N. . . . *Asst.*
Dalton, L. M. 1
Dalton, M. B. . . . . G.
Damon, J. W. 2
Dana, A. S. . . *Res. Asst.*
Dana, D. 4
Dana, L. I. 3
Daniels, D. P. 4
Daniels, H. W. 4
D'Arcy, F. G. 2
Darlington, F. G., Jr. . 4
Dasso, L. . . . . U. 2
Daube, H. J. 1
Davidson, K. S. M. . . 1
Davidson, V. 1
Davies, H. G. . . . *Asst.*
Davies, R. V. 4
Davis, C. P. 1
Davis, F. B. 3
Davis, G. H. . . . . U. 1
Davis, I. W. . . . . U. 1
Davis, L. 3
Davis, V. B. . . . . Sp.
Dawson, N. 2
Day, D. S. . . . . Sp.
Dean, C. M. 3
Dean, K. 4
Dean, W. F. . . . . U. 3
Deane, A. 1
Dearden, R. H. 2
deBeech, A. V. . . . *Asst.*
DeBell, J. M. 3
Dehon, T., Jr. 1
DeLong, C. E. . . . . U. 2
DeMars, P. A. 3
Demeritt, J. E. . . . . U. 3
Demond, D. B. . . . . U. 2
Denison, H. W. 1
Dennen, W. L. 2
Dennison, E. S. 2
Derby, H. S. 1
Derr, L. . . . . . *Prof.*
Derrah, R. V. . . . . U. 2
DeSalvo, L. 1
Devine, E. R. 4
Dewey, D. R. . . . *Prof.*
Dexter, F. C. . . . . U. 3
Dias, M. R. 1
Dickinson, R. G. . . . *Asst.*
Dickson, A. D. . . . . U. 3
Dickson, J. B. . . . . G.
Dickson, R. H. . . . *Inst.*
Diemer, R. W. 4
Dillion, F. H. 1
Dimock, C. E. 2
Dinkins, P. M. 2
Dixon, E. S. . . . . U. 2
Doane, N. D. . . *Res. Asst.*
Dodd, S. R. 4
Dodge, B. F. 3
Dodge, H. F. 4
Dodge, W. W., Jr. . . . U. 4
Dodson, F. W. 3
Doherty, J. E. . . . . U. 4
Dole, M. W. . . . . *Inst.*
Dolmage, V. . . . . G.
Donnelly, T. J., Jr. . . 2
Donovan, C. S. 1
Donovan, G. W. 3
Donovan, H. C. 3
Donovan, J. A. 2
Doon, J. W. 3
Doten, C. W. *Assoc. Prof.*
Doten, E. F. 1
Douglas, A. D. . . . . U. 1
Dow, C. W. 2
Dow, L. M. . . . . U. 3
Dowell, A. E., Jr. . . . 3
Dowsley, F. R. 2
Drake, A. F. 2
Drake, F. E. 3
Drisko, W. J. *Assoc. Prof.*
Drobisch, R. W. . . . . U. 3
Drummey, W. W. 2
Drury, E. W. 2
Dudley, P. F. . . . . U. 3
Duff, P. H. 4
Duffy, H. L. 1
Duggan, J. R. 4
Dumit, M. J. . . . . U. 3
Dunham, A. P. 3
Dunn, D. O. 4
Dunning, S. C. 2
duPont, F. V. 3
Durland, R. W. 1
Duryea, G. R. 4
Dyer, H. A. 2

Eales, M. A. L. 2
Eames, J. J. . . . . *Inst.*
Earl, J. H. . . . . U. 2
Easley, C. B. 4
Eastman, H. F. 3
Eastman, W. Jr. . . . U. 3
Eaton, G. O. . . . . *Asst.*
Eaton, I. C. 3
Eaton, R. H. 3
Eaton, W. W. 3
Eberhard, W. C. . . *Asst.*
Eberthardt, J. D. . . . 4
Eddy, C. W. 4
Eddy, H. P., Jr. 3
Edgarton, L. S. 1
Edson, A. L. . . . . U. 1
Edwards, E. A. . . . . U. 2
Ekdahl, E. A. 4
Eksergian, R. . *Res. Asst.*
Ekwall, G. O. 2
Ellicott, V. L. 4
Elliott, J. T. 1
Elliott, S. E. 2
Ellis, C. T. . . . . U. 3
Ellis, C. M. 2
Ellis, H. W. 4
Ellis, J. H. . G., *Res. Assoc.*
Ellsworth, S. M. 4
Elwell, F. G. 1
Ely, D. . . . . U. 2
Elz, G. A. . . . . U. 2
Engelbrecht, W. B. . . U. 2
English, A. B. . . . *Asst.*
Engstrom, K. E. 4
Ennis, G. H. . . . . U. 2
Enright, E. F. 3
Erb, R. C. 3
Erhardt, J. . . . . *Inst.*
Erving, J. M. 1
Escher, E. . . . . Sp.
Estes, F. M. . . . . U. 2
Evans, H. T. 4
Evans, J. M. 4
Eveleth, F. C. 2
Evelev, Y. . . . . U. 2
Everett, C. . . . . . *Inst.*
Everit, R. S. 1

Fairbanks, R. D. . . . 1
Fairfield, J. G. 4
Fales, H. G. . . . . U. 1
Fales, W. T. 3
Farhi, J. 4
Farist, C. J. 1
Farnsworth, A. P. . . . U. 3
Farr, W. G. 3
Farrand, E. G. 1
Farrar, J. R. 4
Farrisee, W. J. 1
Farthing, W. J. 4
Fassitt, A. J., Jr. . . . 1
Favrot, H. M. . . . . Sp.
Fay, H. . . . . . *Prof.*
Fay, R. D. 3
Fehr, G. . . . . U. 4
Fellows, R. C. . . . . U. 3
Fennessey, E. M. . . . U. 3
Ferretti, A. J. 3
Fields, B. E. . . . . *Asst.*


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Fields, E. S. . . . . U. 2
Fine, H. 3
Fisher, D. K. E., Jr. . . . 4
Fisher, J. R. 1
Fisher, W. P., Jr. . . . U. 2
Fiske, C. D. 2
Fitch, H. W. 2
Flagg, P. M. 3
Flaherty, J. C. . . . . Sp.
Flanders, T. . . . . U. 4
Flannagan, C. 4
Flather, R. F. 1
Fleckenstein, J. . . . . U. 1
Fleming, G. G. 1
Fleming, W. H. 4
Fletcher, R. A. 4
Fletcher, S. W. 2
Flett, L. H. 2
Flint, J. A. . . . . U. 2
Flynn, E. J. 1
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Fogerty, J. S. 4
Folsom, R. A. 2
Foote, F. C. 4
Ford, A. R. 1
Ford, F. L. . . . . U. 3
Ford, H. S. . . . . *Bursar*
Ford, K. L. 2
Ford, W. B. 3
Foss, F. D. 3
Foster, H. L. 4
Foster, W. C. 2
Fouhy, J. J. 4
Fowle, W. H. 4
Fowler, F. M. . . . . U. 1
Fowler, W. H. . . . . U. 2
Frank, H. 4
Franklin, S. H. 2
Frazier, W. S. 2
Freed, E. S. . . . . G.
Freed, S. . . . . U. 3
Freeman, E. E. . . . . U. 3
Freeman, H. T. 4
Freeman, J. R., Jr. . . . 4
Freeman, O. F. 2
Freeman, C. R. 4
Freeman, W. H. 1
Freethy, W. S. 3
French, G. F. . . . . U. 1
French, H. N. 3
Friedlich, R. E. 1
Friend, D. O. . . . . U. 3
Frier, J. W. 2
Frye, R. M. . . . . *Inst.*
Fuller, C. C. 2
Fuller, C. E. . . . . *Prof.*
Fuller, H. C. 4
Fuller, J. R. 2
Fuller, S. . . . . U. 2
Fulreader, O. J. 1
Fulton, G. 4
Funk, F. J. . . . . *Asst.*

Gager, C. C. 3
Gagnebin, W. B. . . . U. 1
Gagnon, E. C. 4
Gagnon, J. . . . . U. 3
Gaillac, E. B. 2
Gallagher, A. J. . . . . U. 1
Gamage, F. L., Jr. . . . 3
Gannett, R. 3
Gardner, C. R. 3
Gardner, H. B. 3
Gardner, H. W. *Assoc. Prof.*
Gardner, J. P. 3
Gargan, J. A. . . . . U. 3
Garnsey, A. E. 1
Gartner, W. C. F. . . . U. 3
Garza, R. 2
Gauger, R. R. . . . . U. 3
Gaus, G. H. 3
Gay, R. N. . . . . U. 3
Gayhart, E. L. 3
Gaylord, W. 1
Geisler, H. P. . . . . U. 2
Gelinas, M. E. 2
George, N. R. *Assoc. Prof.*
Gfroerer, H. 4
Gibbons, T. M. . . . . U. 3
Gibson, J. W. 1
Gidley, R. T. . . . . U. 2
Gigger, A. G. . . . . Sp.
Gilbert, R. H. 1
Giles, A. L. 4
Giles, E. P. . . . . U. 3
Giles, H. C. 1
Giles, W. M. 4
Gilkey, H. J. 4
Gill, A. H. . . . . *Prof.*
Gillespie, K. A. 3
Gillett, L. A. . . . . U. 2
Gilliard, C. T. 3
Gillon, J. F. 1
Gilmore, R. L. . . . . U. 1
Gilmour, A. E. 3
Gilt, C. M. 3
Giuranovich, A. J., Jr. . U. 2
Given, F. J. 1
Glann, C. 4
Gleason, H. L. . . . . U. 2
Gleason, R. W. . . . . U. 2
Gokey, N. W. . . . . U. 3
Goldsmith, H. F. 3
Goldstein, E. J. . . . . U. 4
Goldstein, L. J. 1
Gomez, A. J. 1
Gomez, C. F. . . . . U. 2
Gomez Arzapalo, E. . . . Sp.
Goodale, F. 3
Gooding, P. P. 4
Goodman, A. 2
Goodrich, A. L. . . . *Inst.*
Goodridge, M. E. . . . 1
Goodwin, G. I. . . . . U. 3
Goodwin, H. M. . . *Prof.*
Goodwin, T. G. . . . *Inst.*
Goodwin, T. L., Jr. . . 2
Gordon, P. D. 4
Gore, J. 4
Gorfinkle, L. 3
Goss, D. C. 2
Goudey, R. F. 3
Gould, G. S. . . . . U. 2
Gould, J. H., Jr. 1
Gow, C. R. . . . . *Lect.*
Gracey, F. M. . . . *Inst.*
Graff, M. G. 4
Gramstorff, E. A. . . . 3
Graton, L. C. . . . *Prof.*
Gray, C. H. G. 2
Gray, G. A. 3
Gray, H. P. 4
Gray, W. A., Jr. . . . . U. 3
Greeley, B. M., Jr. . . 2
Green, C. W. . . *Asst. Prof.*
Green, H. W. 4
Green, W. . . . . . *Inst.*
Greenleaf, A. R. . . *Asst.*
Greenleaf, E. A. . . . . U. 3
Griebel, F. W. 1
Griffin, A. E 1
Grohe, R. F. 2
Gross, C. F. 4
Grosscup, H. A. . . . . U. 1
Grossman, A. P. . . . . U. 2
Groves, L. R., Jr. . . . U. 3
Grow, G. W. . . . . G.
Gruber, R. E. 4
Grunsfeld, E. A., Jr. . . 2
Guething, C. T. 4
Guilbert, H. M. 2
Gunn, S. M. . . *Assoc. Prof.*
Gunts, R. F. 4
Guppy, J. S. 1
Guss, M. C. 4
Gustin, E. E. 2

Habicht, E. C. 4
Hackett, R. P. 1
Hada, T. . . . . G.
Hafner, V. L. S. . . . Sp.

Hagan, W. J., Jr. . . . 1
Haggard, R. S. . . . . Sp.
Haggkvist, F. E. . . . 4
Halberstadt, A. E. . . . 4
Hale, E. D. 4
Hale, G. R. . . . . G.
Halfacre, G. F. . . . U. 2
Hall, B. T. 3
Hall, D. C. 1
Hall, E. R. 4
Hall, F. W. . . *Res. Asst.*
Hall, H. E. . . . . U. 4
Hall, I. G., Jr. . . . . U. 2
Hall, R. T. 1
Hall, W. T. . . *Asst. Prof.*
Hamilton, A. L. . . . U. 2
Hamilton, L. F. . . *Inst.*
Hamilton, N. R. 2
Hamilton, R. 1
Hamilton, W. W. . . . 4
Hancock, G. L. . . . . U. 2
Hand, C. N. 4
Hands, H. A. 4
Hanford, E. F. 4
Hanley, J. M. 2
Hannafin, W. G. . . . U. 2
Hannah, F. A. . . . *Lect.*
Hannah, T. E. 3
Hannigan, R. J. 1
Hansberry, T. W. . . . 3
Hanson, A. E. . . . . G.
Hanson, E. R. 3
Hardwick, R. . . . . U. 2
Harlow, F. C. 3
Harms, H. W. . . . . Sp.
Harper, J. 3
Harper, K. L. 3
Harrall, E. R. 2
Harrington, W. . . . . U. 3
Harrower, P. D. 4
Hart, F. R. . . . . *Treas.*
Hart, R. F. 4
Hartman, H. F. G. . . 3
Hartman, L. E. 1
Harvey, C. W. 3
Hastie, F. B. . . . . U. 4
Hatch, F. M. 3
Hatch, F. C. . . . . U. 3
Hatch, H. W. 2
Hatch, P. 4
Hathaway, M. D., Jr. . U. 2
Hauman, E. L. 4
Hauser, W. J. . . . *Asst.*
Haven, G. B. . . . . *Prof.*
Haverty, J. J., Jr. . . . 1
Haviland, T. Z. . . . . U. 3
Hawes, C. P. 4
Hawes, C. W. 3
Hawkes, J. R. 1
Hayden, E. M. 4
Hayden, M. L. 1
Hayes, O. H. 3
Hayes, S. J. 1
Haylett, R. E. . . . . G.
Haynes, R. A. 1
Haynes, W. . . . . G.
Hayward, C. R. *Asst. Prof.*
Hayward, H. W. *Assoc. Prof.*
Heath, C. J. 3
Heath, E. H., Jr. . . . 3
Hedin, C. H. 1
Hefler, R. E. 4
Hegenberger, A. F. . . .
Helrich, C. S. . . . . U. 2
Henderson, G. W. . . . 3
Henry, W. J. 2
Hepinstall, J. 4
Herbert, S. . . . . U. 3
Herfurth, W. R. . . . . U. 2
Herman, E. O. 2
Herrick, C. M. 1
Herzog, H. A. 1
Hewes, F. R. 1
Hewins, E. F. 4
Hewitt, P. A. 2
Heyman, S. 1
Hibbard, L. C. . . . . U. 2
Hickey, J. J. 4
Hickman, E. T. . . . . U. 2
Higgins, E. R. 1
Higgins, J. 1
Hilbert, O. W. . . . . G.
Hill, L. T. . . . . U. 3
Hills, L. H. 3
Hinckley, N. C. 2
Hine, T. K. 4
Hiraoka, M. . . . . Sp.
Hirsch, G. 1
Hitchcock, F. L. . . *Inst.*
Hodgson, M. L. 3
Hoffman, A. F. 1
Hoffman, L. A. . . . . U. 3
Hoffman, S. A. 4
Hoffmann-Pinther, L. . 1
Hofman, H. O. . . . *Prof.*
Hogan, J. F. 4
Holbrook, F. C. 4
Holden, D. F. 3
Holden, T. S. 4
Holland, M. . . . . Sp.
Hollnagel, H. P. . . *Inst.*
Holmberg, C. H. . . . 4
Holmes, A. 4
Holmes, A. F. . . . *Inst.*
Holmes, E. O., Jr. . . . Sp.
Holmes, J. H., Jr. . . . 2
Holt, C. G. 3
Holt, J. 1
Holt, O. W. 3
Holt, W. R. 2
Holta, J. . . . . U. 2
Holton, J. H. 3
Homer, J. W., Jr. . . . 1
Hood, J. M. 4
Hooper, B. M. 2
Hopkins, F. H. 2
Hopkins, H. D. 3
Hopkins, S. D. 4
Hopkinson, F. J. . . . 1
Horan, C. F. . . . . Sp.
Horowitz, M. P. . . . . G.
Horton, E. W. . . . . U. 2
Horton, F. H. . . . . U. 2
Horton, J. W. . . . *Asst.*
Hosmer, G. L. *Asst. Prof.*
Hou, T. P. 3
Hough, A. W. 1
Houghton, S. P. 3
Hovgaard, W. . . . *Prof.*
Howard, A. F. . . . . U. 2
Howard, F. C. 3
Howard, J. W. . . *Asst. Prof.*
Howard, P. H. . . . . U. 2
Howard, W. F. 4
Howe, E. C. . . . . *Inst.*
Howe, J. C. 2
Howes, H. V. 1
Howlett, W. M. . . . . U. 1
Hoxie, F. J. . . . . *Lect.*
Hoye, S. A. 2
Hoyt, F. C. . . . . U. 1
Hoyt, R. N. . . Sp., *Lect.*
Hsieh, E. T. . . . . Sp.
Hsin, C. S. . . . . G.
Hsu, C. Y. . . . . U. 2
Hsu, P. H. . . *Res. Asst.*
Hsu, Y. C. 2
Hu, K. P. 1
Hu, P. Y. 4
Huang, C. Y. 1
Huang, H. H. 2
Hubbard, E. R. 1
Hubbard, F. S. . . . . U. 4
Hubbell, R. V. . . . . U. 1
Huckins, E. W. 2
Hudson, C. M. 4
Hudson, R. G. . . . *Inst.*
Huff, T. H. . . . . *Asst.*
Hughes, H. J. . . . *Prof.*
Hughes, T. J. . . . . U. 1
Hugo, O. G. 2

Hulburd, P. E. . . . . U. 3
Hulse, F. E. 3
Hulseman, G. D. . . . U. 2
Humphreys, W.
Registrar and Recorder
Hunneman, J. R. . . . 4
Hunsaker, J. C. . . *Inst.*
Hunt, F. L. . . . . *Inst.*
Hunt, G. A. . . . . U. 3
Hunter, F. L., Jr. . . . 1
Hunter, W. B. 3
Husted, D. R. 4
Hutchings, G. B., Jr. . . 2
Hutchinson, E. H. . . . U. 3
Hyde, C. W. . . . . U. 1
Hyneman, J. . . . *Asst.*

Iasigi, M. V. . . . . Sp.
Igleheart, G. P. 3
Ilsley, C. H. 1
Ingham, E. A.
Sp., *Inst., Res. Assoc.*
Ingle, J. B. 4
Inglis, C. A. 1
Ingraham, F. T. 4
Ireland, H. K. . . . . U. 2
Irwin, G. A. . . . . U. 1
Irwin, J. C., Jr. 2

Jackson, D. C. . . . *Prof.*
Jackson, H. W. 4
Jackson, L. A. 1
Jacobs, C. N. . . . *Asst.*
Jacobs, J. E. 1
Jacobs, S. J. 2
Jacobson, D. L. 4
Jagger, T. A. *Prof. (absent)*
James, L. . . . . Sp.
James, L. L. 1
James, W. H. . *Asst. Prof.*
Janson, J. C., Jr. . . . U. 2
Jasionowski, V. A. . . . 4
Jenkins, E. S. 4
Jenney, A. S. . . . *Inst.*
Jenney, P. G. . . . . Sp.
Jerman, H. F. . . . . U. 2
Jewett, H. P. 1
Jewett, T. C. 4
Jewett, T. G., Jr. . . . 4
Johansen, C. J. C. . . . U. 3
Johns A. A. . . . . U. 2
Johnson, A. K. . . . . U. 2
Johnson, A. S. 2
Johnson, E. . . . . U. 2
Johnson, E. B. 4
Johnson, G. E. 2
Johnson, L. J. . . . *Prof.*
Johnson, R. L. 2
Johnson, W. F. . . . . U. 3
Johnson, W. T., Jr. . . . 3
Johnston, A. B. . . . . U. 4
Johnston, N. P. . . . . U. 1
Johnston, W. A. . . *Prof.*
Jones, B. F. 1
Jones, B. Q. . . . . Sp.
Jones, C. E. . . . . U. 3
Jones, D. M. . . . . Sp. 4
Jones, W. A. 2
Jones, W. H. . . . . *Inst.*
Jorgensen, V. W. . . . Sp.
Joslin, A. W. . . . . U. 2
Judge, C. E. 2
Junkins, W. H. 4
Justheim, C. I. . . . . U. 2

Kahn, G. 1
Kaiser, J. H. 1
Kaiser, K. H. 2
Kaler, H. V. L. 2
Kallejian, R. M. . . . Sp.
Kanaly, F. M. . . . *Inst.*
Karg, E. E. 1
Karmire, J. L. 1
Kaufman, J. 1
Kaufman, S. A. 1
Kaula, E. L. 4
Kaupe, A. F. 1
Kayser, W. H. . . . . U. 2
Keach, L. 3
Keating, A. E. 3
Keeler, H. Y. . . . . U. 2
Keene, H. N. 3
Keith, H. H. W. *Asst. Prof.*
Keith, Scott 1
Keith, Stewart . . . . U. 3
Keith, S. C. . . . *Lect.*
Keeler, A. R. . . . . G.
Kelley, J. A. 2
Kelley, L. A. 1
Kelly, J. R. 3
Kelly, T. P. 2
Kelsey, A. S. 1
Kemkemian, B. 2
Kenigsberg, A. H. . . . 3
Kenison, A. C. 1
Kenison, E. . . *Assoc. Prof.*
Kenison, E. M. 1
Kennard, I. 1
Kennard, J. W. B. . . . 2
Kennard, R. P. 2
Kennedy, C. T. 2
Kennedy, G. S. . . . . U. 3
Kennedy, P. H. 2
Kennedy, V. C. . . *Asst.*
Kennedy, W. H. J. . *Asst.*
Kennelly, A. E. . . *Prof.*
Kenney, A. W. . . . . G.
Kenney, F. S. . . . . U. 2
Kerstein, B. H. . . . 4
Kilduff, J. W. . . . . U. 2
Kiley, J. T. . . . . U. 2
Kilgore, H. D. 2
Killorin, F. O. . . . . U. 2
Kimball, H. M. . . . . U. 3
Kimball, R. G. . . . . U. 2
Kimball, W. F. 1
King, K. T. 4
Kingman, A. F. 3
Kingsbury, C. L. . . . 2
Kinthong, C. 4
Kitchin, D. W. 1
Kittredge, G. D. . . . 3
Kleinert, A. E., Jr. . . 4
Klemin, A. . . . . G.
Kline, F. L. 2
Knapp, H. A. 3
Kneeland, F. R. . . *Inst.*
Knieszner, W. T. . . . 4
Knight, A. R. 3
Knobel, M. 1
Knowland, R. G. . . . 4
Knowland, T. M. . . . 2
Knowlton, L. E. . . . 4
Knox, C. V. S. . . . . Sp.
Knudsen, R. . . . . U. 2
Koo, V. T. . . . . G.
Kraft, E. . . . . Sp.
Krasnoff, N. 2
Krebs, C. 1
Krigger, A. 4
Krug, F. S., Jr. . . . . U. 3
Kuehle, F. W. 4
Kuhn, S. L. 3
Kuhns, A. . . . . U. 3
Kuljian, H. A. . . . . U. 2
Kurrelmeyer, H. R.
Assoc. Prof.
Kwan, S. S. . . . . U. 2

Lacey, H. R. 2
Lahee, F. H. . *Asst. Prof.*
Lake, H. R. . . . . U. 3
Lam, von Fong 4
Lambirth, J. R. . . *Inst.*
Lamson, H. W. . . *Asst.*
Landy, J. 1
Lane, F. A. 2
Lane, K. M. 3
Lane, S. M. 3
Langille, W. O. 1
Langley, E. F. . . . *Prof.*

Langley, H. E. 2
Lanphier, B. 4
Lansil, C. E. 3
Lanza, G. . . *Prof. Emer.*
Lapham, S., Jr. 4
Larner, H. 4
Larner, H. B. 2
Laskey, W. G. . . . . U. 3
Lauer, L. M. 3
Lavine, H. L. . . . . U. 4
Law, G. R. . . . . U. 1
Lawrance, C. W. . . . 4
Lawrason, L. 4
Lawrence, R. R.
Assoc. Prof.
Lawrence, W. H. . . *Prof.*
Laws, F. A. . . . . *Prof.*
Layng, E. C. . . . . U. 2
Leach, W. B., Jr. . . . U. 4
Leahy, W. J. 1
Lebby, T. D., Jr. . . . 3
Lee, F. M. 1
Lee, K. T. 1
Lee, M. B. . . . . U. 1
Legge, E. E. 2
Lehrman, S. L. . . . . U. 2
Leighton, J. R. . . . . Sp.
Leland, R. M. 1
Lemmon, M. 4
Lemp, B. . . . . U. 2
Lennox, F. J. 3
Leonard, J. T. . . . . U. 2
Leonard, P. C. 2
Leonard, R. S. . . . . U. 2
Levi, E. 3
LeVine, H. C. 2
Levine, L. I. 2
Lewis, B. I. 3
Lewis, C. F. 4
Lewis, E. C. . . . . U. 3
Lewis, R. F. 1
Lewis, S. O. . . . . U. 3
Lewis, W. K. . . . . *Prof.*
Li, Y. C. 3
Libby, B. B. . . . . *Inst.*
Lichauco, M. F. . . . . U. 1
Liddell, W. A. 4
Lieber, A. C., Jr. . . . 4
Lindgren, C. A. 2
Lindgren, R. H. . . . . Sp.
Lindgren, W. . . . *Prof.*
Ling, H. C. 3
Linscott, C. E. 2
Lipka, J. . . . . . *Inst.*
Lipman, S. H. 4
Litchfield, A. C. . . . . U. 3
Little, A. D. . . . . *Lect.*
Little, C. E. 1
Little, T. W. 4
Littlefield, C. E. . . *Inst.*
Littlefield, L. H. . . . U. 3
Littlefield, W. B. . . . 4
Littlefield, W. J. 3
Liu, G. C. . . . . U. 2
Lo, S. P. 3
Lobdell, H. E. . . . . U. 3
Locke, C. E. . . *Asst. Prof.*
Lockwood, R. C. . . . 1
Logan, R. W. 3
Long, F. L. 2
Long, W. E. 4
Long, W. J. 1
Longley, J. E. 2
Longley, J. R. 2
Loo, P. C. . . . . Sp.
Loo, P. Y. 4
Loo, W. P. . . . . G.
Loomer, H. N. . . . . U. 1
Loomis, C. W. 4
Loomis, P. W. . . . . U. 2
Loper, C. . . . . G.
Lord, C. R. 4
Lord, I. P. . . . . . *Inst.*
Lorenz, O. C. 2
Loring, L. D. . . . *Asst.*
Loucks, M. A. . . . . U. 2
Lovejoy, G. M., Jr. . . 3
Loveland, J. W. . . *Lect.*
Lovell, C. W. 4
Lovenberg, A. M. . . . 2
Low, C. E. 3
Lowe, C. H. . . . . U. 2
Lowe, R. E. 4
Lowell, P. *Prof. (Non-res.)*
Lowengard, R. O. . . . 3
Lucas, E. W. V. C., Jr. . 4
Luce, J. A. 2
Lufkin, O. G. 2
Lundquist, A. 1
Lunn, J. A. . . . . U. 3
Luther, H. B. . . . *Inst.*
Lyon, W. V. . . . . *Inst.*
Lyons, R. T. 3

McAdams, W. H. . . . Sp.
MacAlister, A. G., Jr. . U. 2
McAllister, P. 2
MacArdle, D. W. . . . 2
MacAskill, D. 2
McCann, R. B. . . . . U. 2
McCarten, G. C. . . . 1
McCarthy, C. J. . . . 4
McCarthy, E. B. . . . U. 2
McCausland, J. W. . . U. 3
McClellan, J. L. . . . . U. 2
McClintie, H. H., Jr. . . 1
McCloskey, L. C. . . 1
McCreery, G. W. . . . 1
McCurdy, A. C. . . . . U. 3
McDaniel, I. B. . . . . U. 4
McDevitt, J. N. 4
McDill, B. M. . . . . U. 3
McDonald, H. J. . . . 3
McDonald, K. M. . . . 4
McDonald, R. E. . . . U. 3
McDonald, W. C. . . . 4
McDougall, J. G. . . . U. 4
McDowell, J. S. 4
McFarland, D. M. . . . U. 2
McGowan, A. J. 1
McGrady, L. L. . . . . U. 3
McGrath, D. J. *Res. Asst.*
McGreenery, P. A. . . U. 2
MacGregory, S. A. . . . 2
McGuire, W. S. . . . . U. 2
Macheca, G. M. 2
McIntosh, A. H. . . . U. 1
McIntosh, H. W. . . . 1
McIvor, C. C. 2
Mack, G. . . . . G.
Mackay, R. A. . . . . U. 2
Mackay, R. A. D. . . . U. 2
Mackay, W. R. 1
McKechnie, D. . . . . U. 1
McKenney, W. R. . . . 1
Mackenzie, J. D. . G., *Inst.*
Mackenzie, M. C. . *Inst.*
McKeon, J. J. . . . . U. 2
McKinley, M. R. . . . 1
Mackinnon, J. C. . *Asst.*
Mackler, M. J. . . . . Sp.
McKown, F. W. 4
McLaughlin, C. P. . . . 2
McLaughlin, E. R. . . 1
McLaughlin, G. E. . . 2
McLaughlin, H. C. . . 2
McLaughlin, R. J. . . U. 3
McLaughlin, T. S. . . . Sp.
MacLaurin, R. C. . *Pres.*
McLellan, D. H. . . . U. 3
MacLeod, W. R. . . . 2
McManus, J. D. 3
McMorran, A. M. . . . 1
McNally, E. M. 2
McNally, L. A. 2
McNary, H. L. . . . . U. 2
McNeill, W. I. 3
MacNutt, J. S. . . . *Lect.*
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McQuaid, H. S. 3
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Manny, C. C. . . . . U. 1
Manter, E. M. 2
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Mar, P. T. . . . . G.
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Marks, L. S. . . . . *Prof.*
Marks, P. . . . . . *Inst.*
Marquez, M., Jr. . . . 4
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Marshall, H. F. 1
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Marsilius, N. M. . . . U. 3
Marston, N. S. . . . *Inst.*
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Martinson, O. S. . . . 1
Mason, S. S. 3
Maverick, G. M. . . . 4
Maxon, R. S. 1
May, E. D. 1
May, J. de G. . . . . U. 2
Mayer, D. O. 1
Mayers, H. P. 4
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Mead, E. A. . . . . U. 2
Mead, F. L. 1
Mead, G. J. . . . . U. 3
Meader, J. . . . . U. 1
Means, L. M. . . . . U. 3
Means, R. S. 1
Mears, E. N. K. . . . . Sp.
Medding, W. L. 3
Mehaffey, W. C. . . . U. 3
Meigs, J. V. 4
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Purch. Agent, Chem. Dept.
Mellema, W. . . . . G.
Mellen, E. R. 4
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Fac. Sec'y and Prof.
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Merrill, L. H. 1
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Mertz, J. M. . . . . U. 3
Metz, C. W. 4
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Miao, E. C. . . . . U. 3
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Miller, A. M. . . . . U. 4
Miller, C. G. 3
Miller, E. F. . . . . *Prof.*
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Miller, Harold L. . . . 2
Miller, Henry L. . . . 3
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Miller, R. P. 2
Milliken, J. R. 1
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Minard, D. P. 1
Miner, H. A. 1
Mirabelli, E. 1
Miskovsky, R. J. . . . U. 3
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Mitchell, R. Williamson 1
Moberg, H. C. 1
Moffatt, E. H. . . . . U. 2
Monroe, M. A. 4
Montgomery, D. H. . . U. 1
Moody, A. E. . . . . U. 3
Moody, E. G. . . . . U. 1
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Moore, C. L. E. *Asst. Prof.*
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Morrison, P. G. 4
Morrow, C. E. . . . *Inst.*
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Morse, H. E. . . . . U. 3
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Mosher, H. M. . . . *Asst.*
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Moylan, L. J. 1
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Munn, P. J. . . . . *Asst.*
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O'Connor, A. J. 1
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Robinson, C. S. . . *Inst.*
Robinson, E. S. . . . . Sp.
Robinson, K. C. . . *Inst.*
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Robinson, W. R. 2
Rockwell, J. A. *Med. Adv.*
Rockwood, E. F. . . *Lect.*
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Roessler, H. F. B. . . . . U. 2
Rogal, E. . . . . U. 2
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Role, M. . . . . U. 1
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Rooney, G. T. 4
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Root, G. W. 1
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Roper, G., Jr. 3
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Rosenau, Dr. M. J. S. H. O.
Rosenberg, B. R. 4
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Ross, F. D. 4
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Rutledge, G. . . . . *Inst.*
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Ryan, T. W., Jr. . . . 3
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Sache, E. L. . . . . U. 1
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Salisbury, DeR. . . . . U. 2
Samper, B. . . . . Sp.
Sanborn, L. P. . . . . U. 3
Sanchez, F. G. . . . . U. 3
Sandell, H. N. . . . . U. 3
Sandlas, W. H. . . . . G.
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Schoonmaker, L. E. . . . 3
Schroeder, R. A. . . . . U. 3
Schur, A. P. 1
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Schurig, O. R.
Inst., Res. Assoc.
Schwamb, P. *Prof. (retired)*
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Schwartz, L. A. . . . . U. 2
Scofield, E. E. 1
Scott, P. W. 1
Scott, W. J. 2
Scranton, C. W. 1
Searles, H. H. 1
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Seaver, H. L. . . *Asst. Prof.*
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Selya, H. P. 1
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Shepard, H. B. 4
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Sherman, E. M. 1
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Shippey, W. B. 1
Shogenji, K. . . . . Sp.
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Sindler, J. 4
Slater, G. C. . . . . U. 2
Sloan, H. B. 1
Slotnik, I. 1
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Small, F. S. . . . . U. 4
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Smith, A. G. 1
Smith, A. S.
Supt. of Bldg. and Power
Smith, C. C. 3
Smith, E. R. 1
Smith, F. B., Jr. . . . . U. 3
Smith, F. G. C., Jr. . . . 1
Smith, G. B. 2
Smith, G. H. . . . . U. 1
Smith, H. B. 4
Smith, Harrison W.
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Smith, Herbert W. . . *Inst.*
Smith, J. H. 1
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Smith, M. H. . . . . U. 2
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Smyser, F. H. . . . . U. 1
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Snow, L. I. 1
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Southwick, A. M. . . . . U. 2
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Sung, C. H. . . . . Sp.
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Svenson, C. L. 1
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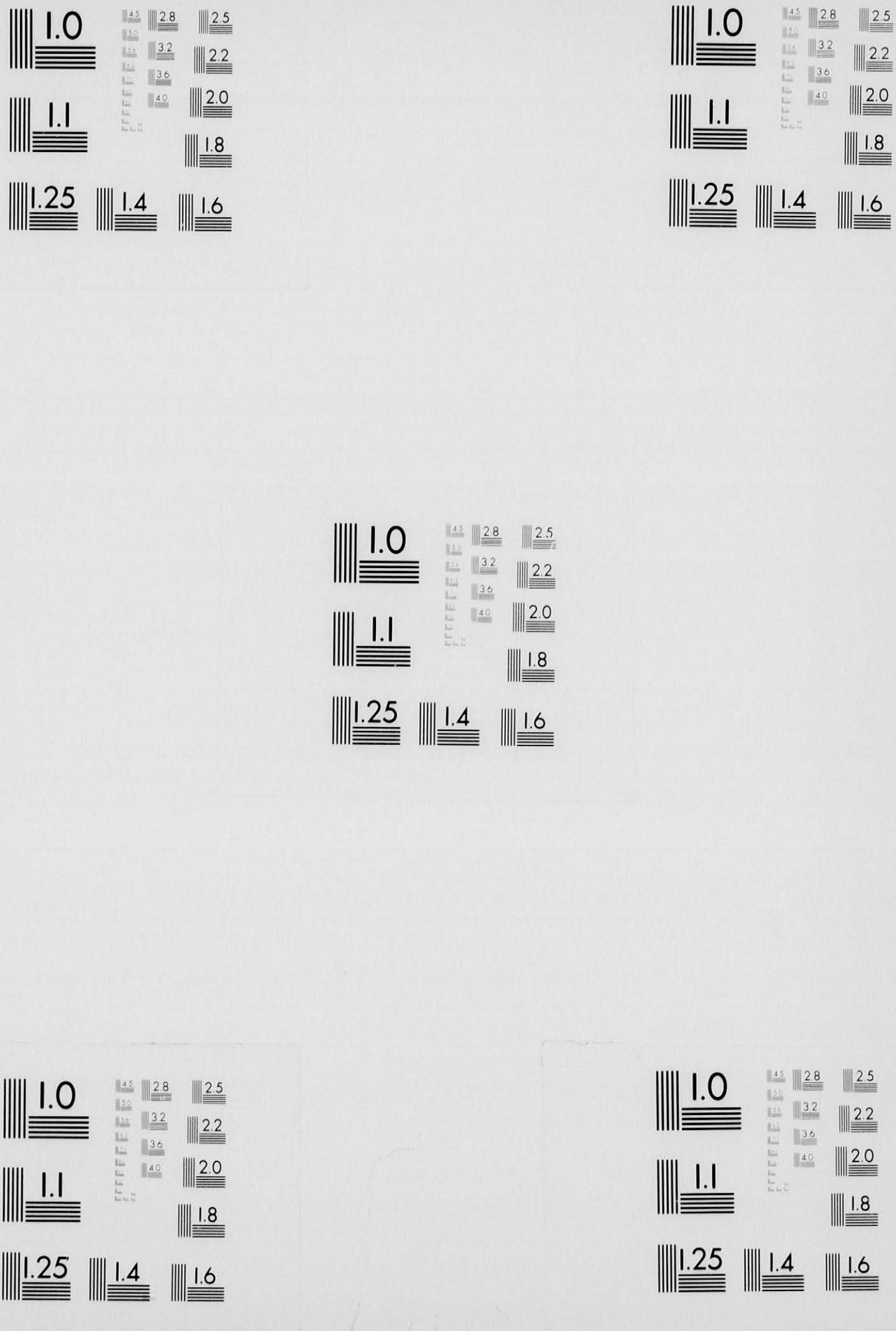
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