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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

GENERAL INFORMATION
ENTRANCE REQUIREMENTS

THE TECHNOLOGY PRESS
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1920

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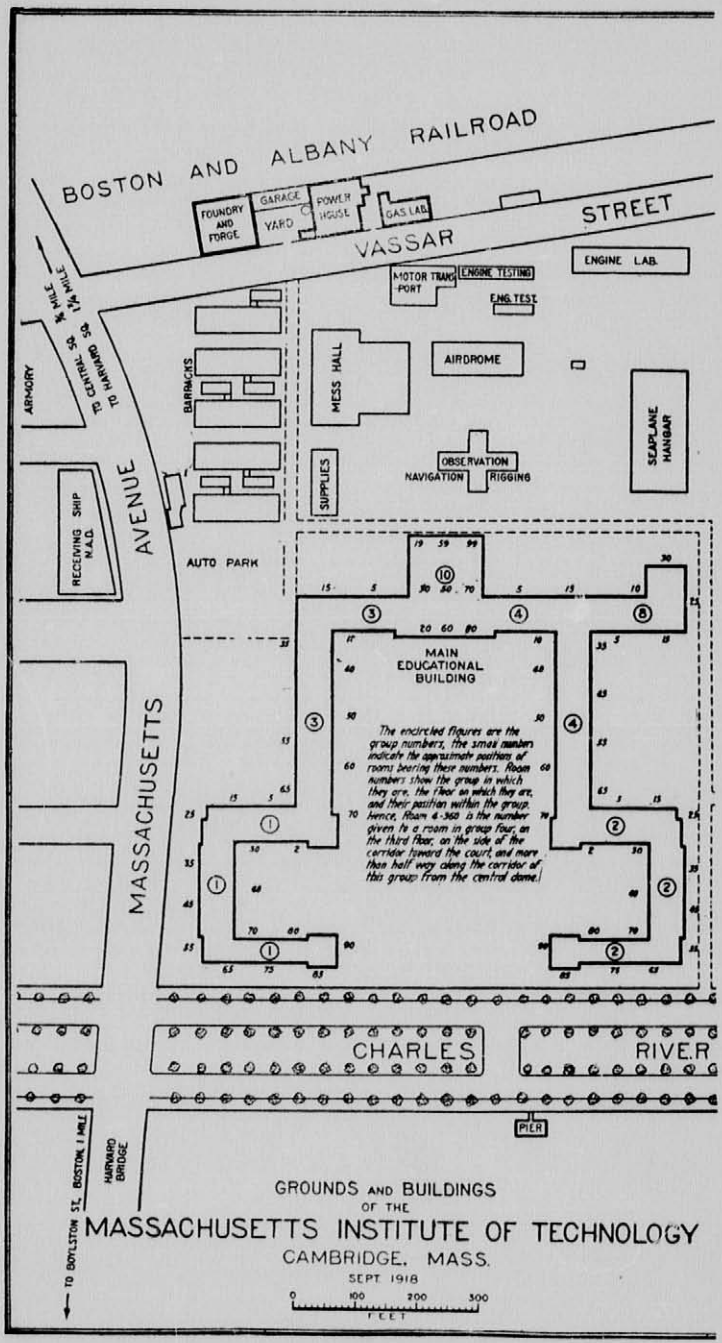
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VASSAR STREET
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ARMORY
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TO HARVARD SQ.
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AUTO PARK
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The encircled figures are the group numbers, the small numbers indicate the approximate positions of rooms bearing these numbers. Room numbers show the group in which they are, the floor on which they are, and their position within the group. Hence, Room 4-368 is the number given to a room in group four, on the third floor, on the side of the corridor toward the court, and more than half way along the corridor of this group from the central dome.
CHARLES RIVER
PIER
HARVARD BRIDGE
TO BOYLSTON ST. BOSTON, 1 MILE
GROUNDS AND BUILDINGS
OF THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.
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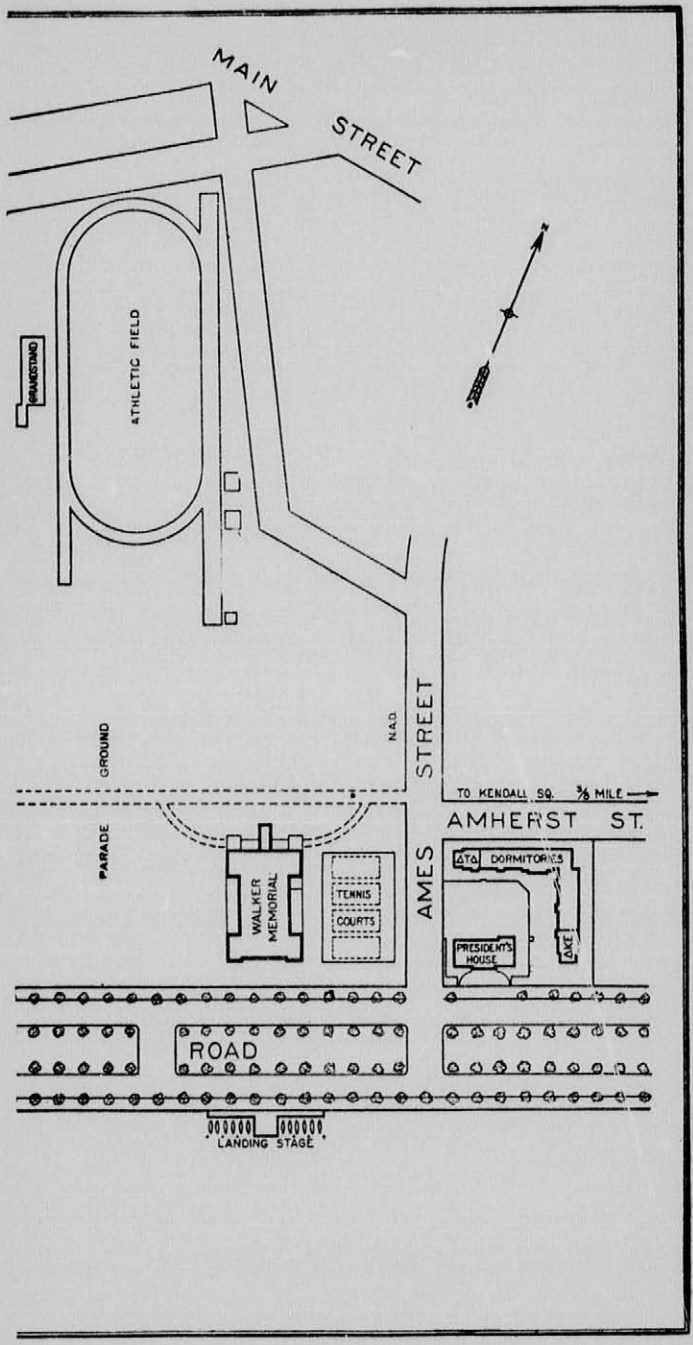
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GROUND
PARADE
WALKER MEMORIAL
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NAD
STREET
AMES
TO KENDALL SQ. 3/8 MILE
AMHERST ST.
4 to DORMITORIES
PRESIDENT'S HOUSE
AME
ROAD
LANDING STAGE

CALENDAR

	1919	1920	1921	1922
College Year Begins	Oct. 6	Oct. 4	Oct. 3	Oct. 2
Semi-Annual Examinations	Dec. 17-23	Dec. 16-22	Dec. 16-22	Dec. 15-21
Christmas Vacation	Dec. 24-Jan. 4	Dec. 23-Jan. 2	Dec. 23-Jan. 2	Dec. 22-Jan. 1
	1920	**1921**	**1922**	**1923**
Second Term Begins	Jan. 5	Jan. 3	Jan. 3	Jan. 2
Condition Examinations* and March Recess	Mar. 14-21	Mar. 13-20	Mar. 12-19	Mar. 11-18
Third Term Begins	Mar. 22	Mar. 21	Mar. 20	Mar. 19
Last Exercise, Third Term	June 1	May 31	May 29	May 29
Annual Examinations	June 2-15	June 1-14	May 31-June 12	May 31-June 12
Last Examination, Fourth Year	June 4	June 3	June 2	June 1
Commencement Day	June 11	June 10	June 9	June 8
Examinations, College Entrance Examination Board	June 21-26	June 20-25	June 19-24	June 18-23
Summer Camp Begins	Aug. 3	Aug. 2	Aug. 1	Aug. 1
Entrance Examinations at Technology Begin	Sept. 25	Sept. 24	Sept. 23	Sept. 23

Exercises are omitted on legal holidays.

*Condition examinations of the first term are held during first part of this week.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

A PAMPHLET OF GENERAL INFORMATION

The Purpose of the Massachusetts Institute of Technology.— 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 Professional Departments of Civil and Sanitary Engineering, Mechanical Engineering, Mining Engineering and Metallurgy, Architecture, and Architectural Engineering, Chemistry and Chemical Engineering, Electrical Engineering, Biology and Public Health, Physics—including Electrochemical Engineering, and Aeronautical Engineering, Geology and Geological Engineering, Naval Architecture — besides the Departments of Drawing and Descriptive Geometry, English and History, Economics and Statistics — including Engineering Administration, — Mathematics, Military Science, Modern Languages, and Physical Training.

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, and an Aerodynamic Research Laboratory.

The Institute offers to its students both undergraduate and graduate 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 Science. 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.

Historical Sketch.— The foundation of the Massachusetts Institute of Technology was laid in a "Memorial" prepared in 1859 by Prof. William Barton Rogers, and presented, by a Committee, to the Legislature of the Commonwealth of Massachusetts 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 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."

The first meeting of the Institute for organization was held April 8, 1862, but 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.

For fifty years the Institute developed on the original site granted by the State. During this time the number increased from fifteen students to nineteen hundred, the staff of instruction from ten to three hundred, and the number of courses of study leading to the degree of Bachelor of Science from six to fifteen.

Location.— After occupying for fifty years its original location in Boston the Institute moved to a new site on the Charles River Basin. This site comprises a tract of fifty acres extending along the esplanade on the Cambridge side of the river and affording an extensive panoramic view of the city of Boston. Here are located the Educational Buildings, the Walker Memorial, a social center, the Dormitories, the Athletic Field and the Power House. Many street car and subway lines afford easy access from all parts of Boston, Cambridge, the suburbs,

and the railroad stations for trains from the north, south and west. The location of the Institute in proximity to the great collections and libraries of Boston and Cambridge, and in the neighborhood of a great manufacturing district, with which the Institute maintains close relations, is of great advantage to technological students.

For the present the Department of Architecture is located in Boston and occupies the Rogers Building on the old site on Boylston Street.

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. Persons who are considerably past the usual age, who are engaged in teaching or technical pursuits, or 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 herewith 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.—Examinations for admission to the first-year class will be held by the College Entrance Exam-

ination Board in June. For place of examination and dates and for information concerning the College Board Examinations candidates should address the Secretary of the College Entrance Examination Board, 431 West 117th Street, New York, N. Y.

A second series of examinations for admission, and for applicants conditioned at the first examinations, will be held at the Institute on the Saturday, Monday, Tuesday and Wednesday after September 25. *Examinations are held by the Institute in September only and in its own buildings. Candidates desiring examination in June are expected to take the examinations of the College Entrance Examination Board.*

Applications for admission after the September examinations will be received only when some exceptional 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 any period of entrance examinations of the Institute. A candidate who is rejected will be required to pay a second fee if he repeats the examinations. Fees may be paid to the Bursar at the time when the examinations are taken, or may be remitted in advance.

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.	MATHEMATICS A, or A_1, and A_2.
ENGLISH.	ENGLISH Comprehensive or A and B.
FRENCH (Elementary).	FRENCH A.
FRENCH (Intermediate).	FRENCH B or Comprehensive.
GEOMETRY, PLANE.	*MATHEMATICS C (Plane Geometry).
GEOMETRY, SOLID.	*MATHEMATICS D (Solid Geometry).
GERMAN (Elementary).	GERMAN A.
GERMAN (Intermediate).	GERMAN B or Comprehensive.
PHYSICS.	PHYSICS or Comprehensive.
TRIGONOMETRY.	MATHEMATICS F.
ELECTIVES.	HISTORY A, B, C or D; LATIN 1, 2 and 3; FRENCH B; FRENCH BC; GERMAN B; GERMAN BC; SPANISH; CHEMISTRY; BOTANY; ZOOLOGY; BIOLOGY; DRAWING.

Records of 60, or higher, will be accepted.

*Candidates are expected to take the divided examinations in Geometry. If the single examination in Geometry, CD, is taken, a record of at least 70 is required.

Order of the Examinations of the Institute. — The order of examinations for September, 1920, will be as follows:

Saturday, September 25, 1920

9.00 A.M. to 12.00 M. . . . . Algebra
2.00 P.M. to 4.00 P.M. . . . . Physics

Monday, September 27, 1920

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 28, 1920

9.00 A.M. to 10.45 A.M. . . . . Solid Geometry
11.00 A.M. to 1.00 P.M. . . . . German (Elementary)
2.00 P.M. to 4.00 P.M. . . . . Trigonometry

Wednesday, September 29, 1920

9.00 A.M. to 11.00 A.M. . . . . French (Intermediate)
11.00 A.M. to 1.00 P.M. . . . . German (Intermediate)
2.00 P.M. to 4.00 P.M. . . . . History (U. S. or Ancient)

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 requirements in regard to elective certificates see pages 14 and 19.

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 must be made up in the following June or September for continuance in dependent work.

Division of Entrance Examinations. — Candidates for admission under certain conditions are allowed at their option to divide their entrance examinations over a period of three years, or between June and September of the same year.

A complete candidate is one who takes all his examinations at one time.

A preliminary candidate is one who takes part of his examinations one year with a view to taking the remainder the next year as a final candidate, or the following two years, first, as a preliminary candidate again and then, as a final candidate.

A final candidate is one who has already received credit for his "preliminary" examinations and purposes to enter the following school year.

A partial candidate is one who takes part of his examinations in June and part in September of the same year.

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. If the candidate divides his examinations over a period of three years he may elect any of the following subjects at his first examination period.

Algebra **French**
Plane Geometry **German**
History

Except for Solid Geometry or Trigonometry, examinations in any of the remaining subjects may be taken by the candidate during the following year. An examination in either Solid Geometry or Trigonometry must be taken the year of entrance.

The preliminary candidate who takes the Institute examinations is also required to present from his preparatory school a statement concerning his preparation in the subjects taken, blank forms for which are furnished on application by the Registrar of the Institute.

A preliminary candidate should not offer English unless he has completed satisfactorily four years of English of high school grade.

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).

Subjects for Examination. — To be admitted 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:

Algebra **Solid Geometry** **Physics**
Plane Geometry **Trigonometry** **English**
Also in either (a) Elementary French and Elementary German,
or (b) Elementary and Intermediate French,
or (c) Elementary and Intermediate German,

Applicants for admission must also present a certificate from their preparatory school for one unit of history with record of certificate grade, or pass a satisfactory examination in one unit of History. A certificate for two units of the following, or similar elective subjects completed with a satisfactory passing grade, must also be presented.

Biology
Chemistry
English (Additional)
French (Intermediate)[2]
German (Intermediate)[2]
History (Additional)
Latin[3]
Mechanical Drawing
Mechanical Drawing and Mechanic Arts
Spanish

Summer Courses in Entrance Subjects. — The Institute offers summer courses corresponding to entrance requirements in Algebra, Solid Geometry, Trigonometry, Physics, French and German.

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

Entrance Mathematics. — 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, the same number in plane and solid geometry and not

[1] Those who enter on (b) or (c) are to present an additional elective representing at least a half unit. Those who enter on (b) or (c) may not offer the Intermediate language as an elective.

[2] Unless used for entrance language requirement.

[3] Latin is not accepted for less than two units and may count for more.

less than 80 in trigonometry. A considerable portion of the mathematics should be given during the final years of preparation.

Algebra. — 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; 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 arithmetical and geometric progressions, with applications.

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.

A summer course is given in this subject.

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.

A summer course is given in this subject.

Trigonometry. — Definitions and relations of the six trigonometric functions as ratios; circular measurements of angles. Proofs of principal formulas, in particular for the sine, cosine, and tangent of the sum and the difference of two angles, of the double angle and the half angle, the product expressions for the sum or the difference of two sines or of two cosines, etc.; the transformation of trigonometric expressions by means of these formulas. Solution of trigonometric equations of a simple character. Theory and use of logarithms (without the introduction of work involving infinite series.) The solution of right and oblique triangles and practical applications. Accuracy in the use of four-place tables of natural and logarithmic functions is important. The use of the slide rule is optional but will not be permitted at the examination.

A summer course is given in this subject.

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 classroom experiments. A sufficiently extended treatment of the subject will be found in any of the principal text-books now in use in secondary schools. Ability to solve simple problems will be expected.

It is furthermore expected that the student will receive training in laboratory work. Deficiency in laboratory work will not necessarily lead to rejection, provided the school from which

the student comes is unable to furnish such instruction. In this case, however, a certificate of such inability will be required from the principal of the school.

The laboratory work required 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. This work should preferably come during the school year immediately preceding the student's entrance. A satisfactory selection may be made from Experiments 1 to 51 of the College Entrance Examination Board.

A summer course is given in this subject.

English. — The examination in English is intended as a test of the candidate's ability to express himself clearly and simply, and of his capacity for using his past experience and reading in elementary processes of thought.

In preparation for the examination the candidate should have done a considerable amount of reading, chosen from authors of recognized worth. The books adopted by the National Conference on Uniform Entrance Requirements are taught in most secondary schools, and the candidate may, if necessary, use these in his preparation. In any case it is expected that the aim of preparatory study will be, first, to develop in the pupil a consciousness that words, if understood, convey definite ideas; and, secondly, to form in him the habit of comparing these ideas with his own experience and his own views.

The candidate will be required to write upon subjects familiar to him, or to comment on a literary treatment of some such subject. When questions of a literary sort are asked, they are intended rather as a test of the candidate's power to read intelligently than of his knowledge of specific books.

The composition should be correct in spelling, punctuation, grammar, idiom, and the formation of paragraphs, and should be plain and natural in style. The candidate will be judged by how well he writes rather than by how much he writes.

NOTE. — It is expected that the translations from French and German will 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.

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.

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.

French (Intermediate). — This course should consist of recitations partly conducted in French. It should comprise 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 with considerable ease, and, finally, have a real appreciation of the authors read.

Summer courses are given in French.

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.

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.

German (Intermediate). — This course should include a systematic review of grammar. The reading, scientific as well as literary, should become more difficult, and the syntax, idioms and synonyms of the language should be carefully studied.

By the end of the course the student 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.

Summer courses are given in German.

History. — Preparation in one year of History taken four or five hours per week may be offered in place of an examination if the record of the candidate is of certificate grade.

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

Additional units of History may be offered for Electives.

Elective Subjects. — The object of the elective requirements is to secure and to recognize greater breadth of preparatory training. The time allotment for each unit elective is to be equivalent to four or five periods per week for a school year of approximately forty weeks.

These requirements are to be met by the presentation of certificates made out on forms supplied by the Institute. Certificates are not required of candidates passing College Entrance Board Examinations in the elective subjects.

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. 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 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 zoology 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.

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

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 English. — The work of secondary schools varies so much in this subject that no definite requirement is formulated at present. Any applicant who has carried work in English materially beyond the entrance requirements may present for approval as his elective a statement of the amount and kind of work done.

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 Cæsar or the equivalent. As a smaller amount of Latin would be of no practical advantage, this is the minimum amount that can be accepted.

The study of Latin is recommended to persons who purpose to enter the Institute and who can give the subject adequate attention while preparing for the regular requirements for admission.

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. Applicants are

advised in general not to offer mechanical drawing or descriptive geometry with a view to omitting these courses at the Institute.

Elective Mechanical Drawing and Mechanic Arts. — These subjects may be offered in combination. The drawing should represent at least 60 hours' work, as described in the preceding section, or such as is ordinarily given in connection with mechanic arts courses.

In mechanic arts, the applicant 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; chiseling, including chamfering, grooving, and plain molding work; framing, including tenoning, mortising and fitting in braces; use of the ordinary molding-planes and the making of simple moldings; the making and use of the miter-box in fitting moldings; nailing; dovetailing; gluing; and the proper use of sandpaper.

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, with particular attention to the production of smooth work by the cutting action of the tools, and not by the excessive use of sandpaper.

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

Elective Spanish (Elementary). — Elementary grammar, 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 given at the Institute.

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. 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 to one of the professional courses in the second, third, or fourth-year class, the applicant must have attained the age of eighteen, nineteen, or twenty years, respectively, and may be required to 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 substantially equivalent to at least that required in the first year at the Institute may be excused provisionally from taking the corresponding examinations at the Institute.

Opportunities for College Students in the Undergraduate Professional Courses. — Graduates of colleges and scientific schools granting degrees are admitted to the Institute without the usual entrance examinations, 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. 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 Registrar in regard to their credits as early as May 1, if in doubt as to what studies, if any, should be pursued during the summer preceding entrance. *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 notebooks, etc. In certain subjects the passing of an advanced standing examination may carry credit for elementary work.

Graduate Courses and Research. — For information concerning opportunities for graduate work and research applicants are referred to the special circular entitled "Graduate Study and Research." This will be mailed upon application.

Admission of Special Students. — Persons considerably past the usual age of entering students may be admitted to one or more selected subjects (*i.e.*, to a partial or special course,) in one of the regular courses except that in architecture, 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 have had 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 take in their first year of residence courses in descriptive geometry, mechanical drawing and English 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. Entrance to these courses must be approved by the Departments of Drawing and English and satisfactory records must be obtained in order to continue architectural 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. Special students in option 1 will be required to take, in addition to the subjects already mentioned, courses in design, shades and shadows, perspective, applied perspective and architectural history, 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, in addition to the courses already named, obtain satisfactory records in the courses in European civilization and art and philosophy of architecture and a satisfactory record in graduate design. Special students who desire to take work in option 2, 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 this option.

Fees. — The tuition fee for all students entering after the academic year of 1918-19, and pursuing regular courses other than the Course in Naval Construction for government students, is $300 per year and must be paid *in advance* as follows:

$100.00 on or before the first Monday in October.
$100.00 on or before the first day of the second term, about January first.
$100.00 on or before the first day of the third term, about April first.

$300.00

The tuition fee will continue at $250.00 for students completing regular undergraduate courses that have been entered upon at the Institute during the academic year 1918-19 or earlier, and is due in three payments:

$84.00 on or before the first Monday in October.
$83.00 on or before the first day of the second term, about January first.
$83.00 on or before the first day of the third term, about April first.

The above rules are not applicable to the fees of students pursuing the courses in Naval Construction which are subject to special arrangements and to change according to arrangement with the United States Navy Department.

No bills are sent. 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.

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.

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, $20; 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.

Student Tax. — A tax of $9 per year is levied on all male students who pay, or have paid on their behalf, more than half the regular tuition fees for the year and the corresponding tax for students who pay one-half the regular tuition fee or less is $4.50 per year.

In the case of female students the tax is $3.00 per year for those who pay more than the half full tuition and $1.50 per year for those who pay half or less. No part of this tax is appropriated for the maintenance of athletics or of the Walker Memorial.

This tax is payable in three equal parts upon the same dates as the tuition fee and is levied on all students, including graduate students, special students and unclassified students.

The tax will be remitted and the corresponding amount supplied from funds applicable to such purposes in the case of all students who are granted scholarships on the basis of financial need and of others who may be exempted from the payment of the tax by a committee appointed to deal with such matters.

The proceeds of the tax will be devoted to the promotion of student life at the Institute with special reference to the physical and social welfare of the students. No part of the tax shall be spent for any class function, athletic event or social entertainment that is not open without charge to every qualified member of the student body in good standing.

This tax will be expended under the general direction of

the Institute Committee subject to the approval of an Advisory Committee appointed by the Corporation.

Subject to modification the tax will be apportioned approximately as follows:

Institute Committee	$0.17
Class Dues	.73
Athletics	2.50
Walker Memorial	4.00
Health Insurance	1.00
Reserve and Contingent Fund	.60

Payments. — All payments should be made to Horace S. Ford, Bursar, Massachusetts Institute of Technology, Cambridge 39, Mass. *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.

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 classified students, that is to students who are taking the full work of any term of a course and have no deficiencies back of them and 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 whose records are entirely clear.* Awards will be made in the summer. Applications for scholarships should be made not later than May 1, on blanks supplied by the Registrar. Application for Massachusetts State Scholarship should be made only to the Commissioner of Education, State House, Boston, from whom the necessary blanks may be obtained.

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 Secretary of the Technology Christian Association 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.

Residence. — 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.

Expenses. — Students who make application for scholarship aid must fill out blanks which call for an itemized account of their expenses for the school year. It is found upon examination of these blanks that the amounts noted below are the average for a period of thirty-eight weeks. It should be borne in mind, however, that as scholarship aid is restricted to students who present evidence of need, the average cost thus obtained is somewhat lower than the average for the whole student body.

FOR A PERIOD OF 38 WEEKS

Tuition $300 First year Chemical deposit 20 Student Tax 9	$329.00
Board	238.00
Room	109.00
Clothes	91.00
Books	62.00
Other items, not including carfare	68.00
	$897.00

Walker Memorial. — The Walker Memorial, built in memory of the late president, General Francis A. Walker, is the center of the social activities of the Institute. The building was finished in 1917 at a cost exceeding $500,000 contributed

in part by Alumni. The income of a considerable bequest by the late Frank H. Cilley, of the Class of '89, is available for purposes connected with the Memorial.

On the top floor of the building is a large gymnasium with lockers and dressing rooms. There are offices for the various student activities, squash courts and rooms for hand ball. There are club rooms, lounges and reading rooms and on the main floor a large dining hall with cafeteria service. In the grill room a table d'hôte lunch is served and other dining rooms provide for class dinners and dinners of any Technology organization. In the basement are found bowling alleys, a billiard room and a shooting gallery. A matron is in attendance and excellent opportunities are afforded for the entertainment of guests. Meals are served at cost, and, while the prices are subject to fluctuation, a light lunch is now provided in the large hall by cafeteria service. In the grill room the table d'hôte lunch with service is given.

Outside the building there are tennis courts for the use of students. In front of the Memorial, on the esplanade, there is a pier for boating and bathing.

DORMITORIES

1. Buildings and Location. — The first of the new dormitory buildings is located at the east end of the Institute property on the line of the Charles River Esplanade, near the Walker Memorial. It is built along the north and east sides of the lot that contains the President's house and includes two fraternity houses.

The dormitory consists of four halls, each hall with a separate entrance, and four stories high, except in the case of Runkle, which has rooms on six floors.

The halls are named Atkinson, Runkle, Holman and Nichols. These men were professors at the Institute in its earlier years.

2. Rooms. — The rooms on the first floor in each hall are single rooms. A few of the rooms on the fifth and sixth floors of Runkle Hall are also for single occupancy. All other suites are arranged for two or three men. They consist of a study, a

dressing-room, and either a double or two single sleeping rooms. There are fifty-four double suites and seven triple suites. One hundred and seventy men may be accommodated in the four halls.

Sixty per cent of the rooms are provided with lavatories. Toilets and shower baths are located on every floor in each hall.

3. Equipment. — The Institute equips the rooms as follows: *Single Rooms:* Iron bed, mattress and cover, pillow, all bedding, chiffonier, desk and chair, rocking chair, bookcase, electric lamps (Mazda), sash curtains and wastebasket.

Suites: As above for each man, also wardrobes (single rooms have closets) and study tables.

4. Application for Rooms. — Application for rooms in the dormitories should be filed before March 1 on forms provided for the purpose at the Bursar's office. Applications for double or triple suites must bear the signatures of the two or three men who desire to occupy them.

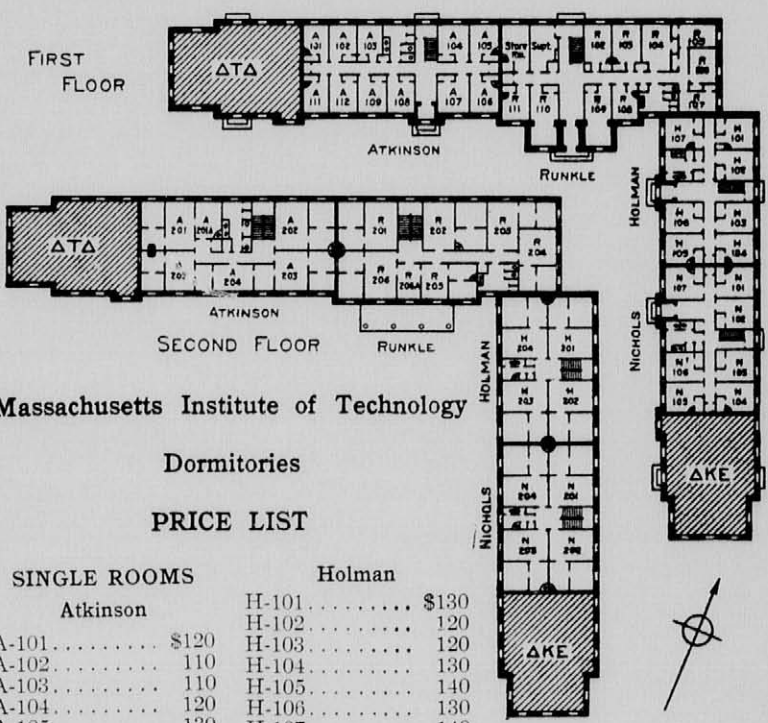
5. Rentals and Payments. — The rentals of the single rooms and suites vary according to space, floor, exposure and on account of lavatory installation.

In addition to the rental of the space, students should observe that prices include: Furnishings, heat, light, water, janitor and chamber service, soap and towel supply and laundry service for all bedding.

Rentals will be made by lease, bearing signatures of applicants, also of parents or guardians, and payments will be regularly due *without notice* — one-third on or before *October 1* and one-third on or before *January* 1, and the remaining third on or before *April 1. No bills will be sent.*

Leases will not be accepted unless accompanied by a deposit of $5, which amount will be applied toward the first payment. This deposit will be refunded only to students who are unable to attend the Institute, and only upon notice filed with the Dormitory Committee before September 1.

6. Occupancy. — Rooms may be occupied from the Monday before the opening of the fall term until the Saturday after Commencement. Tenancy beyond these dates will be charged for at a summer rate — somewhat less than the regular rental.



Massachusetts Institute of Technology

Dormitories

PRICE LIST

SINGLE ROOMS

Atkinson

A-101	$120
A-102	110
A-103	110
A-104	120
A-105	130
A-106	150
A-107	140
A-108	140
A-109	140
A-110	140
A-111	150

Runkle

R-102	$150
R-103	150
R-104	140
R-105	110
R-106	110
R-107	110
R-108	150
R-109	175
R-110	175
R-111	150
R-501	100
R-502	90
R-601	100
R-602	90
R-603	80

Holman

H-101	$130
H-102	120
H-103	120
H-104	130
H-105	140
H-106	130
H-107	140

Nichols

N-101	$130
N-102	120
N-103	120
N-104	130
N-105	140
N-106	130
N-107	140

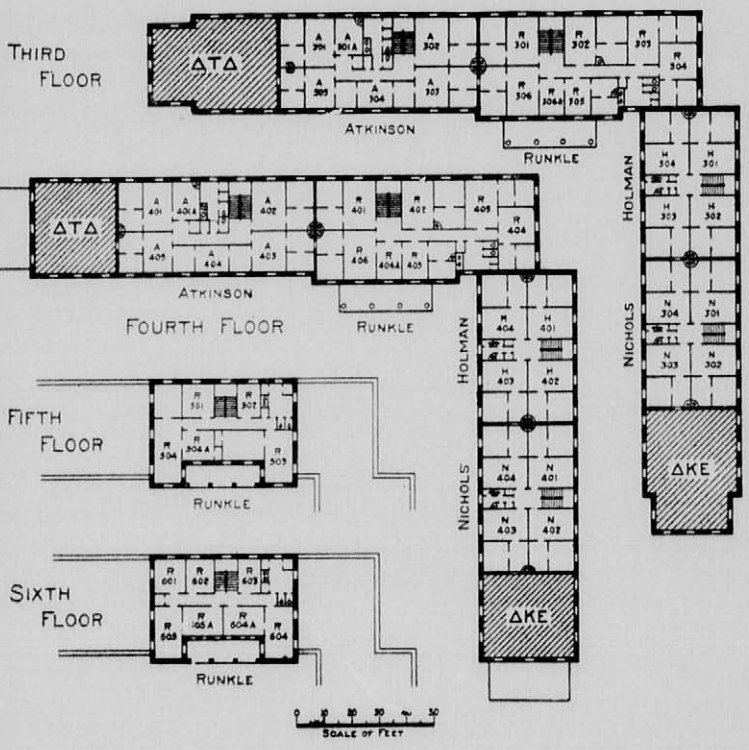
DOUBLE SUITES

Atkinson

A-202	$330
A-203	360
A-204	330
A-205	360
A-302	320
A-303	340
A-304	320
A-305	340
A-402	310
A-403	330
A-404	310
A-405	330

Runkle

R-201	$330
R-202	330
R-203	320
R-204	290
R-205	300
R-301	320
R-302	320
R-303	310
R-304	280
R-305	290
R-401	310
R-402	310
R-403	300
R-404	270
R-405	280
R-503	330
R-604	270
R-605	270



Holman

H-201	$340
H-202	340
H-203	370
H-204	370
H-301	330
H-302	330
H-303	360
H-304	360
H-401	320
H-402	320
H-405	340
H-404	340

Nichols

N-201	$340
N-202	340
N-203	370
N-204	370
N-301	330
N-302	330
N-303	360
N-304	360
N-401	320
N-402	320
N-403	340
N-404	340

TRIPLE SUITES

Atkinson

A-201	$440
A-301	420
A-401	410

Runkle

R-206	$500
R-306	490
R-406	470
R-504	520

Double Suites

R–604 — R–605 if rented as single rooms $135 per year per man.

Triple Suites

As listed above, if rented as single and double respectively.

A-201	$110 and $330
A-301	100 and 320
A-401	100 and 310
R-206	120 and 380
R-306	120 and 370
R-406	110 and 360
R-504	140 and 380

A student will not be permitted to sublet or transfer his room or his share in a room without the consent of the Dormitory Committee.

7. Allotment of Rooms. — Rooms will be allotted by the Dormitory Committee in the following manner:

First. Student occupants of the dormitory for the current year will be allowed to register a prior choice of rooms, or may renew their leases upon application before March 1.

Second. The remaining rooms will be assigned as far as possible in order of application.

Third. Notices will be sent as soon after March 1 as possible to successful applicants, and signed leases must be in the hands of the Dormitory Committee before May 1, otherwise the rooms will be reassigned.

8. Dormitory Awards. — Students who cannot afford to pay as much as the rentals quoted may apply to the Dormitory Committee for financial assistance, which will be known as a Dormitory Award. A limited number of these — in no case to exceed one-fourth of the yearly rental — will be granted. All such awards will be confidential. Application for the above must be filed with the Dormitory Committee preferably with the application for rooms and in any event before September 1.

9. Government. — While the government of the dormitories is carried on under the superintendence of the President of the Institute, through the Dormitory Committee, it is the desire to place the whole question of discipline, maintenance of good order and right living, in the hands of the student occupants themselves. The Dormitory Committee is responsible for the sanitation and janitor service and general regulations as to the allotment of rooms and will make an inspection of the rooms from time to time in these interests. The student members of each hall will be required to elect on or before October 15 of each year a Section Committee composed of a member from each class, with the Fourth Year student as House Representative. The four Representatives so elected shall in turn choose a fifth (also a Fourth Year man and a resident of the dormitories), and the five shall constitute the General House Committee of the dormitories. This committee elects its own

chairman. The committee of each hall shall be charged with the maintenance of order and the enforcement of regulations passed by the Dormitory Committee.

Only in the event of a failure of such student government to maintain order and right living will it become necessary for the Dormitory Committee to assume its responsibilities and take summary action.

House rules framed by the Student House Committee will be posted in each hall and each occupant of a room will be provided with a copy of the same.

10. General Information. — *Withdrawals:* In the event of a student withdrawing from the Institute, the Dormitory Committee will endeavor to reassign the room vacated, provided proper notice is given.

Keys: Key cards, obtainable at the Bursar's office, may be exchanged at the office of the Superintendent of Buildings and Power, Room 3-005, for individual room keys. A deposit of fifty cents is required.

Mail and Express: Packages and mail matter should be addressed to the students, Massachusetts Institute of Technology Dormitory, Ames Street and Charles River Road, Cambridge 39, Mass. Individual lock boxes are provided at Superintendent's office.

Telephone Service: Public pay-stations are located on the first floor of each hall. Persons calling the dormitory from outside should give the number — Cambridge 57077. An intercommunicating telephone service, reaching each corridor, enables the Superintendent's office to call any occupant. Private telephone service may be arranged for by communicating directly with the Commercial Department of the New England Telephone and Telegraph Company at Cambridge.

Storage: Ample facilities for the storage of trunks, luggage, etc., are provided in the basement of the dormitory without charge.

Additional Lights: Students who desire to purchase desk fixtures or other additional lighting should see that the connecting plugs will fit the wall sockets which are generally provided throughout the dormitories.

Building Service: The building is of concrete construction with brick and stone facing, and is as near fireproof as possible. Power and light are furnished directly from the Institute's own power plant and the building is cleaned by the use of vacuum cleaners. The service is directly in charge of a Superintendent and is maintained by experienced colored porters. The Superintendent's office is always open, and a representative of the Institute is on the premises day and night.

For further information address the Bursar.

School Year. — This is shown on the calendar on page 6. The exercises of the Institute are omitted on Massachusetts legal holidays, which are January 1, February 22, April 19, May 30, Juy 4, Labor Day, October 12, Thanksgiving Day, December 25.

Registration: Registration Card. — Before the opening of each term the student is required to fill out and present to the Registrar, blank forms which are supplied. Three unmounted photographs, not larger than 1½ x 2 inches, must also be furnished for the records of the Institute. Among these forms the Registration 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.

Attendance. — Students are expected to attend all exercises in the subjects applied for, unless excused by special vote of the Faculty. With the exception of an interval of one hour in the middle of the day, 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.

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 physical exercise under the direction of the Instructor in Physical Training.

Bronze medals, known as the Cabot Medals for Improvement 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 where opportunity is afforded for track-team contests and inter-class games. There is also a well equipped gymnasium in the Walker Memorial.

Military Science. — All male students who are rated as first or second-year students, except aliens, are required to attend exercises in military science and drill, except as excuse may be granted by the Faculty in the cases of men considerably beyond the usual age. The military exercises include not only military drill but lectures upon military subjects.

Several units of the Reserve Officers' Training Corps, such as Artillery, Engineer Corps, Ordnance and Signal Corps, are being arranged, whereby students may prepare themselves to become reserve officers in these various branches of the Army. Members of this R. O. T. C. continue their military work into and through the third and fourth year classes in conjunction with their professional courses.

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 co-operates with the President in matters touching discipline and other student relations. In co-operation with the Technology Christian Association a number of upper classmen have been selected to act as advisers to incoming students. These men have been assigned to students who have taken entrance examinations, and they will be expected to help new men in matters of registration, in the selection of rooms, etc.

On request to the Dean, advisers will also be assigned to new students from the instructing staff.

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.

Undergraduate Courses of Study. — The undergraduate courses of study are of special importance and the Institute

aims in them to afford to students with the preparation furnished by the better high schools, the additional instruction in English, History and Political Science, and in other general studies, the choice of which is elective, which are essential to a liberal education; to give them a thorough training in the fundamental sciences of chemistry, physics and mathematics, 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 classroom instruction is given to small sections of students, and in its laboratories and drawing-rooms students receive a large amount of personal 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 desired 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.

On the following pages are given general descriptions of the various undergraduate courses of study.

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 from forty-eight to fifty hours each week.

During the summer following the first year all students in regular courses are required to complete assigned courses of reading of a literary, historical, and general scientific character.

In the summer following the second year, certain of the professional courses require attendance at summer classes. These are shown in the curricula of the various courses.

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.

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.

In the third year, in addition to the other prescribed subjects, all students in regular courses, except in Architecture and in Engineering Administration, are required to devote a specified amount of time to elective work in General Studies.

Four-Year Courses. — Regular Four-Year Courses of Study leading to the degree of Bachelor of Science are offered in the fifteen branches of science and engineering named below.

Special attention is however called to the fact that admission to the Institute does not guarantee subsequent admission to any particular professional course nor to certain special courses, which may be open only to the extent of professional

equipment and may be restricted to citizens of the United States or to minors whose parents are citizens of the United States.

ARCHITECTURE AND ARCHITECTURAL ENGINEERING, Course IV.

BIOLOGY AND PUBLIC HEALTH, Course VII, with options in Bacteriology and Industrial Microbiology, and in Sanitary Biology and Public Health.

CHEMICAL ENGINEERING, Course X.

CHEMISTRY, Course V.

CIVIL ENGINEERING, Course I, with options in Hydraulic Engineering and Railroad Engineering.

ELECTRICAL ENGINEERING, Course VI, with electives in professional subjects in the fourth year.

ELECTROCHEMICAL ENGINEERING, Course XIV.

ENGINEERING ADMINISTRATION, Course XV, with options in Civil Engineering, Mechanical and Electrical and Chemical Engineering.

GENERAL SCIENCE, Course IX-A, and GENERAL ENGINEERING, Course IX-B.

GEOLOGY AND GEOLOGICAL ENGINEERING, Course XII.

MECHANICAL ENGINEERING, Course II, with electives in professional subjects in the fourth year.

MINING ENGINEERING, AND METALLURGY, Course III, with options in Mining and Metallurgy, in Metallurgy, and in Mining.

NAVAL ARCHITECTURE, Course XIII.

PHYSICS, Course VIII, with options in Industrial and Theoretical Physics. (In this Department Graduate Work in Aeronautical Engineering is given).

SANITARY ENGINEERING, Course XI.

In most of these courses distinct options or electives in professional subjects, as shown above, 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.

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.

Choice of Professional Course. — All these courses are practically identical, 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. Owing to the abnormal demand for admission to certain courses, it may be necessary in the future to limit the number of students in these courses by maintaining specially high standards of admission thereto. It is probable that this limitation may have to be imposed immediately in the course in Chemical Engineering. In making the choice of course, 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.

Five-Year Courses. — Five-Year Undergraduate 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.

A knowledge of more than one branch of science or engi-

neering 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. He is classed in the year in which he takes a majority of his studies.

The Professional Courses. — The descriptions of the fifteen professional courses are arranged here alphabetically, but they are associated with numerals and are frequently referred to, within the school, as Course I, Course II, etc.

ARCHITECTURE AND ARCHITECTURAL ENGINEERING COURSE IV

Architecture is essentially a fine art which for its inspiration must continually refer to the wonderful achievements of the past, and for its fulfilment must borrow much from the sciences and from engineering. The education of the architect,

therefore, which is based primarily upon the canons of art, must at the same time include historical study of civilization, painting, sculpture, and architecture, as well as some instruction in science and its engineering applications. As a profession it requires many years of earnest effort and self-sacrificing study. The architectural school can undertake to furnish only the fundamental training necessary to start the young man in his career. He must be given the proper attitude toward this profession; he must be made familiar with the underlying principles of art and science which are to become the foundation of his professional knowledge and development; he must be taught the logic of all true architecture; his taste, his power of discrimination between the good and beautiful and the commonplace and vulgar must be developed. He must be given facility in the processes which he must use in the expression of his imagination and thought, and 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 methods of instruction employed have been selected not merely to prepare the student for the future practice of his profession, 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 the architect. The option in General Architecture lays most stress upon design and art with a minimum of engineering, while that in Architectural Engineering lays greatest emphasis upon structural design and engineering, with enough of general architecture and art to bring 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 the members of both options should be working with the same end in view — the noblest architectural accomplishment.

The first year is to a large extent a preparatory one, including courses in drawing, history, literature, language, and

science, which lead in the later years to the various phases of professional study.

The study of architectural design is begun in the second year, and in the option in General Architecture occupies increasing periods of the student's time until in the senior year over one-half the school hours is devoted to this subject. In the third year of the Engineering option architectural design is replaced by applied mechanics, theory of structures, testing of materials, and structural design. Courses in architectural history and history of European civilization and art, taken by all students, form the broad, artistic, historical and technical background which is necessary for the full appreciation of any great period of architecture.

The degree of Bachelor of Science 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 the 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 25. 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.

All drawings and designs made during the course are to become the property of the Department, to be retained, published, exhibited or returned at the discretion of the Department.

BIOLOGY AND PUBLIC HEALTH — COURSE VII

Useful and inviting careers in the service of cities, states and the United States, or with public-service or private corporations, or firms or individuals, are now open to ambitious

students in certain technical branches of biology and public health science such as bacteriology, microbiology, industrial and sanitary biology, industrial hygiene and sanitation, planktonology, serology, etc., as well as in research and investigation. For persons proficient in these subjects the demand has of late years often exceeded the supply, graduates readily obtaining positions as bacteriologists, microbiologists, health officers, sanitary inspectors, or assistants with manufacturers of biologic products and other commercial firms or public-service corporations.

To provide the equipment necessary for these positions a group of related studies covering four years has been arranged. These studies afford also an excellent preparation for entrance into the best medical schools or for social service positions, and graduates of this Department are immediately eligible as candidates for, and after one year of additional study may expect to obtain, the Certificate in Public Health (C. P. H.) in the School for Health Officers.

The course in Biology and Public Health thus furnishes certain essential elements of a well rounded education with professional training for special occupations. Some who follow it enter medical schools — the best of which now require at least two years of college work, which must include physics, chemistry and biology. Others go immediately into professional occupations. Those who remain for graduate studies or investigation find ample opportunity for advanced work, including research, in the various Departmental Laboratories.

CHEMICAL ENGINEERING — COURSE X

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 build and operate manufacturing industries based upon chemical principles is the purpose of this 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 and experience 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 Electrical Engineering Department. The instruction in Chemical Engineering I and II, and Industrial Chemistry II is of a distinctly professional nature.

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.

Owing to the abnormal demand for admission to certain courses, it may be necessary in the future to limit the number of students in these courses by maintaining specially high standards of admission thereto. It is probable that this limitation may have to be imposed immediately in the course in Chemical Engineering.

CHEMICAL ENGINEERING—COURSE X-A

With School of Chemical Engineering Practice

The chemical industries of the United States demand more insistently each year that there be provided that training which will produce a creative chemical engineer. This is a man who has acquired a solid foundation in science, has become a keen and accurate observer, an exact and logical thinker, and who

has a love for the application of this knowledge and training to the investigation and solution of the many problems which modern industry presents. While the four-year course in Chemical Engineering described on the preceding pages is fundamental in its character, it lacks two essential elements in the development of the man who can most efficiently fill the increasing demand for technical directors in chemical manufacturing plants and leaders of industrial research. These are, first, a systematic knowledge, acquired by direct contact in the works, of the most important types of machines, structures, and processes involved in the chemical industries, and their interpretation in terms of physics, chemistry, and mechanics; and, second, an opportunity to profit by advanced courses in science and by further training in the methods of scientific research which become doubly valuable after this period of intensive practice in the applications of the principles of science to the problems of industry.

The Institute therefore now offers a five-year course in Chemical Engineering, including a School of Chemical Engineering Practice and a year of advanced study, for the completion of which the degree of Master of Science will be awarded.

The first four years of the course are practically the same as those for the course in Chemical Engineering. Application for admittance to this school must be made during the first part of the fourth year. At the end of the fourth year students enter the School of Chemical Engineering Practice, where they remain until the end of the first term of the fifth year.

This school is carried on in four separate instructional centers or stations, established and operated by the Institute, in the industries. The class will be distributed among them in groups of equal size. These groups will remain at each station for a period of seven weeks, and will then rotate. The work of the last two terms of the fifth year is advanced in character and broad in scope and wholly elective.

CHEMISTRY—COURSE V

The course in Chemistry provides fundamental training in inorganic, analytical, organic, theoretical and industrial chemistry, in both classroom 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 growing appreciation of the importance of chemical science, especially in its technical applications, has created an active demand in widely different fields for graduates with a thorough chemical training. It is believed, however, that this demand can best be met by making this training fundamental and common to all students for the first three years of the course with opportunity for an optional selection of subjects during the last year, which will allow the individual student to pursue that branch of the science (or related sciences) which most appeals to him.

In any scientific career, the highest success is attained by those who possess an ability to surmount difficulties as they appear, to attack untried problems systematically, and to use knowledge already acquired to advance the boundaries of the science. This is particularly true of chemical science. In particular, it is the purpose of the Chemistry course to foster this spirit, and the subjects designated as " Experimental Problems" in the third and fourth years, as well as the thesis required of all students, are designed to develop these powers. In these courses each student is assigned a small piece of investigation work, which he is expected to study, plan, and execute, under reasonable guidance from an instructor, and to present his results in the form of a carefully prepared report. The extensive equipment of the various laboratories is fully utilized for this work. For those students who show special aptitude for such work, opportunity for advanced research is offered in the Research Laboratories of Physical Chemistry, and that of Applied Chemistry. The instruction in Theoretical Chemistry is also especially designed to develop power on the part of the student.

The optional subjects afford an opportunity to acquire

specialized practice in such subjects as water supplies, foods, oils, gas, sugars and starches, and the methods of proximate technical analysis.

CIVIL ENGINEERING—COURSE I

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, including the making of geodetic and geological surveys and surveys for engineering construction; transportation engineering, consisting of the building of railroads, highways, canals, docks, harbors, and other works serving the purpose of commerce and transportation; municipal engineering, including the construction of sewers, waterworks, roads, and streets; structural engineering, consisting of the construction of bridges, buildings, walls, foundations and all fixed structures; hydraulic engineering, including the development of water power and public water supplies, the improvement of rivers and the reclamation of land by irrigation. All of these branches of engineering rest upon a relatively compact body of principles, and in these principles the students are trained by practice in the classroom, the drafting-room, the field and the testing laboratory.

In the comparatively advanced work of the fourth year, the student is offered a choice between two options or lines of study; namely, a general option in civil engineering, including the study of hydraulic and sanitary engineering in considerable detail and an option in which more than usual attention is devoted to railroads and railroad management.

ELECTRICAL ENGINEERING — COURSE VI

Great importance is attached in Electrical Engineering to the study of mathematics, chemistry, physics and applied mechanics in the earlier years, and of the theory of electricity and magnetism beginning in the second year and continuing throughout the remainder of the course. Along with these are associated the essential principles of steam engineering, hydraulic power engineering, the designing of structures and machines and of political economy. The electrical engineering lectures of the junior and senior years 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 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 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 importance of work of the nature of scientific research is emphasized. Research laboratories are provided and meetings are held monthly at which the progress of research work being carried on is reported and discussed. The historical development of the electrical sciences and arts is discussed in monthly meetings of an electrical engineering seminar. These meetings are open to all students.

ELECTRICAL ENGINEERING — COURSE VI-A

Maintained in Co-operation with the General Electric Company

This course is conducted by the Institute in co-operation with the General Electric Company and affords a distinctive

training for the technical and executive responsibilities of the electrical manufacturing industries. The course covers a period of five years, the first two identical with Course VI, and the last three equally divided between instruction at the Institute and practical training at the West Lynn or other works of the General Electric Company. The instruction in the first four years is similar in method and content to Course VI, with minor omissions and abridgments. The work of the final year is of a distinctly advanced nature, with emphasis on problems of administration, the design and development of engineering projects and creative research. The training at the works is laid out and conducted with a view to the maximum educational value and is intimately correlated with the professional instruction at the Institute. In the final year of this training considerable latitude may be exercised in the assignment of men to posts in engineering and research bureaus with a view to utilizing and developing individual aptitudes.

The co-operative training occupies three calendar years, beginning in June at the end of the second year of the course, and is divided into ten periods. The first eight periods, each of approximately four months, are spent alternately in residence at the Institute and in training at the works. During this time each class is divided into two sections which exchange places at the end of each period. The ninth period occupies nine weeks and is spent by the two sections jointly at the works. The final period of ten weeks is spent by both sections at the Institute. The three years of co-operation include vacation periods amounting to about nine weeks. At the conclusion of the prescribed work an optional period of fourteen weeks at the works is offered.

The successful completion of the course leads to the degree of Master of Science, together with the Bachelor's degree as of the preceding year. The number of men who may be admitted to the co-operative training each year is at present limited to forty. Candidates for admission are subject to the approval of both the Institute and the General Electric Company. On account of the limitations of number and the unitary nature of the training, men who are admitted to the course with the approval of both parties are expected to carry it through to

completion unless prevented by exceptional circumstances. Well qualified students who have completed at other institutions the substantial equivalent of the work of the first two years may be admitted on advanced standing at the beginning of the co-operative training. Students in training at the works are subject to the usual regulations of the Company. They receive regular compensation for their work, the total of which considerably exceeds the tuition charges for the three years of co-operation. The work in the shops, testing departments and engineering divisions is supplemented by conferences with the department heads in which technical and administrative problems arising in the works are intimately discussed. At the conclusion of the course graduates are free to accept employment wherever offered without further obligation to the General Electric Company.

ELECTROCHEMICAL ENGINEERING — COURSE XIV

The course in Electrochemical Engineering aims primarily to prepare students to enter the various electrochemical and electrometallurgical 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 similar to those taken by students in electrical engineering, and include courses in the theory of direct and alternating currents, courses in direct and alternating current generators and motors and power transmission, with practice in the laboratories of electrical engineering and electrical testing. 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 heat 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 and third terms the instruction is continued by lectures on applied electrochemistry, including electro-deposition, accumulators, electric furnaces, and their products, electrolytic processes, and electrometallurgy, and by work in the laboratory of applied electrochemistry. Current periodical literature is reviewed in a weekly colloquium. The thesis required is also on some electrochemical topic.

Beyond the 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 who are fitting themselves for some special line of work.

ENGINEERING ADMINISTRATION — COURSE XV

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. 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. 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 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, railway drawing, stereotomy, and topographical drawing. The graduates of this option are, however, well trained in the fundamental principles and professional subjects upon which the practice of civil engineering depends.

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, certain of the more specialized subjects. 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.

GENERAL SCIENCE AND GENERAL ENGINEERING COURSE IX, A AND B

General Science IX-A. — This course, largely elective, is designed to offer first a broad education along scientific lines and to provide subsequently, through its electives, for intensive training in some science. With the growing inter-relations of the sciences and the increasing applications of various sciences to everyday life there are distinct opportunities for students who have acquired a general knowledge of science previous to specialization. Furthermore, this course makes possible in the later years the choice of a considerable amount of such humanistic studies as English, modern language, history, and economics.

A schedule is suggested as affording approximately three terms of work in each of the fundamental subjects, mathematics, chemistry, physics, biology, and geology. (Substitutions may be allowed by the committee in charge of the course). The student must use his electives of the third and fourth

years, subject to the approval of the committee, in such a way as to attain in some branch of science the real proficiency which will enable him to write a creditable thesis. Those who are able to continue in graduate work will be eligible for the Master's and Doctor's degrees as in other courses.

General Engineering IX-B. — This course is designed to meet the needs of those who desire a training in fundamental engineering subjects and who either do not wish to specialize in any particular branch of engineering to the extent demanded by one of the regular engineering courses, or who may wish to follow out some line or lines of work not provided for by the schedule of any particular engineering course.

A definite schedule, except for that portion listed as elective, has been prepared and is offered as one suitable for a broad training in engineering. Substitution of suitable subjects other than those listed will, however, be allowed by the committee in charge of the course in order to meet individual requirements and thus give flexibility to the course. There is also ample opportunity for the election of economic and business subjects, or of courses in literature and the languages.

GEOLOGY AND GEOLOGICAL ENGINEERING — COURSE XII

This course prescribes during the first two years the usual fundamentals taken by all the engineering and science courses. It also requires summer work in surveying and, throughout the upper years, a carefully arranged list of geologic subjects fundamental to one specializing in geology. A considerable amount of time is left for electives which may be chosen from either engineering subjects closely related to geology, such as mining engineering, or from more advanced geological subjects. The course is thus given considerable flexibility and can be adapted to the special needs of students desiring to specialize in one of the larger divisions of geologic science; the same flexibility makes it possible to adapt the course to the needs of students from other colleges who may have in part anticipated the prescribed studies of the course.

MECHANICAL ENGINEERING — COURSE II

Just as Civil Engineering, which embraces outdoor engineering of all sorts, is the oldest and earliest developed branch of the profession, so Mechanical Engineering ranks next in point of time and development as the foundation of all industrial progress. It is essentially the engineering of design and production in industry.

The course in Mechanical Engineering prepares the student to enter any one of a number of branches of that profession. Besides machine design, with its specialties, engine design, power plant design, locomotive construction, steam turbine engineering and mill engineering, courses are offered in the upper years preparing for heat and ventilation engineering, refrigeration and hydraulic engineering, factory construction, and industrial management. There is also some work in Electrical Engineering, sufficient for the handling of ordinary problems.

The work of the first two years is made up of the fundamentals for all these professions. It 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 for the successful designer of machinery. Mechanism, mechanical drawing, precision of measurements, are, of course, essentials in this preparatory work. Beginning with the third year the student may begin to specialize in his chosen field. All courses offer, parallel with the classroom work, a sufficient amount of laboratory work to assist the student in getting a thorough grasp of his subject.

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 all 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 choice of several professional electives.

MINING ENGINEERING AND METALLURGY — COURSE III

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. The broad foundations laid in scientific and engineering subjects also give a student the general training he needs if he intends to follow technical enterprises other than mining and metallurgy.

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 and in the Summer School of Surveying, of Mining and of Metallurgy.

Graduate 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.

NAVAL ARCHITECTURE AND MARINE ENGINEERING
COURSE XIII

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.

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 co-ordination 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 manœuvring, 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.

A course of lectures is given to the United States Naval Constructors on "The Design and Construction of Merchant Ships."

While the fundamental principles of design are the same for all kinds of ships, the relative importance of the various factors is very different. Such items as economy of cost both during construction to reduce capital charges and when in commission so as to minimize working expenses, the influence of marine insurance, and the rules of the Registration Societies, the commercial limit of economical speed in relation to length of voyage, the stability at beginning and end of voyage and its effect on the behaviour of the ship at sea, the freeboard and tonnage laws, types of propelling machinery, and the general sequence of work in the shipbuilding yard are described, and their effects on the problems of design are discussed.

PHYSICS — COURSE VIII

The position of Physics in science and engineering is so fundamental that it is imperative to offer a course in Physics, both theoretical and industrial, wherein the instruction shall be so organized as to carry the study of the basic sciences, mathematics, physics, and chemistry through the Junior and into the Senior year. The student thus equipped is fitted to apply his knowledge in a broad way to existing industries or to conduct scientific investigations for the industry of the future and for science itself. A considerable part of the Senior year's work is left elective so that the student may be free to follow his own bent.

Option 1. Industrial Physics. The demand for the industrial physicist is great and increasing. Large corporations have already come, and smaller ones are rapidly coming to realize that they must have in their employ men capable of dealing with old and new problems of which the solution involves a thorough knowledge of physical instruments, of physical properties of matter, and of methods of scientific procedure. To enable the student to fit readily into the industry, a large amount of engineering work is offered in the Senior year, in part at the expense of continued work in science.

Option 2. Theoretical Physics. Our higher institutions of learning, great business concerns like the United States Government, and the General Electric Company, maintain large research laboratories where the pure scientist shall carry on

investigations for the future in addition to the present. To fit students for these activities the option in theoretical physics continues the work in pure physics to the end of the Senior year instead of turning aside in large part into engineering as does Option 1.

The Department reserves the right to limit admission to Course VIII above the Sophomore year to that number of students (at present about twelve or fifteen in each class) who may be properly trained with the professional equipment available. The limitation if necessary will be effected by the selection of the applicants of highest grade.

In this department graduate work in Aeronautical Engineering is given. The subjects treated in the course of Aeronautical Engineering are dynamics of rigid bodies, fluid dynamics, theoretical and experimental, aeronautical engines and meteorology; also the theory and practice of aeroplane design, airship design and propeller design; students are given practice in the aerodynamical laboratory and are required to present a thesis.

SANITARY ENGINEERING — COURSE XI

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, in the following particulars:

There is a reduction in the time devoted to railroads and bridges, and an entire omission of the courses in 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 co-operate 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.

Options in General Studies. — All students in regular courses in the third and fourth years, except in Architecture and Engineering Administration, are required to devote a specified amount of time to elective work in general studies. The division of this time between exercises and preparation varies for the different subjects.

The object of these options is to promote breadth of intellectual interest. Most of the student's time beyond the second year is devoted directly, or indirectly, to increasing his future professional efficiency. Even in the earlier years this has been the underlying purpose of most of the work.

Without attempting any discrimination between general and professional, or liberal and technical studies, the Faculty has aimed to include in the list of general studies subjects so far removed from the professional field that the student shall acquire in some measure new points of view and a wider mental horizon. Even subjects which have an implied relationship to the professional fields are presented with such emphasis on their broader general aspects as to serve the purpose indicated.

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, XI, XII.

Summer Reading. — All students who are candidates for the Bachelor's degree of the Institute are required by the Faculty to complete a prescribed course of reading of a non-professional character during the summer following the first school-year. A written paper on each of the works read during the summer is required at the beginning of the next school-year.

The purpose of this course is to increase the acquaintance of the student with modern history and political and social topics, 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. The books are selected for their value from the point of view of general training, and the attempt is made to include only readable and attractive modern works.

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 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. As noted above, certain entrance subjects are given at the Institute in the summer. These courses are referred to in connection with entrance requirements.

Examinations. — General examinations are held each year in December and in June. The December examinations are confined to the work of the first part of the year. The June examinations may cover the work of the entire year. In the March recess condition examinations for the first term subjects are held. Examinations for students conditioned in June

in subjects of the first, second, and third years are held on the Thursday preceding the September entrance examinations and following days. In the fourth year the June 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. After September, 1920, a fee of five dollars will be charged for each condition examination taken by any individual student except in cases of valid excuse, and beginning January 1, 1921, a charge of five dollars will be made for each deficiency removed.

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.

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. As noted above, because of the limited accommodations due to the abnormal demand for certain courses, specially high standards may be required of candidates for admission to these courses. Exceptions to this rule may be made in individual cases after special consideration by the Faculty.

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.

Reports of Standing. — Intermediate informal reports are sent during the term; formal 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 at the beginning of the term, but reports will be sent to a parent or guardian in any other case also on application to the Regis-

trar, and notification will be made to parents or guardians in all cases of students advised or required to withdraw, or placed on probation.

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

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, 8x10½ 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 cannot 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.

Graduate Courses of Study and Research. — In addition to the regular prescribed courses leading to the Bachelor's degree, the Institute offers to its graduates and to graduates of other Scientific Schools, Universities, and Colleges of good standing who have the requisite preparation, the opportunity for advanced study and research leading to the degrees of Master of Science, Doctor of Philosophy, and Doctor of Science. The value of graduate study cannot be overestimated. 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 leading to the Master's degree. 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 textbooks, 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 Science are awarded by the Institute for advanced study and research 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, and the Aerodynamic Laboratory.

For more detailed information see the special Bulletin on Advanced Study and Research.

Educational Buildings. — The plans for the development of the Institute on its new site provide for the utilization of the entire fifty acres and are the result of years of the most careful expert study and investigation. As a result the Institute now possesses an entirely new plant that is unrivaled in its facilities and adaptation to the purposes of technological instruction. The most important part of the buildings now completed consists of the Educational Group, comprising distinct but connected units which occupy and enclose an area of about thirteen acres with a floor space of about fifteen acres. As the need arises new building units will be added until ultimately this group will enclose an area of about thirty acres with a floor area of about thirty-five acres. Within this group of buildings is carried on all the educational work of the Institute except that in the Department of Architecture, which for the present will be given in the Rogers Building on the old site on Boylston Street in Boston.

Libraries. — The Library of the Institute contains about one hundred and twenty-five thousand volumes and fifty thousand pamphlets and maps, and receives regularly eight

hundred and seventy periodicals. It includes the Central Library and a number of Departmental Libraries and Reading Rooms.

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 is 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.

The system of laboratory instruction now includes the following:

The Mechanical Engineering Laboratories, including the Laboratory of Steam and Compressed Air, the Hydraulic Laboratory, the Refrigeration Laboratory, the Testing Materials Laboratories, the Gas Engine Laboratory, the Power Measurement Laboratory, and the Laboratories of Mechanic Arts.

The Laboratories of Mining Engineering and Metallurgy.

The Laboratories of Chemistry.

The Research Laboratories of Physical Chemistry.

The Research Laboratory of Applied Chemistry.

The Laboratories of Electrical Engineering.

The Research Laboratories of Electrical Engineering.

The Laboratories of Biology and Public Health.

The Laboratories of Physics, including Laboratories of General Physics and the special Laboratories of Heat Measurements, Physico-Chemical Measurements, and Electrochemistry.

The Mineralogical and Geological Laboratories.

The Aerodynamic Laboratory.

The Institute laboratory work is effectively supplemented by visits to engineering and industrial establishments, and by excursions directed by members of the Faculty.

Further information may be obtained by addressing the Massachusetts Institute of Technology, Cambridge 39, Mass.

5-20-3,000-T. P.