M.I.T. ANNUAL CATALOGUES AND BULLETINS
1873/74 01 OF 01

Massachusetts Institute of Technology.

NINTH

ANNUAL CATALOGUE

OF THE

OFFICERS AND STUDENTS,

WITH

A STATEMENT OF THE COURSES OF INSTRUCTION

1873-74.

BOSTON:
PRESS OF A. A. KINGMAN.
1873.

Massachusetts Institute of Technology.

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CONTENTS.

Extracts from Acts of the General Court of Massachusetts, in relation to the Massachusetts Institute of Technology.

Act of Incorporation. "William B. Rogers [and others named], their associates and successors, are hereby made a body corporate, by the name of 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 sciences in connection with arts, agriculture, manufactures, and commerce."

Chapter 183, *Acts and Resolves of* 1861.

Grant of Public Lands. "When the Massachusetts Institute of Technology shall have been duly organized, located, and established, ... there shall be appropriated and paid to its treasurer, each year, on the warrant of the Governor, for its endowment, support, and maintenance, one third part of the annual interest or income which may be received from the fund created under and by virtue of the 130th chapter of the Acts of the 37th Congress, at the second session thereof, approved July 2, 1862 [giving Public Lands to the States in aid of instruction in Agriculture the Mechanic Arts, and Military Science and Tactics]. . . . . Said Institute of Technology, in addition to the objects set forth in its Act of Incorporation [as above quoted], shall provide for instruction in military tactics."

Chapter 186, *Acts and Resolves of* 1863.

Power to confer Degrees. "The Massachusetts Institute of Technology is hereby authorized and empowered to award and confer degrees appropriate to the several courses of study pursued in said Institution, on such conditions as are usually prescribed in universities and colleges in the United States, and according to such tests of proficiency as shall best promote the interests of sound education in this Commonwealth."

Chapter 247, *Acts and Resolves of* 1868.

CORPORATION

OF THE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR 1873-74.

President,

JOHN D. RUNKLE.

Secretary,	Treasurer,
SAMUEL KNEELAND.	JOHN CUMMINGS.

Committee on the School of Industrial Science,

JOHN A. LOWELL, *Chairman.*
EDWARD ATKINSON,
PHILLIPS BROOKS,
J. ELLIOT CABOT,
GEORGE B. EMERSON,
SAMUEL K. LOTHROP,
JOHN D. PHILBRICK,
HENRY B. ROGERS,
WILLIAM B. ROGERS,
J. BAXTER UPHAM.

Committee on the Museum,

ERASTUS B. BIGELOW, *Chairman.*
THOMAS T. BOUVÉ,
CHARLES H. DALTON,
JOSEPH S. FAY,
FRED. W. LINCOLN,
JAMES L. LITTLE,
AUGUSTUS LOWELL,
M. D. ROSS,
STEPHEN P. RUGGLES,
SAMUEL D. WARREN.

Committee on the Society of Arts,

MARSHALL P. WILDER, *Chairman.*
CHARLES L. FLINT,
JAMES B. FRANCIS,
H. WELD FULLER,
J. C. HOADLEY,
HENRY P. KIDDER,
HORACE McMURTRIE,
E. R. MUDGE,
ALEXANDER H. RICE,
EDWARD S. TOBEY.

Committee on Finance,

JAMES M. BEEBE, *Chairman.*
J. INGERSOLL BOWDITCH,
J. WILEY EDMANDS,
WILLIAM ENDICOTT, JR.
JOHN M. FORBES,
NATHANIEL THAYER.

On the Part of the Commonwealth,

HIS EXCELLENCY, GOVERNOR WILLIAM B. WASHBURN.

HON. HORACE GRAY, *Chief Justice of the Supreme Court.*

HON. JOSEPH WHITE, *Secretary of the Board of Education.*

OFFICERS OF INSTRUCTION.

President.

JOHN D. RUNKLE, PH.D., LL.D.

JOHN D. RUNKLE, PH.D., LL.D.
Walker Professor of Mathematics and Mechanics.

JOHN B. HENCK, A.M.,
Hayward Professor of Civil and Topographical Engineering.

WILLIAM R. WARE, S.B.,
Professor of Architecture.

WILLIAM P. ATKINSON, A.M.,
Professor of English and History.

GEORGE A. OSBORNE, S.B.,
Professor of Mathematics, Astronomy, and Navigation.

EDWARD C. PICKERING, S.B.,
Thayer Professor of Physics.

SAMUEL KNEELAND, A.M., M.D.,
Professor of Zoölogy and Physiology.

JOHN M. ORDWAY, A.M.,*
Professor of Metallurgy and Industrial Chemistry.

JAMES M. CRAFTS, S.B.,
Professor of Analytical and Organic Chemistry.

ROBERT H. RICHARDS, S.B.,
Professor of Mining Engineering, in charge of the Mining and Metallurgical Laboratories.

THOMAS STERRY HUNT, LL.D.,
Professor of Geology.

GEORGE H. HOWISON, A.M.,
Professor of Logic and the Philosophy of Science.

S. EDWARD WARREN, C.E.,
Professor of Descriptive Geometry, Stereotomy, and Drawing.

WM. RIPLEY NICHOLS, S.B.,
Professor of General Chemistry.

CHARLES P. OTIS, PH.D.
Professor of Modern Languages.

HENRY L. WHITING, U. S. Coast Survey,
Professor of Topography.

HENRY MITCHELL, A. M., U. S. Coast Survey,
Professor of Physical Hydrography.

ALPHEUS HYATT, S.B., Custodian of the Boston Society of Natural History,
Professor of Palæontology.

* The instruction in Botany is at present given by Prof. Ordway.

WILLIAM H. NILES, PH.B., A.M.,
Professor of Physical Geology and Geography.

LIEUT. E. L. ZALINSKI, U. S. A.,
Professor of Military Science and Tactics.

CHARLES R. CROSS, S.B.,
Assistant Professor of Physics.

GAETANO LANZA, S.B., C.E.,
Assistant Professor of Mathematics and Mechanics.

CHANNING WHITAKER, S.B.,
Assistant Professor of Mechanical Engineering.

ERNEST SCHUBERT,
Instructor in Free-Hand and Machine Drawing.

EUGENE LETANG,
Assistant in Architecture.

JOHN A. WHIPPLE,
Instructor in Photography.

WILLIAM E. HOYT, S.B,
Instructor in Civil Engineering and Drawing.

E. C. F. KRAUSS,
Instructor in German.

CHARLES KASTNER,
Lowell Instructor in Practical Design.

EDWARD K. CLARK, S.B.,
Instructor in Mechanical Drawing.

FOSTER E. L. BEAL, S.B.,
Instructor in Mathematics.

CHARLES E. STAFFORD, S.B.,
Instructor in the Mining and Metallurgical Laboratories.

WEBSTER WELLS, S.B.,
Instructor in Mathematics.

CLARENCE S. WARD, S.B.,
Instructor in Quantitative Analysis.

FRANK B. MORSE, S.B.,
Instructor in Drawing.

JOHN B. HAMBLY,
Assistant in Free Hand and Mechanical Drawing.

CHARLES C. R. FISH,
Assistant in General Chemistry and Qualitative Analysis.

HENRY N. MUDGE,
Assistant in Mechanical Drawing.

DARWIN C. FOGG, *Janitor.*

FACULTY.

JOHN D. RUNKLE, PH.D., LL.D., *President.*
JOHN B. HENCK, A.M.
WILLIAM R. WARE, S.B.
WILLIAM P. ATKINSON, A.M.
GEORGE A. OSBORNE, S.B.
EDWARD C. PICKERING, S.B.
SAMUEL KNEELAND, A.M., M.D., *Secretary.*
JOHN M. ORDWAY, A.M.
JAMES M. CRAFTS, S.B.
ROBERT H. RICHARDS, S.B.
THOMAS STERRY HUNT, LL.D.
GEORGE H. HOWISON, A.M.
S. EDWARD WARREN, C.E.
WILLIAM R. NICHOLS, S.B.
CHARLES P. OTIS, PH.D.
E. L. ZALINSKI, U. S. A.
CHARLES R. CROSS, S.B.
GAETANO LANZA, S.B., C.E.
CHANNING WHITAKER, S.B.
E. C. F. KRAUSS.

STUDENTS.

RESIDENT GRADUATES.

NAME.	HOME.	RESIDENCE.
Brewster, Benj. E., S. B.	Boston	Boston.
Swallow, Ellen H., (A. M., *Vassar College*)	Boston	Boston.

REGULAR STUDENTS.

I. Civ. Eng.; II. Mech. Eng.; III. Min. Eng.; IV. Arch.; V. Chem.; VI. Metal.; VII. Nat. Hist.; VIII. Phys.; IX. Sci. and Lit.; X. Phil.

FOURTH YEAR.

NAME.	COURSE.	HOME.	RESIDENCE.
Austin, Charles D.	I.	Boston	380 Columbus Ave.
Barrows, Herbert	I.	Reading	Reading.
Barrus, George H.	II.	Reading	Reading.
Blunt, William T.	I.	East Somerville	East Somerville.
Burrison, Henry K.	I.	Boston	156 Saratoga St.
Doane, George E.	I.	Middleboro'	Middleboro'.
Dowse, William B.	IV.	Boston	350 Columbus Ave.
Emerson, Joseph S.	I.	Hawaiian Is.	209 W. Springfield St.
Holbrook, Elliot	I.	E. Abington	E. Abington.
Hongma, Aechirau	I.	Fukuoka, Japan	114 Chandler St.
Howard, Charles P.	I.	Hartford, Conn.	16 Chester Sq.
Jackson, Frank H.	III.	Brighton	Brighton.
Means, Walter K.	I.	Boston	8 Ashburton Pl.
Myrick, Willis H.	II.	Peterboro', N. H.	30 Dwight St.
Perkins, Herbert B.	I.	Ware	Watertown.

NAME.	COURSE.	HOME.	RESIDENCE.
Pond, Frank H.	II.	Woonsocket, R. I.	114 Chandler St.
Shaw, Edward S.	I.	Cambridge	Cambridge.
Silsbee, Francis H.	II.	Salem	Salem.
Sweetser, Arthur W.	I.	Cliftondale	Cliftondale.
Ware, Robert C.	IX.	Marblehead	Marblehead.
Wilder, Stephen H.	IX.	Cincinnati, O.	117 Chandler St.

THIRD YEAR.

Boyden, Amos J.	IV.	Foxboro'	34 Temple Pl.
Burnet, Moses D.	III.	Syracuse, N. Y.	298 Columbus Ave.
Church, Chris. A., Jr.	I.	New Bedford	8 Allston St.
Dabney, Frank	V.	Fayal, Azores	34 Lambert St.
Dabney, Herbert	V.	Fayal, Azores	34 Lambert St.
Dabney, Wm. H., Jr.	IV.	Teneriffe, Canaries.	411 Beacon St.
Dodge, Frank S.	I.	Beverly.	Beverly.
Dorr, Edgar S.	I.	Mt. Auburn	Mt. Auburn.
Edes, William C.	I.	Bolton	372 Dudley St.
Frye, George B	III.	Boston	Boston Highlands.
Goodale, Charles W.	III.	Hudson	614 Ninth St.
Hammatt, Edw'd A. W.	I.	Newton Centre	Newton Centre.
Handy, Edward A.	I.	Barnstable	221 Shawmut Ave.
Head, James H.	II.	Brookline	Brookline.
Hibbard, Thomas	II.	West Roxbury	West Roxbury.
Huntington, Wm. F.	I.	Springfield	221 Shawmut Ave,
Jackson, Frank (*A.B., Harvard College*)	I.	Boston	88 Marlborough St.
King, Frank T.	III.	Buffalo, N. Y.	298 Columbus Ave.
Kinnicutt, Leonard P.	V.	Worcester	94 Chestnut St.
Knowles, J. Frank	I.	New Bedford	8 Allston St.
Lewis, Wilfred	II.	Philadelphia, Pa.	53 Temple St.
Lincoln, Edwin H.	I.	Brookline.	Brookline.
Mixter, Samuel J.	IX.	Boston	219 Beacon St.
Oxnard, Benjamin A.	III.	Jamaica Plain	Jamaica Plain.
Palmer, Fred. M.	I.	Boston	426 Broadway.
Phipps, David W.	X.	Boston	31 Leverett St.
Plimpton, Thomas D.	II.	Walpole.	Walpole.
Powell, John H.	V.	Newport, R. I.	7 West Cedar St.
Prentiss, William A.	X.	Holyoke	117 Chandler St.
Sargent, Francis T.	II.	Malden.	Malden.
Sargent, Welland F.	I.	Sedgwick, Me.	9 Oliver Place.

NAME.	COURSE.	HOME.	RESIDENCE.
Shockley, William H.	III.	New Bedford	335 Columbus Ave.
Stanwood, James B.	II.	Cincinnati, O.	Arlington.
Warren, Henry L. J.	III.	Boston	16 Marlborough St.

SECOND YEAR.

Allen, Charles F.	Cincinnati, O.	98 Pembroke St.
Aspinwall, Thomas, Jr.	Brookline	33 Hancock St.
Atwood, William P.	Lowell	Lowell.
Baker, Eugene B.	Auburndale	Auburndale.
Bakewell, Thomas H.	Pittsburg, Pa.	335 Columbus Ave.
Barrows, Walter B.	Reading	Reading.
Beal, B. Leighton	Boston	Hotel Dudley.
Blodgett, Aaron D.	Boston	83 Chambers St.
Brazer, Ralph F.	Lowell	Lowell.
Breed, Joshua B. F.	Louisville, Ky.	Lynn.
Buck, Waldo E.	Woburn	Woburn.
Buss, Edward A.	Auburndale.	Auburndale.
Buttolph, Harry T.	Buffalo, N. Y.	339 Tremont St.
Carney, William W.	Leavenworth, Kan.	98 Pembroke St.
Carr, E. Frederick	Quincy	Quincy.
Copeland, Frederick K.	Ridley Park, Pa.	Cambridge.
Cunningham, Caleb L.	Readville	Readville.
Davis, Lorenzo M.	New Bedford	67 Appleton St.
Davis, Willis E.	San Francisco, Cal.	43 St. James St.
Dennett, Clarence L.	Beverly	Beverly.
Fairbank, Warren H.	Harvard	Waltham.
Farr, Millard	Brooklyn, N. Y.	6 Tyler St.
Fletcher, Charles R.	Chelsea	Chelsea.
Freeman, John R.	W. Bridgton, Me.	Chelsea.
Frye, Charles R.	Salem	Salem.
Galloupe, Francis E.	Lynn	Lynn.
Gay, Martin	Staten Island, N. Y.	1281 Washington St.
Giles, Jabez E.	Rockport	Cambridge.
Gould, Robert H.	East Cambridge	East Cambridge.
Greeley, Frederick	Chicago, Ill.	81 Pinckney St.
Hapgood, Everett E.	Hudson	3 Crescent Place.
Hatch, John H.	West Medford	West Medford.
Henck, John B., Jr.	Brookline	Brookline.
Heustis, Charles H.	Hyde Park	Hyde Park.
Hodgdon, Frank W.	Arlington	Arlington.
Hollingsworth, Sumner	South Braintree	South Braintree.

NAME.	HOME.	RESIDENCE.
Holman, Silas W.	Framingham	Newton.
Hunt, Alfred E.	Hyde Park	Hyde Park.
James, Samuel, Jr.	Cambridgeport.	Cambridgeport.
Kilham, Alfred C.	Beverly	Beverly.
Learned, Francis M.	Allston	Allston.
Lewis, Theodore J.	Philadelphia, Pa.	53 Temple St.
Low, Albert H.	Chelsea	Chelsea.
Main, Charles T.	Marblehead	Marblehead.
Mills, Arthur L.	Everett	Everett.
Munroe, William R.	Lexington	Lexington.
Partridge, Edward J.	Boston	1332 Shawmut Ave.
Prichard, Charles F.	Marblehead	Marblehead.
Raeder, Henry	Hyde Park	Hyde Park.
Sawyer, Charles A.	Chicago, Ill.	18 Thornton St.
Schwarz, Theodore E.	Boston	157 Charles St.
Simonds, Henry	Lexington	Lexington.
Stimpson, Oliver D.	Boston	45 Chestnut St.
Susman, Julius H.	Boston	42 Upton St.
Townsend, Walter D.	Boston	10 Brimmer St.
Waite, Charles N.	Lowell	Woburn.
Waitt, Henry M.	Nantucket	349 Columbus Ave.
Whiting, George A., Jr.	Charlestown	Charlestown.
Wood, Henry B.	Woburn	Woburn.

FIRST YEAR.

Alden, John, 2d	Randolph	Randolph.
Austin, D. Henry	Lynn	Lynn.
Bartol, George	Lancaster	Charlestown.
Beal, John W.	So. Scituate	So. Scituate.
Beeching, William H.	Boston	117 Princeton St.
Bradford, William B.	Boston	Sumner St.
Brown, Frederic J.	Woburn	Woburn.
Brown, Harry A.	Lowell	375 Columbus Ave.
Capen, George W.	Canton	Canton.
Carter, Henry H.	Boston	55 St. James St.
Chamberlin, William E.	Cambridgeport	Cambridgeport.
Chapman, George H., 3d	Winchester	Winchester.
Coburn, Arthur B.	Charlestown	Charlestown.
Colcord, Jonathan M.	Boston	240 Shawmut Ave.
Colgan, Charles J.	Indianapolis, Ind.	Dorchester.
Cushing, Caleb, Jr.	Newburyport	44 Dover St.

NAME.	HOME.	RESIDENCE.
Decatur, Stephen, Jr.	Boston	13 West Cedar St.
Evans, Howard	Cincinnati, O.	5 St. James Ave.
Fairbanks, Warren E.	Caryville	Caryville.
Faunce, Linus	Kingston	Kingston.
Fisher, Charles H.	Canton	Canton.
Flint, William C.	Salem	Salem.
Frost, Walter S.	Boston	44 Winthrop St.
Geer, Robert D.	Springfield	564 E. Seventh St.
Gill, Clarence	N. Bridgewater	N. Bridgewater.
Glover, Albert S.	West Newton	West Newton.
Gowing, E. Harley	Reading	Reading.
Greenough, Walter C.	Cambridgeport	Cambridge.
Grover, Edmund	Walpole	Walpole.
Hallette, William L.	Springfield	82 Appleton St.
Hardman, John E.	Lowell	68 Brimmer St.
Harris, Charles L.	Lincoln, Neb.	375 Columbus Ave.
Hewitt, George H.	Springfield	82 Appleton St.
Hibbard, Henry D.	West Roxbury	W. Roxbury.
Holman, Francis C.	Boston	31 Bowdoin St.
Hopkins, Frank T.	Bridgewater	Bridgewater.
Kinney, George K.	Cincinnati, O.	5 St. James Ave.
Kittredge, George W.	No. Andover	No. Andover.
Knowles, Allan H., Jr.,	Yarmouth Port	Charlestown.
Leach, Lucius M.	No. Bridgewater	No. Bridgewater.
Lincoln, Arthur T.	Dennysville, Me.	108 W. Springfield St.
Locke, Frank B.	Rye, N. H.	Charlestown.
Lovering, George G.	Somerville	Somerville.
Macomber, Chandler	Boston	129 Concord St.
Monroe, Herbert J.	Fitchburg	Charlestown.
Mudge, Benjamin C.	Lynn	Lynn.
Norton, Charles H.	Charlestown	Charlestown.
Peabody, Frank E.	Boston	247 Berkeley St.
Peters, William M.	Jamaica Plain	Jamaica Plain.
Piper, Edward E.	Hyde Park	Hyde Park.
Plimpton, Arthur L.	Boston	7 Hawthorn St.
Rollins, Theodore B.	Wellesley	Wellesley.
Skinner, Frank C.	Lawrence	Lawrence.
Southworth, Harry C.	West Stoughton	West Stoughton.
Spalding, Frederic P.	Lowell	Lowell.
Stewart, Charles E.	Boston	363 Dorchester St.
Stimpson, Thomas F.	Swampscott	Swampscott.
Story, Isaac M.	Somerville	Somerville.

NAME.	HOME.	RESIDENCE.
Swain, George F. . . .	San Francisco, Cal. .	19 Ashland Pl.
Taber, Edward G. . . .	New Bedford . . .	67 Appleton St.
Taney, Edmund	Bangor, Me. . . .	73 E. Brookline St.
Temple, Francis W. . .	Boston	2 Myrtle St.
Thayer, Arthur W. . . .	Dedham	Dedham.
Tudor, Henry	Boston	28 Brimmer St.
Walker, Elliot	Pittsfield	Brookline.
Whidden, William M. . .	Boston	37 Upton St.
Wiggin, Frank E. . . .	Boston	11 Wyman St.
Wood, Frederick W. . .	Lowell	Lowell.

STUDENTS NOT CANDIDATES FOR A DEGREE.

[Students who are taking studies in different years are placed under the highest year, and the other years are indicated by the Arabic figures affixed. The Roman numerals show that a student is taking parts of the corresponding Regular Course.]

FOURTH YEAR.

NAME.	COURSE.	HOME.	RESIDENCE.
Adams, Joseph S. . .	V.	Framingham . . .	Framingham.
Allen, Samuel E. 3 . .	I.	Fall River	293 Columbus Ave.
Atwood, Heman D. (*S.B. and C.E., Univ. City of New York*) 3	I.	Jersey City, N. J. .	32 Village St.
Bouvé, Walter L. . .	I.	Boston	40 Newbury St.
Crosby, Wm. O. 3, 2	VII.	Georgetown, Col .	Cambridge.
Dodd, Arthur H. . .	IV.	Boston	137 Boylston St.
Faxon, John L. . . .	IV.	Longwood	Longwood.
Foster, William . . .	V.	Brookline	Brookline.
Haberstroh, Charles E.	I.	Boston	28 Sherman St.
Lodge, Francis G. . .	V.	Boston	1227 Washington St.
Nickerson, Wm. E. 3 .	V.	E. Somerville . . .	E. Somerville.
Sampson, Thomas H. .	II.	Charlestown . . .	Charlestown.
Simpson, Charles A. 3 .	V.	Saxonville	Newtonville.

THIRD YEAR.

Abbot, Samuel L., Jr. .	VI.	Boston	90 Mt. Vernon St.
Atkinson, Richard S. 2	IV.	West Roxbury. . .	West Roxbury.
Barnard, Edward H. .	IV.	Belmont	Belmont.
Boutelle, Clarence M. 2	I.	Chester, Minn. . .	57 Tremont St.
Bowditch, Frederic C. .	IX.	Brookline	Brookline.

NAME.	COURSE.	HOME.	RESIDENCE.
Bradford, Charles O. 2	II.	New Albany, Ind.	44 Dover St.
Cochran, Charles H.	IV.	E. Somerville	E. Somerville.
Conover, Frank 2	II.	Dayton, O.	788 Washington St.
Guŷs, Armand	V.	Quincy	Quincy.
Kilby, John Q.	IV.	Boston	21 Woodbine St.
King, Herbert G., (*B. S., Dartmouth College*) 2	IV.	Springfield	519 Columbus Ave.
Knapp, J. Austin 2	II.	Hanover	Hanover.
Little, Arthur	IV.	Boston	2 Commonwealth Av.
Locke, Augustus W. 2	I.	Rye, N. H.	Charlestown.
Morey, Charles A. 2	IX.	Lake City, Minn.	Somerville.
Nichols, Kingman S.	IV.	Wakefield	Wakefield.
Paine, Walter J.	IV.	Fall River	Fall River.
Patton, Normand S. (*A.B., Amherst College*)	IV.	Chicago, Ill.	537 Fourth St.
Peck, Louis W.	II.	Providence, R. I.	21 Gray St.
Rich, Charles L. 2	I.	Morrisville, Vt.	E. Somerville.
Richardson, Wm. C.	IV.	So. Lawrence	So. Lawrence.
Roby, Luther A.	II.	Nashua, N. H.	85 Lexington St.
Stickney, Fred. W.	IV.	Lowell	Lowell.
Taylor, Jacob M.	I.	Brighton.	Brighton.
Very, Frank W.	IX.	Salem	Salem.
Webster, William R.	III.	Philadelphia, Pa.	287 Columbus Ave.
Willard, William P.	I.	Boston	20 Oak St.

SECOND YEAR.

Allen, Robert H.		Walpole	Walpole.
Avery, George C.		Louisville, Ky.	293 Columbus Ave.
Cabot, William R.	II.	Brookline	Brookline.
Caldwell, Eliot L.		Fitchburg	Newtonville.
Davis, Edward W. 1		Boston	9 E. Newton St.
Draper, George A.		Milford	Milford.
Duncklee, Albert C. 1		Cambridge	Cambridge.
Dustan, Robert J. 2		Milton	Milton.
Flint, George L. 1		North Reading	46 Clarendon St.
Goodrich, Charles H.		Chicago, Ill.	293 Columbus Ave.
Hicks, Charles A.		Needham	Needham.
Hills, Edgar R.		Brookline	Brookline.
Homer, Joseph W. 1, 3		Boston	59 Winthrop St.
Hopps, Arthur D.		Lamoille, Ill.	63 Clarendon St.
Jaques, William W.		Newburyport	63 Clarendon St.
Jenney, Walter 1		Boston	525 Broadway.

NAME.	HOME.	RESIDENCE.
Lawrie, Andrew D. (*A.B., Amherst College*) . . .	Boston	480 Shawmut Ave.
Lord, John D.	Minnesota City, Minn.	63 Clarendon St.
Neal, George W.	Boston	289 Columbus Ave.
Norcross, Edward M. . .	Grantville	Grantville.
Norton, Lewis M. 3 . . .	Natick	Natick.
Slade, Abbott E.	Fall River	293 Columbus Ave.
Staniford, Daniel, Jr. . .	Boston	76 Highland St.
Wilson, Joseph M. 1 . . .	Charlestown . . .	Charlestown.

FIRST YEAR.

Atherton, James, Jr. . .	Stoughton	Stoughton.
Bell, William M. 3 . . .	Boston	9 Dwight St.
Berton, Edward F. 3 . .	St. John, N. B. . .	Newton.
Brown, Frederick W. 2 .	Boston	154 Charles St.
Brown, Merrill J. 3 . . .	Williamsburgh . .	12 Bond St.
Clarke, Charles A. . . .	Watertown . . .	Watertown.
Claussen, Francis F. . .	Cambridgeport . .	Cambridgeport.
Clement, Erskine . . .	Boston	7 Somerset St.
Cook, Charles B.	Chillicothe, O. . .	357 Columbus Ave.
Correa, John B. 3 . . .	Boston	65 Bainbridge St.
Cowdery, Edward G. . .	No. Andover . . .	No. Andover.
Everett, Arthur G. 3 . .	Boston	478 Shawmut Ave.
Hackett, Wallace . . .	Portsmouth, N. H. .	30 Chestnut St.
Higgins, Byron E.	Wellfleet	Charlestown.
Holbrook, Henry L. . . .	So. Abington. . . .	So. Abington.
Knott, Frank P.	Springfield, Mo. . .	334 Shawmut Ave.
Lane, Henry M.	Cincinnati, O. . .	207 Harrison Ave.
Locke, Alonzo S. . . .	Waltham	Waltham.
Nelson, George A. . . .	Lincoln	Charlestown.
Newbold, Frederick P. . .	New York, N. Y. .	
Newell, Charles H. . . .	Springfield	357 Columbus Ave.
Page, Edward D.	Rutland, Vt. . . .	Cambridge.
Plimpton, Walter H. . .	Boston	Clarendon House.
Pond, Wallace R. . . .	Rutland, Vt. . . .	
Prescott, Charles O. 2 . .	Westford.	Cambridgeport.
Reed, Frank	Charlestown . . .	Charlestown.
Sargent, Charles W. 2 . .	Boston	407 Columbus Ave.
Sherman, Frank I. . . .	Foxboro'	Foxboro'.
Wilson, John A. 3 . . .	Baltimore, Md. . .	67 Appleton St.
Woodward, Edwin C. . .	Damariscotta, Me. .	31 Lynde St.

STUDENTS IN PRACTICAL DESIGN.

NAME.	HOME.	RESIDENCE.
Anthes, John E.	Melrose.	Melrose.
Cowdery, Charles H.	Winchester	Winchester.
Faunce, Carroll S.	Boston	64 Forthfield St.
Hinckley, Howard G.	Boston.	14 Rutland St.
Johnston, Alexander S.	Charlestown	Charlestown.
Mabille, Henry P.	Roslindale	Roslindale.
Pennock, Salmon C.	Somerville	Somerville.
Pierce, Robert E.	Melrose	Melrose.
Sawyer, Henry H.	Charlestown	Charlestown.
Tarbell, John H.	Boston	45 Lawrence St.
Williams, Edward	Boston	S. Boston.
Barnard, Anne W.	Lynn	Lynn.
Barnard, L. F. S.	Lynn	Lynn.
Barnes, C. R.	Boston	23 Pinckney St.
Baxter, Winifred A.	Malden	Malden.
Greene, Caroline A.	Boston	129 West Newton St.
Hudson, Annie M.	E. Cambridge	E. Cambridge.
Hudson, E. Frances	E. Cambridge	E. Cambridge.
Jefferson, Mary I.	Melrose	Melrose.
Mendum, Elizabeth M.	Melrose	Melrose.
Ricker, M. Elizabeth	Dorchester	Dorchester.
Simonds, Kate T.	Boston	45 Dover St.
Stimers, Annie D.	New York, N. Y.	48 Charles St.
Torrey, Ella M.	Grantville	Grantville.
Wason, N. Rockwood	Brookline	Brookline.

GRADUATES IN 1868.

NAME.	RESIDENCE.	IN THE DEPARTMENT OF
Albert F. Hall	Charlestown	Mechanical Engineering.
Frank R. Firth	Boston	Civ. and Top. Engineering.
Charles E. Greene	Cambridge	" "
William E. Hoyt	Portsmouth, N. H.	" "
Walter H. Sears	Plymouth	" "
Charles A. Smith	Newburyport	" "
Joseph Stone	Charlestown	" "

NAME	RESIDENCE	IN THE DEPARTMENT OF
Ellery C. Appleton	Boston	Geol. and Min. Engineer'g.
Nelson W. Conant	Louisville, Ky.	" "
Charles C. Gilman	Chelsea	" "
Robert H. Richards	Boston	" "
Bryant P. Tilden	Boston	" "
James P. Tolman	Boston	" "
Eli Forbes	Clinton	Science and Literature.

GRADUATES IN 1869.

William R. Nichols	Boston	Chemistry.
Channing Whitaker	Lowell	Mechanical Engineering.
J. Rayner Edmands	Boston	" "
William H. Baker	Fitchburg	Civ. and Top. Engineering.
Howard A. Carson	Boston	" "

GRADUATES IN 1870.

Edward K. Clark	Bangor, Me.	Mechanical Engineering.
Daniel W. Willard	Jamaica Plain	" "
Russell H. Curtis	Jamaica Plain	Civil Engineering.
Sampson D. Mason	Concord	" "
Theodore F. Tillinghast	New Bedford	" "
Edmund K. Turner	Marblehead.	" "
N. Fred Merrill.	Cambridgeport	Chemistry.
Charles W. Hinman	W. Concord, Vt.	Mining Engineering.
Charles R. Cross	Newburyport	Science and Literature.

GRADUATES IN 1871.

Foster E. L. Beal	South Boston	Civil Engineering.
Addison Connor, (*A.B.*, *Tufts College*)	Boston	" "
Henry M. Cutler	San José, Cal.	" "
Elmer Faunce	Kingston	Mining Engineering.
Edward H. Foote	North Somerville	Civil Engineering.
Frank L. Fuller	Grantville	" "
Henry M. Howe, (*A.B.*, *Harvard College*)	Boston	Mining Engineering.
Albert H. Howland, (*A.M.*, *Amherst College*)	West Barnstable	Civil Engineering.

NAME.	RESIDENCE.	IN THE DEPARTMENT OF
G. Russell Lincoln	Philadelphia, Pa.	Mining Engineering.
William A. Pike	Dorchester	Civil Engineering.
George H. Pratt	Salem	Chemistry.
Edward W. Rollins	Concord, N. H.	Mining Engineering.
Walter W. Smith	Dayton, O.	Mechanical Engineering.
Charles F. Stone	Waltham	Mining Engineering.
Almarin Trowbridge, Jr	Charlestown	Mechanical Engineering.
Isaiah S. P. Weeks	West Barnstable	Civil Engineering.
Randal Whittier	Boston	Chemistry.

GRADUATES IN 1872.

Calvin Francis Allen	Boston	Civil Engineering.
William B. Dodge	Beverly	" "
Walter Shepard, (*A.B., Harvard College*)	Dorchester	" "
Frederic A. Emmerton	Salem	Chemistry.
J. Amory Herrick	Winchester	"
Charles S. Minot	Jamaica Plain	"
Bradford H. Locke	Charlestown	Mining Engineering.
James M. Hodge	Plymouth	" "
Clarence S. Ward	Bridgewater	" "
Richard H. Soule, (*A. B. Harvard College*)	Brookline	Mechanical Engineering.

GRADUATES IN 1873.

Amory Austin, (*A. B., Harvard College*)	Boston	Chemistry.
William E. Brotherton	Cincinnati, O.	"
Sam'l A. Fabens, Jr.	Marblehead	Civil Engineering.
Frederick L. Fisher	Medway	" "
William D. Harris	Boston	" "
William A. Kimball	Boston	Mechanical Engineering.
William C. May	Boston	Chemistry.
Frank B. Morse	Boston	Civil Engineering.
George Phillipps	Marshfield	Geol. and Mining Engin'g.
Henry A. Phillips	Chicago, Ill.	Architecture.
Robert A. Shailer	Boston	Civil Engineering.

NAME.	HOME.	DEPARTMENT.
Charles E. Stafford . .	Boston	Geol. and Mining Engin'g
Ellen H. Swallow, (*A. M.*, *Vassar College*) . .	Worcester . . .	Chemistry.
S. Everett Tinkham . .	Taunton	Civil Engineering.
Webster Wells . . .	Boston	" "
Randal Whittier, *S.B.* .	Boston	" "
Francis H. Williams .	Boston	Chemistry.
Louis F. Wood . . .	Wellesley . . .	"

SUMMARY.

Resident Graduates	2
Regular Students, fourth year	21
" " third "	34
" " second "	59
" " first "	68
Students not candidates for a degree, fourth year . .	13
" " " " third " .	27
" " " " second " . .	24
" " " " first " .	30
" in Practical Design.	25
Total, ...	303

CALENDAR.

School-year began	Monday, Oct. 6, 1873.
School-year ends	Saturday, May 30, 1874.
The next School-year will begin . . .	Monday, Sept. 28, 1874.
First Entrance Examinations . .	Monday, June 1, 1874, and Tuesday, June 2, 1874.
Second Entrance Examinations . .	Wednesday, Sept. 23, 1874, and Thursday, Sept. 24, 1874.
Examinations for advanced standing . .	Friday, Sept. 25, 1874.

COURSES OF INSTRUCTION.

The Massachusetts Institute of Technology provides a series of scientific and literary studies and practical exercises, embracing pure and applied mathematics, the physical and natural sciences with their applications, drawing, the English language, mental and political science, French, and German. These studies and exercises are so selected and arranged as to offer a liberal and practical education in preparation for active pursuits, as well as a thorough training for the various scientific professions. Ten Regular Courses, each extending through four years, have been established as follows: —

I. A Course in Civil and Topographical Engineering.
II. " " " Mechanical Engineering.
III. " " " Geology and Mining Engineering.
IV. " " " Building and Architecture.
V. " " " Chemistry.
VI. " " " Metallurgy.
VII. " " " Natural History.
VIII. " " " Physics.
IX. " " " Science and Literature.
X. " " " Philosophy.

These courses are identical during the first year; but for the three remaining years the studies in each course are selected and arranged with reference to the end in view.

In the professional courses non-professional studies generally end at the middle of the fourth year. The course for the second half of the year is then made up, and is mainly devoted to professional duties, including the preparation of the Thesis.

The courses in Natural History, Physics, Science and Literature, and Philosophy, differ somewhat from the others in having

a less distinctly professional character. The course in Natural History affords an appropriate general training for those whose ulterior object is the special pursuit of Geology, Mineralogy, Botany, Zoology, Medicine, Pharmacy or Rural Economy. The course in Physics is based on the mathematical and physical sciences, the course in Philosophy on the mathematical and philosophical sciences, and the course in Science and Literature on the sciences and modern literature, and each course offers a sound education as well as suitable preparation for any of the departments of active life.

In all the courses it is intended to secure to every student a liberal mental development and general culture, as well as the more strictly technical education which may be his chief object.

For proficiency in any one of these courses the degree of S.B., Bachelor of Science, is conferred.

Advanced courses of study have recently been established, and the degree of Doctor of Science authorized by a vote of the Corporation.

The Institute also provides annually several courses of instruction, scientific and literary, open to both sexes. At present these courses are free, being supported by the Trustee of the Lowell Institute. Fuller details are given on page 62.

REGULAR COURSES.

ALL COURSES. — FIRST YEAR.

			No. of Exercises	Hrs. per week
1	Algebra finished	1st half	45	3
	Plane and Solid Geometry reviewed	2d half	15	3
	Plane and Spherical Trigonometry	2d half	30	3
2	General Chemistry	1st half	60	6
	General Chemistry	2d half	30	2
	Qualitative Analysis	2d half	30	4
3	Structure of the Sentence	1st half	45	3
	Rhetoric	2d half	45	3
4	French		90	3
5	Mechanical Drawing and Elements of Descriptive Geometry and Perspective		90	6
6	Free Hand Drawing		90	3
7	Physiology and Hygiene	2d half	30	2
8	Military Science and Tactics		60	2

I. CIVIL ENGINEERING.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Descriptive Geometry	1st half	45	3
	Mechanical Drawing	1st half	45	6
	Theory and Use of Surveying Instruments	1st half	10	
	Surveying	2d half	45	3
	Topographical and Plan Drawing	2d half	45	6
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Survey and Location of Roads	1st half	45	6
	Construction of Roads	2d half	20	6
	Water supply, Drainage, etc.	2d half	25	6
	Stereotomy	1st half	30	2
	Drawing	1st half	30	2
	Field Practice		30	3
	Drawing		30	2
2	Calculus	$\frac{1}{4}$ year	25	3
	Applied Mechanics	$\frac{3}{4}$ year	65	3
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Stability of Structures	1st half	20	6
	Strength of Materials	1st half	25	6
	Structures of Stone	2d half	15	6
	Structures of Wood	2d half	10	6
	Structures of Metal	2d half	20	6
	Topography (Field Practice)	2d half	10	
	Physical Hydrography	2d half	10	
	Structure Drawing	2d half	45	6
	Building Materials	2d half	10	3
2	Mechanism of the Steam Engine	2d half	20	4
	Water power and Water wheels	2d half	25	4
3	Metallurgy of Iron	1st half	30	3
4	Applied Physics	2d half	30	2
5	German	1st half	45	3
6	Constitutional History	1st half	30	2
7	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

II. MECHANICAL ENGINEERING.

SECOND YEAR.

			No. of Exercises	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Descriptive Geometry	1st half	45	3
	Mechanical Drawing	1st half	45	6
	Theory and Use of Surveying Instruments	1st half	10	
	Principles of Mechanism	2d half	45	3
	Machine Drawing	2d half	45	6
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Machinery and Millwork	$\frac{2}{3}$ year	80	4
	Strength of Materials	$\frac{1}{3}$ year	40	4
	Mechanical Laboratory		30	2
	Machine Drawing		60	4
2	Calculus	$\frac{1}{4}$ year	25	3
	Applied Mechanics	$\frac{3}{4}$ year	65	3
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Principles of Thermodynamics	1st half	60	4
	Mechanism of the Steam Engine	2d half	25	4
	Water power and Water wheels	2d half	35	4
	Machine Drawing		90	6
	Mechanical Laboratory		90	6
2	Metallurgy of Iron	1st half	30	3
3	German	1st half	45	3
4	Constitutional History	1st half	30	2
5	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

III. MINING ENGINEERING.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Qualitative Analysis	1st half	45	6
	Quantitative Analysis	2d half	45	6
	Chemical Philosophy	1st half	45	3
	Theory and Use of Surveying Instruments	1st half	10	
	Botany	2d half	30	2
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Chemical Laboratory		90	
	General Quantitative Analysis (Lectures)	1st half	30	2
	Mineralogy	1st half	45	6
	Mining Engineering	2d half	45	3
	Strength of Materials	2d half	30	2
	Structural Palæontology	2d half	30	2
2	Calculus	$\frac{1}{4}$ year	25	3
	Applied Mechanics	$\frac{3}{4}$ year	65	3
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Ore dressing	$\frac{1}{4}$ year	15	3
	Metallurgy	$\frac{1}{2}$ year	45	3
	Assaying	2d half	10	
	Mining and Metallurgical Laboratory	2d half	75	10
	Chemical Laboratory		150	10
2	American Geology	1st half	40	3
	Coal and Ore Deposits	2d half	15	3
	Building Materials	2d half	10	3
	Chemical Geology	2d half	15	3
3	German	1st half	45	3
4	Constitutional History	1st half	30	2
5	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

IV. ARCHITECTURE.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Descriptive Geometry	1st half	45	3
	Mechanical Drawing	1st half	45	6
	Theory and Use of Surveying Instruments	1st half	10	4
	Perspective, Shades, and Shadows	2d half	30	2
	Mechanical Drawing	2d half	30	6
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	The Orders.	1st quar.	45	3
	Greek and Roman Arch. History	2d quar.	25	3
	Architectural History and Design	2d half	45	3
	Stereotomy	1st half	30	2
	Drawing	1st half	30	6
	Architectural Drawing		150	10
2	Calculus	$\frac{1}{2}$ year	25	3
	Applied Mechanics	$\frac{3}{4}$ year	65	3
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Theory of Architecture	1st half	30	2
	Theory of Architecture	2d half	30	3
	Architectural History and Design	2d half	15	3
	Architectural Drawing		150	10
2	Stability of Structures	1st half	20	6
	Strength of Materials	1st half	25	6
	Structures of Stone	2d half	15	6
	Structures of Wood	2d half	10	6
	Structures of Metal	2d half	20	6
	Building Materials	2d half	10	3
3	Applied Physics	2d half	30	2
4	German	1st half	45	3
5	Constitutional History	1st half	30	2
6	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

V. CHEMISTRY.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Qualitative Analysis *	1st half	45	6
	Quantitative Analysis	2d half	45	6
2	Chemical Philosophy	1st half	45	3
	Botany	2d half	30	2
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Chemical Laboratory		150	10
	General Quantitative Analysis (Lectures)	1st half	30	2
	Quant. Anal., Special Methods (Lectures)	2d half	30	2
	Mineralogy	1st half	45	6
	Industrial Chemistry	2d half	45	3
2	Chemical Physiology	1st half	30	2
	Structural Palæontology	2d half	30	2
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Chemical Laboratory		150	15
	Organic Chemistry (Lectures)		60	2
	Metallurgy	½ year	45	3
2	American Geology	1st half	40	3
	Chemical Geology	2d half	15	3
	Coal and Ore Deposits	2d half	15	3
	Building Materials	2d half	10	3
	Assaying	2d half	10	
3	Applied Physics	2d half	30	2
4	German	1st half	45	3
5	Constitutional History	1st half	30	2
6	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

VI. METALLURGY.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Qualitative Analysis	1st half	45	6
	Quantitative Analysis	2d half	45	6
2	Chemical Philosophy	1st half	45	3
	Botany	2d half	30	2
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Chemical Laboratory		150	10
	General Qnantitative Analysis (Lectures)	1st half	30	2
	Quant. Anal., Special Methods (Lectures)	2d half	30	2
	Mineralogy	1st half	45	6
	Industrial Chemistry	2d half	45	3
2	Chemical Physiology	1st half	30	2
	Structural Palæontology	2d half	30	2
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Ore-dressing	½ year	15	3
	Metallurgy	½ year	45	3
	Assaying	2d half	20	
	Mining and Metallurgical Laboratory	2d half	75	10
	Chemical Laboratory		150	10
2	American Geology	1st half	40	3
	Coal and Ore Deposits	2d half	15	3
	Building Materials	2d half	10	3
	Chemical Geology	2d half	15	3
3	German	1st half	45	3
4	Constitutional History	1st half	30	2
5	Philosophy of Science	1st half	45	3

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

VII. NATURAL HISTORY.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Chemical Philosophy	1st half	45	3
	Botany	2d half	30	2
2	Qualitative Analysis	1st half	45	6
	Quantitative Analysis	2d half	45	6
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Mineralogy	1st half	45	6
	Comparative Zoology	2d half	45	3
	General Quantitative Analysis (Lectures)	1st half	30	2
	Chemical Laboratory		90	6
2	Chemical Physiology	1st half	30	2
	Structural Palæontology	2d half	30	2
3	German		90	3
4	Physical Laboratory		60	2
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Special Zoology, Special Geology, Special Botany, or Special Stratigraphical Palæontology	Laboratory	180	12
2	American Geology	1st half	40	3
	Coal and Ore Deposits	2d half	15	3
	Building Materials	2d half	10	3
	Chemical Geology	2d half	15	3
3	Applied Physics	2d half	30	2
4	German		90	3
5	Constitutional History		60	2
6	Philosophy of Science	1st half	45	3
	Political and Industrial Geography	2d half	30	2

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

VIII. PHYSICS.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Qualitative Analysis	1st half	45	6
	Quantitative Analysis	2d half	45	6
	Chemical Philosophy	1st half	45	3
	Theory and Use of Surveying Instruments	1st half	10	
	Botany	2d half	30	2
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	Physical Laboratory		120	4
	Physics (additional Lectures)	2d half	30	2
2	Calculus	$\frac{1}{4}$ year	25	3
	Applied Mechanics	$\frac{3}{4}$ year	65	3
	Strength of Materials	2d half	30	2
3	General Quantitative Analysis (Lectures)	1st half	30	2
	Quant. Anal., Special Methods (Lectures)	2d half	30	2
	Chemical Physiology	1st half	30	2
	Chemical Laboratory	1st half	45	6
4	German		90	3
5	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
6	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Physical Research		150	10
	Advanced Physics	2d half	15	2
	Photography	1st half	15	4
	Lantern Projections	1st half	15	4
	Microscopy	2d half	15	4
	Electrical Measurements	2d half	15	4
2	Chemical Laboratory	2d half	75	10
3	Principles of Thermodynamics	1st half	60	4
4	German		90	3
5	Constitutional History		60	2
6	Philosophy of Science	1st half	45	3
	Political and Industrial Geography	2d half	30	2

In addition to the prescribed studies, French, or Spanish, may be taken in the Third Year, and Italian in the Fourth.

IX. SCIENCE AND LITERATURE.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Modern English Literature	1st half	45	3
	History	2d half	45	3
2	Chemical Philosophy	1st half	45	3
	Botany	2d half	30	2
3	Physics (Lectures)		90	3
4	French finished, German begun		90	3
5	Qualitative Analysis	1st half	45	6
	Logic	2d half	45	3
6	Descriptive Astronomy	1st half	30	2
	Physical Geography	2d half	30	2
7	Military Science and Tactics		60	2

THIRD YEAR.

1	History of Commerce and Industry		90	3
2	Advanced French		90	3
3	Chemical Physiology	1st half	30	2
	Structural Palæontology	2d half	30	2
4	German		90	3
5	Physical Laboratory		60	2
6	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2
7	History and Literature	1st half	30	2
	Political Economy	2d half	30	2

FOURTH YEAR.

1	Early English Literature	1st half	45	3
	Science of Language	2d half	45	3
2	Business Law	1st half	30	2
	Political and Industrial Geography	2d half	30	2
3	American Geology	1st half	40	3
	Chemical Geology	2d half	15	3
	Coal and Ore Deposits	2d half	15	3
	Building Materials	2d half	10	3
4	German		90	3
5	Constitutional History		60	2
6	Philosophy of Science	1st half	45	3
	Applied Physics	2d half	30	2

In addition to the prescribed studies, Spanish may be taken in the Third Year, and Italian in the Fourth.

X. PHILOSOPHY.

SECOND YEAR.

			No. of Exercises.	Hrs. per week.
1	Analytic Geometry	1st half	45	3
	Calculus	2d half	45	3
2	Modern English Literature	1st half	45	3
	Logic	2d half	45	3
3	French finished, German begun		90	3
4	Chemical Philosophy	1st half	45	3
	Botany	2d half	30	2
5	Physics (Lectures)		90	3
6	Descriptive Astronomy	1st half	30	2
7	Physical Geography	2d half	30	2
	Military Science and Tactics		60	2

THIRD YEAR.

1	Applied Logic	1st half	45	3
	Elements of Philosophy, viz.,	2d half	45	3
	(*a*) Its Definition and General Problems (3 lectures)			
	(*b*) The Solutions proposed by the several Schools (7 lectures)			
	(*c*) Résumé of the Terminology (5 lectures)			
	(*d*) Outlines of Psychology (30 lectures)			
2	History and Literature	1st half	30	2
	Political Economy	2d half	30	2
3	Advanced French		90	3
4	History of Commerce and Industry		90	3
5	German		90	3
6	Physical Laboratory		60	2
7	Outlines of Zoology	1st half	30	2
	General Geology	2d half	30	2

FOURTH YEAR.

1	Philosophy: Critical History of Systems	1st half	45	3
	Philosophy: Critical History of Systems	2d half	15	3
	Philosophy: Ethics	2d half	30	3
2	Philosophy of Science, viz.,	1st half	45	3
	(*a*) Theory of Induction—its precise nature as a Mental Process, its Conditions of Application, and its Five Auxiliary Methods (20 lectures)			
	(*b*) Classification of the Natural Sciences, with discussion of their Logical Connexion, and of the Logical System of each (10 lectures)			
	(*c*) Same treatment of the Mathematical Sciences (5 lectures)			
	(*d*) Logical Theory of the Calculus (10 lectures)			
	Science of Language	2d half	45	3
3	Early English Literature	1st half	45	3
4	German		90	3
5	Constitutional History		60	2
6	Business Law	1st half	30	2
	Political and Industrial Geography	2d half	30	2

In addition to the prescribed studies, Spanish may be taken in the Third Year, and Italian in the Fourth.

ADVANCED COURSES.

These courses are intended to afford to Bachelors of Science of this Institute, and others of equal attainments, the means of continuing their studies. For proficiency in them the degree of S. D., or Doctor of Science, has been authorized.

The particular course of study which a student wishes to pursue must be submitted in writing, and must meet the approval of the Faculty. The methods of instruction, whether by lectures, or projects, or practice in the field or in the laboratories, will be those best adapted to each case. Frequent examinations will be held to test the progress of the student; but in voluntary subjects no examination will be required.

The minimum term of residence of candidates for a degree will be two years; but occasional short absences, when the time is spent upon professional work by advice of the Faculty, will not be considered as interruptions of the student's residence.

A candidate will be required to present at least one printed thesis on some subject embraced in his course.

The usual final examinations for the degree will be held, and these, with all previous examinations and the thesis, will be the tests of the student's proficiency.

CONDITIONS OF ADMISSION.

Regular Courses. To be admitted as a regular student of the first year's class, applicants must have attained the age of sixteen years, and must pass a satisfactory examination in arithmetic (including the metric system of weights and measures), algebra through equations of the second degree, plane and solid geometry, French grammar through regular and irregular verbs,[1] English grammar and composition, rhetoric (so much

[1] The amount of French at present required is embraced in Part I. of Otto's Grammar, and the first twenty-five pages of Böcher's French Reader, or their equivalents. After 1874, the requirements in French will be increased.

as is included in the first part of Bain's Rhetoric, or its equivalent), and geography. In general, the training given at the best High Schools, Academies and Classical Schools, will be a suitable preparation for this School.

To be admitted as a regular student of the second year's class, applicants must be at least seventeen years of age, and must pass a satisfactory examination upon the first year's studies, besides passing the examination for admission to the first year's class; and a like rule applies to the case of applicants for admission into the classes of the succeeding years.

Graduates of Colleges will, in general, be presumed to have the requisite attainments for entering the third year as regular students, and may do so on satisfying the department which they purpose to enter that they are prepared to pursue their studies to advantage. Such students, if deficient in any of the scientific studies of the first two years, will have opportunities for making them up without extra charge, and will be required to pass an examination in them before entering upon the studies of the fourth year. Should they be already proficient in any of the general studies of the third and fourth years, they will be excused, if they wish, from attendance on the exercises in these subjects.

A knowledge of the Latin language is not required for admission; but the study of Latin is strongly recommended to persons who purpose to enter this School. Those who intend to take the course in Natural History will find it advantageous also to acquire the elements of Greek.

Persons not candidates for a degree will be allowed to enter special divisions of either of the courses,—as, for example, the classes of mathematics, chemistry, physics, drawing, engineering, metallurgy, architecture, natural history, etc., — on giving satisfactory evidence to the Faculty that they are prepared to pursue with advantage the studies selected. They must be present for examination at the times stated below, and will be required to pass the entrance examination prescribed for regular

students, except when the studies selected do not require a knowledge of certain of the subjects covered by that examination; in that case solid geometry and French may be omitted, and the examination in algebra may cover that portion of the subject only which precedes quadratics. Students may be admitted to the classes in drawing without examination.

An examination for admission to the first year's class will begin at 9 A. M., on the first Monday in June, and continue two days. A second examination will begin at 9 A. M., on the Wednesday preceding the last Monday in September, and continue two days. Attendance on both days of either examination is required. Applicants for advanced standing must present themselves at either the first or second entrance examination, as given above, and if they pass this examination, must present themselves for further examination at 9 A. M., on the Friday preceding the last Monday in September. Applications for admission at other times than the above will be received only when sickness or some other equally good cause has prevented attendance on the days prescribed. Copies of recent examination papers and further information in regard to the requirements for admission may be obtained by application to the Secretary of the Institute.

Advanced Courses. Bachelors of Science of the Institute may enter on these courses without examination. Bachelors of Arts, Science, or Philosophy of any other Institution may enter, on giving satisfactory evidence, by examination or otherwise, that they are qualified to pursue the course selected. Any person may enter who, by examination, is found qualified to take the degree of Bachelor of Science in the Institute.

METHODS AND APPARATUS OF INSTRUCTION.

Ordinary Exercises. Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories, and the drawing rooms. The progress of each student is tested by frequent oral examinations. Text-books are used in many, but not in all departments. A high value is set upon the educational effect of laboratory practice, drawing, and field-work.

Written Examinations. Besides the oral examinations in connection with the ordinary exercises, written examinations are held from time to time, particularly in those departments in which the oral examination of the students is necessarily too infrequent to be exclusively relied upon.

Near the close of the months of January and May, general examinations are held,—that of January embracing the subjects studied during the first half-year, that of May covering the studies of the whole year. Each examination on a distinct subject is marked on a scale of 100, and the marks of each student are reported to his parent or guardian. These returns are intended to enable the parent or guardian to judge of his son's or ward's proficiency in each department of instruction. The examinations of January and May form the basis of admonition or advice from the Faculty in the case of students who are not profiting by their connection with the School. A student who fails to pass the May examination in any subject will not be permitted to enter upon the studies of the following year without passing a new examination. Such students must appear for re-examination at 9 A. M., on the Friday preceding the first Monday in October.

The Instruction in Chemistry. In the chemical laboratories provision is made for teaching General Chemistry, Qualitative Analysis, Quantitative Analysis, Assaying, Determinative Min-

eralogy, the Use of the Blowpipe, Metallurgy, and Industrial Chemistry. The department occupies five laboratories, a chemical lecture-room, besides rooms for apparatus, balances, and storage.

During the first term of the first year, instruction is given in General Chemistry by recitations and lectures, and by practical exercises in the laboratory, where every student is provided with a desk and the necessary apparatus, and is required to perform, under the supervision of the professors, a large number of experiments selected to illustrate the laws of chemical action and the properties of all the more important chemical elements. In the second term, a systematic course of instruction in Qualitative Analysis is given, by laboratory practice and by oral and written examinations.

During the first term of the second year, further instruction in Qualitative Analysis is given to those students who pursue the regular courses in Mining Engineering, Chemistry, Metallurgy, Natural History, and Physics. Instruction is also given in Chemical Philosophy to students pursuing the courses just named, and also to those who choose the courses in Science and Literature and Philosophy. In the second term of the second year, and in the third and fourth years, the principal subjects of study are Quantitative Analysis, Organic Chemistry, Gas Analysis, the Preparation of Chemical Products, Assaying, Mineralogy, the Use of the Blowpipe, Metallurgy, and Industrial Chemistry. In the third year, a series of lectures is given upon new methods in Quantitative Analysis, and a course of study in Volumetric Analysis is pursued with the use of a German text-book. The fourth year's chemical work in the lecture room is devoted to a thorough study of Organic Chemistry. Competent students are encouraged to undertake special researches, and are assisted in bringing them to useful results.

The Instruction in Physics. During the second year the whole subject is discussed in a series of lectures, which are attended by all the regular students. The various branches are treated both mathematically and experimentally. In all cases the theoretical discussion of a question is followed by a full account of its practical applications.

The first part of the course is devoted to Mechanics of solids, liquids, and gases, and is designed both to prepare the student for an extended study of General Physics, and to serve as an introduction to Analytical and Applied Mechanics.

The Institute possesses an extensive and constantly increasing collection of physical apparatus. The lectures are also illustrated by a large number of photographs on glass, which are projected upon a screen by means of the calcium light.

The Rogers Laboratory of Physics. In the third year, the students enter the physical laboratory, and learn to use the different instruments, and to perform a variety of experiments. Special attention is paid to the testing of physical laws, by comparing the observed and computed results.

In the fourth year, they carry on systematic investigations in particular branches of physics, or pursue such portions of the following subjects as have a direct bearing on their professional studies: —

Strength of Materials. Flexure of beams and girders; breaking weight; laws of elasticity.

Weighing and Measuring. Comparison of scales; calibrating tubes; use of dividing engine; making standards of weight and volume.

Laws of Gases and Vapors. Mariotte's law; expansion by heat; pressure of steam at different temperatures.

Flow of Liquids and Gases. Coefficients of efflux; weirs; effusion and transpiration of gases; velocity of air and water currents; flow under different pressures.

Microscopy. Methods of viewing various objects; magnifying powers; focal lengths; polariscope; micrometers; mounting

objects dry and in balsam; making cells; cutting and grinding sections; injecting tissues.

Spectroscopy. Application to chemical analysis; electric spectra of metals and gases; constructing normal maps of the solar spectrum; measurement of indices of refraction and wave-lengths.

Photometry. Candle power of gas; comparison of burners; ratio of light to consumption.

Electrical Measurements. Measurement of quantity, electro-motive force, and resistance; testing electro-magnets; comparison of different batteries; application to submarine telegraphy; detection of faults in the cable.

Teachers of physics, and others properly qualified, may enter the laboratory, and take the whole or any part of the above subjects.

The Instruction in Rhetoric and History. Lectures are given on Rhetoric and the history of the English Language. Systematic practical exercises in English Composition will be required of all regular students, as an essential part of their training. Practice in writing English will be continued throughout the four years, in the preparation of abstracts of the lectures or of the collateral reading prescribed, of translations from the French or German manuals used in the instruction in history, and of original papers or essays to be read to the class.

In the second and third years, courses of lectures are given on Modern Literature and History, in connection with the reading of manuals in French or English, and accompanied by written abstracts and translations.

In the fourth year, instruction is given in English and American Constitutional History. To students in the department of Science and Literature opportunity is afforded for a more detailed study of English by the critical reading of annotated texts of standard English authors; and for a more extended study of History, especially of the political, commercial and industrial history of present times.

The Instruction in Logic and Philosophy. The work done under these heads may be divided into two bodies: first, that required of all regular students, irrespective of the special Department to which they belong; and, second, that required as the main work of the students in the special Department of Philosophy.

I. The subjects required of all regular students are Logic and the Philosophy of Science. In these, the aim of the instruction will be to familiarize all with the logical principles underlying the sciences which form the subjects of their other studies, and warranting the methods of investigation which are taught in each. The final object will therefore be, to acquaint each student with the Laws of Belief, so far as they have been reduced to system, and to give him so rational a comprehension and conviction of them, that he shall be able to apply them in testing and regulating his own acceptance of propositions in all the fields of his knowledge. But, as the first step towards this end, a fair knowledge of Formal Logic will be secured, as contributing towards the essentials of Belief so much as is involved in the conditions of Consistency; and by a fair knowledge of this subject, will be meant such a familiarity with the rules of deductive inference, and with the fallacies arising from their violation, as will enable (and incline) the student to test his own deductive processes and those of his associates — his own attempts at proof and the arguments of others — by their habitual and natural application.

For this reason, in the teaching of Logic, especial attention will be paid to the illustration, and indeed to the first development, of principles by *examples*; these being selected, as far as practicable, from the fields in which the student works in his special department.

The instruction in the Philosophy of Science will include, as requirements for *all* regular students, (1) the Theory of Induction — its Nature, Limits, and Canons, and (2) the Classification, Logical Connexion, and Logical Structure of the Natural Sciences. It will add, as requisites for the students in Engi-

neering, Architecture, Physics, and Philosophy, (3) the Classification and Logical Structure of the Mathematical Sciences, and (4) the Logical Theory of the Calculus, developing the real grounds for the validity of the Infinitesimal Method, and its entire consonance with the arithmetical and geometric axioms.

II. The requirements for regular students in the special department of Philosophy are embraced in a somewhat detailed study of the elements of Philosophy in General, in addition to the subjects taken in common with other regular students.

The specific object of this Department is to furnish the basis for a sound general education, in such a study of Philosophy as, gathering within its scope the solid products of the modern mind, will bring its idea into immediate connection with the Conduct of Life. The Department rests upon the theory, that the problem of all general education is, to equip its subject for the highest concerns of the real world; that these are the various exercises of *character*, in its relations to the great combinations of mankind in the State, in Civil Society, in Art, and in Religion; and that the formation of a character adequate to deal with these combinations must depend at last on a study and comprehension of the principles which account for their existence, warrant their continuance, and explain their spiritual significance as the theatres of the highest human action.

The characteristic studies of this Department, additional to those pursued in the same field by all regular students, will be Applied Logic, the Elements of Philosophy, and the history and criticism of Philosophical Systems. The work in Applied Logic will consist in analyzing certain celebrated arguments, and in investigating the reasoning of at least one of the important parallel studies pursued by the class. In the history of Systems, the ground chosen will be that of Modern Philosophy, beginning in England with Locke, and ending there with Spencer, after passing through France and thence through Germany from Kant to Hegel. Such references to ancient systems as may be necessary merely to explain the modern, will of course

be made; and the central works of the leaders of the modern systems will themselves be the text upon which the work will be founded; the student will be brought into direct contact with them by his own reading. Under the head of Ethics, in this course, will be included the doctrine of the foundations of the State and of Society in General, as well as the grounds of individual conduct.

The Instruction in Modern Languages. The immediate object of the instruction in French and German is to enable the student to avail himself of the literature in these languages relating to his particular department of professional study. As many of the text and reference books used in the school are only accessible in one or the other of these languages, it is desirable that he should become able to use them as soon as possible. But although the object aimed at is the practical one of learning in the shortest time to read fluently and accurately a foreign scientific work, it is believed that this is most satisfactorily accomplished by a thorough and systematic preliminary training. In this way the student acquires sufficient *strength* in the language to master the difficulties he will meet, and obtains a general view of the structure of the language, so that he will not easily *forget* his acquisition in after years. Thus at the same time with the best and quickest attainment of the practical object, much of the *culture* resulting from the study of the language and literature of another people, is secured.

For the reasons above indicated French is diligently continued through the first year and until the student is able to read with fluency and accuracy by himself. German is commenced at the beginning of the second year (or after the French is finished), and continued with the same thoroughness and concentration as the French. To this point these languages are studied by all regular students.

In the courses of Science and Literature and Philosophy, French and German are continued after they are finished in the professional courses. In these courses it is intended to

pursue more extensively the critical study of difficult authors in both languages, with more special reference also to the literature of the same, and the relations of these languages to the English. The special object of these courses being to afford a liberal education, it is felt that the languages should be taught here accordingly, and in a more disciplinary manner than where the object is principally to learn to read in the shortest time.

The elements of Italian and Spanish are taught in volunteer classes in the third and fourth years. Only the elements, however, are taught, the student being expected to build up by himself on the foundation here laid. A more extended course in Italian and Spanish is contemplated in connection with the Advanced Courses.

Opportunity is also offered in these courses for the study of the older forms of the modern Languages, the relations to one another of the different branches of the German and Roman families, and of the subject of linguistic science.

A knowledge of Latin is essential to those pursuing the latter studies. A previous study of Latin is also of very great help to all the students in the Modern Languages. The vocabulary and forms of the French come directly from it; and a previous study of it (although brief) gives the student a training in language which will enable him to take up the French and German with much greater facility and advance much more rapidly.

The Instruction in Descriptive Geometry, Stereotomy, and Drawing. Descriptive Geometry is taught as the Geometry of Form and Position in Space, treated by the method of projections, and has associated with it, for convenience, both Elementary and Higher Plane Problems.

Stereotomy means the cutting of forms, whether material or immaterial, so as to fulfil given conditions. It thus embraces Shades and Shadows; Perspective; Cinematics; and Structure Joints, or Articulations, whether of Wood or Metal, or in Stone Cutting; and Mechanical Elements.

The instruction in these subjects is distributed among the various professional courses; and is generally conducted by this department in conjunction with others; but in the case of Cinematics and Machine Drawing, by the department of Mechanical Engineering separately.

Drawing is taught under three heads: geometrical drawing, embracing all the instrumental drawing associated with the foregoing subjects; machine, and structure drawing; topographical drawing, including the construction of maps of surveys; and free-hand drawing, conducted with reference to the wants of the scientific professions, rather than as a training for artistic pursuits.

The first year's work is complete in itself, and thus serves not only as a foundation for the succeeding work of the school, but also to meet the wants of special students in drawing, and of any who can devote but a year to their studies.

The distribution of the remaining work of the department is sufficiently evident from the programmes of the several courses.

The Instruction in Civil Engineering is given by means of lectures and recitations, and by practice in the field and in the drawing rooms. The use of the various instruments for measuring lines and angles, and of the level, is taught mainly by actual work in the field; first, in ordinary surveying and levelling; then in laying out curves, both circular and parabolic; and afterwards in the survey of a railway line, and in staking it out ready for construction. These surveys are plotted and represented on finished plans. The necessary computations of areas, earth-work, etc., are also made. In most of the remaining subjects peculiar to this department, as set down in the Course of Instruction on page 23, Rankine's Civil Engineering is used as a text-book; and the aim is to enable the student, by means of suitable explanations, illustrations, and examples, to acquire a thorough working knowledge in these branches. The department has a good stock of excellent field instruments. An *Observatory*, erected upon the Institute build-

ing, from which a large number of U. S. Coast Survey stations are visible, is used in the instruction in triangulation and geodesy. Observations are also made for the determination of the meridian, and of latitude and longitude.

The Instruction in Topography is mainly given in the field by means of the Plane-Table, as perfected and used in the United States Coast Survey. The maps are completed in the drawing rooms, where instruction is given in the conventional modes of shading and topographical illustration.

The Instruction in Physical Hydrography is begun by practice in water surveys. After the student has become familiar with the data and the means of obtaining them, applications are made to the construction of breakwaters, docks, wharves, and other harbor improvements, as well as to the dyking and reclaiming of lands, to the location and construction of canals, and to the rectification of rivers.

The Instruction in Mechanical Engineering is given in three courses: the mathematical, the practical, and the graphical. In these courses the work is taken up in the same order as in Professor Rankine's works on "Mills and Millwork," and "Steam Engine and other Prime Movers," which are read as text-books. All three courses are carried on together with the same class, each approaching the same subject from a somewhat different stand-point. In the mathematical course Prof. Rankine's demonstrations are usually given; but care is taken to collect from his books and papers all he has given upon a particular subject, that the simplest as well as fullest discussion may be presented to the class. In the practical course the entire attention is given to the application of the theory, as involved in practice. Applications, as far as possible, are made to existing engineering works, and to problems as they occur in practice. In the graphical course the instruction is chiefly based upon good examples of American practice; and

it is intended that each exercise in theory, or practice, shall be supplemented by a drawing exercise covering the same ground. Once a fortnight, or oftener, visits are made to establishments where machines are in use, or in process of construction. Each student is held responsible for some particular part of a machine or operation, which he must report upon, either in writing, or by measurement and sketches. Afterwards a summary of all these reports is made for the benefit of the whole class, and as the basis of such further instruction upon the particular subject under consideration as may be desired.

The Instruction in Mineralogy. Determinative Mineralogy is taught by the study of crystalline forms, and the physical properties of minerals, and by the use of the blowpipe; and Descriptive Mineralogy by the actual handling of specimens.

The collection of minerals in use for purposes of instruction is receiving frequent additions from specimens gathered in the summer excursions of the students, and from private contributions. The rich collection of the late James T. Hodge, Esq., has also been lately presented to the Institute by Mrs. Hodge.

The Instruction in Geology and certain related subjects is given as follows:—

In the third year, is given a course of thirty lectures on Descriptive and Theoretical Geology, embracing the classification of the Sciences; Scope of Geological Studies; Nature of Rocks, or Lithology; Stratigraphy; Succession of Formations; Zoological History; Geological Dynamics; Chemical and Physical Forces; Aqueous and Igneous Agencies; Currents; Sedimentation; Elevation and Subsidence; Geographical Distribution of Formations; Nature and Origin of Mountains; Volcanic Action.

In the fourth year, are given:—a course of forty lectures on American Geology, comprising Geological History; Geology of North America, considered lithologically, stratigraphically, and palæontologically; Comparative Geognosy:— a course of ten

lectures on Practical Lithology, comprising the mineralogical composition of Rocks; Building-stones, their cohesion, porosity, etc.; Granites, Marbles, Limestones, Sandstones, Slates; Limes, Cements, and Mortars; Ornamental Stones and Gems:—and a course of fifteen lectures on Chemical Geology, or the chemical history of the globe; comprising the Origin of Rocks, both stratified and unstratified; the History of Veinstones and Ore-deposits; the Formation of Coal and Petroleum; the Chemistry of Salt-deposits and of Mineral Waters; the Seat and Origin of Volcanic and Earthquake phenomena.

The second is a course of fifteen lectures on Economic Geology, mainly devoted to a detailed description of the coal and ore-deposits of North America, especially such as are most extensively worked.

The Instruction in Mining is given to students of the third year by a course of forty-five lectures on the general character of the various deposits of the useful minerals, in the theory and practice of mining operations, such as prospecting, boring, sinking of shafts, driving of levels, different methods of working, hoisting, pumping, ventilation, etc.

In the fourth year, ore-dressing and metallurgy are taken up in a course of sixty lectures. This is followed by a series of continuous practical exercises in the concentration and smelting of ores in the Mining and Metallurgical Laboratories, and the student is thus afforded opportunities for acquiring a familiar knowledge of the subject, founded on actual experiment.

The Professers in this department hope to give each student of Mining and Metallurgy at least one chance during his course of study, to join a party organized for visiting some of the more interesting mining regions.

The valuable scientific library and the large geological collection of the late Prof. Henry D. Rogers of the University of Glasgow, presented to the Institute by Mrs. Rogers, are accessible to the students in Geology and Mining. This collection is made up chiefly of fossils and rock specimens from American

localities, and is especially rich in coal-plant fossils. Accompanying this collection are a large number of diagrams and maps of great value for the lecture room. The collection of ores and vein-stones is already large and varied, and is constantly receiving additions from the various mining regions.

A typical set of models of mining machinery, chiefly from Freiberg, Saxony, is used in the course of instruction. They are designed mainly to illustrate the principles of the various processes of mining and ore-dressing, but combine also the latest improvements in machines. They show, in detail, the methods of working under ground by underhand and overhand stoping, the timbering and walling of shafts and levels, the arrangements of pumps, man-engines, ladder-ways, hoisting-ways, the sinking of shafts, etc. The machines for ventilation, as well as those for ore-dressing, are working models, with all their parts made proportional. The latter illustrate all the stages of the concentration of ores. It is proposed, as opportunity offers, to add to this collection other similar models.

The Instruction in Palæontology is given to students of the third year.

Palæontology, including the history of ancient animal life, and the study of the distinctive and characteristic fossils of the different formations, is taught as a necessary foundation for the further study of Geology. The aim of the course is to give the student a practical acquaintance with the structure of the characteristic families and orders of living and extinct animals, and by a judicious selection of examples to familiarize him to some extent with the genera which characterize various formations.

The handling and drawing of specimens by the students is an essential feature of the method of instruction. The lectures of the instructor are devoted largely to explanatory demonstrations of the specimens which the students are at the same time drawing.

The Mining and Metallurgical Laboratories. These Laboratories are intended to furnish to the student in Mining and Metallurgy the means for studying experimentally the various processes of ore-dressing and smelting, and ores of different kinds may be here subjected to the same modes of treatment as have been adopted at the best mining and metallurgical establishments. The mining laboratory contains an upright tubular boiler, a fifteen horse-power engine, a five-stamp battery of the form in use in Colorado and on the Pacific coast, an amalgamating pan, settler, and concentrator of the kind used in the Washoe process in California and Nevada, for the treatment of silver and gold ores, a Blake crusher, a Whelpley and Storer pulverizer, an edge stone mill, a Rittinger automatic shaking-table, a hand-jigger, a Freiberg shaking-table, a Sturtevant pressure-blower, and a Batchelder's dynamometer. The metallurgical laboratory contains blast and reverberatory smelting furnaces, a roasting furnace, a furnace for cupellation, furnaces for fusion, and crucible and muffle assay furnaces.

The experimental work of the laboratory is carried on by the students under the immediate supervision of an instructor. A sufficiently large quantity of ore is assigned to each student, who first examines it for its component minerals, samples it, and determines its character and value by analysis and assays, and makes such other preliminary examinations as serve to indicate the proper method of treatment. He then treats the given quantity, makes a careful examination of the products at each step of the process, ascertains the amount of power, water, chemicals, fuel, and labor expended, and thus learns approximately the effectiveness and economy of the method adopted.

The Institute is from time to time receiving ores of gold, silver, lead, copper, antimony, zinc, iron, etc., from various localities on this continent. These ores are worked, and reports sent to those who contributed them; and it is hoped that by such coöperation the laboratory will continue to receive the necessary amount and variety of ores.

Models, etc., relating to the Engineering Courses. The collections under this head consist of models in wood, in metal, and in plaster, besides lithographs, photographs, and manuscript drawings, chiefly selected from the best collections of France, Germany and Switzerland, and, in some instances, made expressly for the school. They are arranged for convenience in the following groups. Some of these groups contain one or two hundred models, others only a few typical ones; it is, however, proposed to add from time to time such as may be required for the purposes of instruction.

Descriptive Geometry and its Applications. A set of models in relief, illustrating the various problems of Descriptive Geometry, arranged upon sets of planes at right angles to each other, and containing the corresponding graphical solutions; a set of models illustrating linear perspective, and the theory and practice of shades, shadows, and reflections; plaster models showing the intersections of cylinders, cones, and surfaces of revolution with each other, the penetrations made in each surface, and the common solid; models of brass and silk threads to illustrate the course on developable and warped surfaces.

Masonry and Stone Cutting. Models representing groined and cloistered arches, domes, staircases, etc., with detached voussoirs; models of right and oblique bridges, with their approaches and other accessory works.

Carpentry. Models of joints and mouldings; models of wooden and iron roof trusses, including a model illustrating Polonceau's system of iron roofs, centres for bridges, girders, etc.

Iron Bridges. A set of models illustrating the most recent constructions in iron bridges, beautifully executed by Bock, of Dresden.

Experimental Mechanics. Casts of Saint Venant's models, showing the changes of forms which bodies of various shapes undergo, when subjected to forces causing flexure and torsion; a full sized model of the liquid vein observed and measured by Poncelet and Lesbros, in their hydraulic experiments. These

models are duplicates of those made for the *Conservatoire des Arts et Métiers*, at Paris.

Graphical Representation. Model representing the mean temperature of a place for the twenty-four hours of each day of the twelve months of the year; topographical models, showing contour lines, with accompanying topographical drawings.

Mechanism. Models showing the different methods of laying out teeth of wheels in the various cases of racks, outside and inside gearing, etc.; bevel and skew bevel wheels; an instrument for laying out teeth devised by Schröder; models of pulleys and wrapping connectors, belts, and chains; models of parallel motions, including Watt's parallelogram, applied to land and marine engines; Seward's parallel motion, fitted to the engines of the Gorgon, etc.; models of non-circular, and screw wheels; endless screws; wheels in trains; epicyclic trains; Ferguson's paradox; equation clock; system of Lahire, etc.; models of cams; of silent feed motions; regulating apparatus, for stopping, reversing, or modifying the motions of machines — these include governors, friction cones and clutches, reversing gear, Oldham's coupling, etc.

Resistance of Materials. A set of models illustrating the best forms of beams for resisting flexure, torsion, and compression under various conditions of stress; to which is added an apparatus for testing the deflections caused by loads applied in any manner to test their strength or stiffness.

Construction of Machines. These consist of a number of highly finished models of the parts of machines, such as screws, chains, hooks, riveting, axles, plumber blocks, steps and supports for shafts, wheels, pulleys, cranks, eccentrics, cross-heads, connecting rods, working beams, valves, pistons, etc.

Lifting Engines. These consist of the following working models:—Crab engine; Fairbairn's plate iron dock crane; hydraulic press.

Hydraulic Motors. A model of the water pressure engine at Alt Mordgrube, in Freiberg, Saxony, with the pumps and apparatus for draining mines; a model of Poncelet's water

wheel; Fourneyron's turbine; Jonval's turbine; also Swain's and Leffel's inward flow turbines.

Steam Engines. Boilers and fire grates; steam cylinders, pistons, valves, etc.; slide valves and the mechanism showing the distribution of the steam; variable cut-off valves; Stephenson link motion; models of steam engines of various forms.

The Instruction in Architecture. It is the object of this Department to give to its students the instruction and discipline that cannot be obtained in architects' offices. The course is, however, practical as well as theoretical, and, besides the scientific study of construction and materials, it comprises the study of building processes, and of professional practice and procedure, as well as that of composition and design, and of the history of the art. It is calculated to meet the wants not only of young men who propose to pursue a comprehensive course of architectural study, but of those who are looking only for such an elementary training as shall qualify them for positions as draughtsmen.

The recent establishment of Advanced Courses of study in the School has rendered possible a more systematic arrangement of this work than hitherto.

The Regular Course will henceforward be confined to the subjects of Architectural History and Design, with so much of Construction as the Departments of Engineering afford. Though the degree of Bachelor of Science is given in Architecture to all students at the conclusion of their fourth year, who have passed the prescribed examinations, and have executed in a satisfactory manner the drawings and designs required, the training of such students cannot be such as to entitle them to call themselves Architects. It is, however, complete in itself, and not only includes the scientific basis of professional work, giving what an architect needs to know of Mathematics, Chemistry, Physics, Geology, and Engineering, but gives also as much of more strictly technical knowledge and artistic skill as can properly be attempted in a school of science.

The more strictly professional work begins in the third year, the first half of which is given to the study of the Five Orders, and their applications, and to Greek and Roman Architectural history. At the same time the students of the fourth year attend a series of lectures upon ornament, composition, and the theory of architecture. In the last half of the year the historical studies are continued, and both classes, for convenience, attend the same exercises. The mediæval period, from the fall of the Roman Empire to the fall of Constantinople, and the modern period, including that of the Renaissance, are taken up in alternate years, so that each class is carried over the whole ground. Throughout both years the students are constantly practiced in original design. The character of the problems given out, and the time allowed for their completion, vary according to the advancement of the class, and the kind of drawings required. The work of this sort done by the class which graduated in 1873, consisted of: 1, a balcony; 2, a Carthusian cloister with cells and gardens; 3, a porch; 4, a carriage-porch; 5, a portico in a garden; 6, a peristyle; 7, a casino; 8, a mantle-piece; 9, a monumental column; 10, an artist's house; 11, a railway station; 12, a monumental chapel; 13, a private museum of painting and sculpture; 14, a campanile; 15, the employment of four columns; 16, a pavilion between two bridges; 17, a village church; 18, a grand staircase, with a vaulted ceiling or dome; 19, a Natural History building; 20, a school of Chemistry; 21, details for the same; 22, a naval and military tomb. This last was designed and drawn in perspective. Each set of drawings is examined and criticised before the class.

Special exercises are also had in shades, shadows and perspective, and the perspective of shadows, and in tracing and sketching and modelling, in their practical application to architectural work. In the fourth year opportunity is afforded to measure and draw out buildings already erected. By the favor of the Rector and Wardens of Kings's Chapel, careful studies have this year been made of this interesting building.

The Advanced Course is designed to have a less distinctly scientific character than the undergraduate course, the studies and exercises being rather those of a school of art than those of a school of science. But the study of the various arts employed in building is also taken up, with specifications and working drawings, subjects which, though belonging strictly to office work, require a more systematic treatment than students in offices can generally give them.

Special students in Architecture are received into either of these classes, and are allowed to follow a selected course, on passing the examinations for entrance into the school, and giving evidence that they are qualified to pursue these studies to advantage. Professional draughtsman also may, in their intervals of leisure, join the school for short periods of time, taking part in whatever work may be in hand.

The Boston Society of Architects "wishing to do its part in the work of professional education," has established, by consent of the Corporation of the Institute, two prizes, of the value of fifty dollars each, one for the best work in the class of design, and one for the best work in the class of construction, during the year.

The prize in design was last year awarded to Mr. Henry A. Phillips of Chicago, Illinois, of the graduating class. The prize in construction was not awarded.

The Architectural Museum. A large number of photographs, prints, drawings, and casts, have been collected for this Department, by means of a special fund raised for the purpose. This collection includes a number of English and French water-colors, mostly of architectural subjects, several lithographic publications issued by architectural students in England and on the continent, and photographs from the competition drawings for the Foreign Offices, the Law Courts, and the National Gallery in London, and others from French competitions for public buildings, and from the *Concours* of the *Ecole des Beaux-Arts.*

The collection of casts comprises both architectural details and specimens of carving and sculpture illustrating various periods of art. It includes a large and valuable collection of sculptures from the choir of Lincoln Cathedral, and contains also several models of temples and other buildings, lent to the School by the Boston Athenæum.

To these collections the following additions have been made, mostly by gift: —

A considerable collection of photographs, lithographs and drawings, presented to the Institute by French, English and American architects, taken from their own works, including sets of actual working drawings, with details and specifications.

A complete series of drawings, mostly presented by Ernst Benzon, Esq., of London, formerly a merchant of Boston, illustrating the course of Architectural instruction in the *Ecole des Beaux-Arts* in Paris: —*Esquisses-Esquisses*, *Projets Rendus*, *Projets d'ordre*, *Projets de Construction*, *Grand Prix de Rome*, *Envoi de Rome*.

Specimens of modern English and American stained glass and tile-work, partly purchased, and partly presented by the makers, with cartoons and drawings illustrating the processes of manufacture.

The publications of the Royal Institute of British Architects, and of the Architectural Institute of Scotland, and the miscellaneous papers of the Architectural Publication Society, have been presented by the authorities of these institutions. A considerable library is in course of formation.

The Instruction in Natural History. This will be given with the aid of the collections and library of the Boston Society of Natural History, which, by an agreement between the Society and the Institute, are freely open to the students. These collections rank among the first in the country for extent and value, and in many departments are unsurpassed; the library s rich in works on Natural Science, many of them finely illus-

trated, and embraces the leading American and European journals and periodicals on Natural History. It is believed that the facilities thus afforded to the students of the Institute are ample for the most thorough instruction in Zoology, Palæontology, and other branches of Natural Science. This instruction will be given by the Professors of the Institute and partly in the lecture room of the Natural History Society, whose building is upon the same square.

Botany is more generally required than heretofore, as affording the proper and natural introduction to the study of Zoology, Palæontology, and Biological Chemistry; and as being the science best calculated to train the mind for close observation, accurate description, and systematic classification. The instruction is given by lectures, recitations, and practical exercises in the examination of living plants and tissues. The numerous conservatories in Boston and vicinity furnish the means of studying hand specimens in many of the natural orders, and the wild flowers of early spring are usually obtained before the end of the school year.

The Instruction in Military Science and Tactics. In conformity with the requirements of the Act of Congress of July 2, 1862, and of the Act of the General Court of Massachusetts in furtherance thereof, the Institute provides instruction in military science and tactics. During the first two years all students are required to attend twice a week an exercise in military science, or tactics, unless specially excused. For these exercises they are organized as a battalion of two companies, and are required to provide themselves with a uniform consisting of a dark blue double breasted sack-coat, pantaloons, cap, and silver cap ornament. These uniforms are manufactured from measures, and by contract, to secure uniformity of material and manufacture, as well as cheapness. The whole cost will not exceed twenty-five dollars. The uniform must be worn at times of instruction, and may be worn at other times if the student chooses to do so. Arms and equipments are lent to

the School by the United States. The matter of attendance at drill is under the control of the Professor; but excuses of general application can be granted by the Faculty only.

Excursions. In aid of the practical studies of the school, and as a means of familiarizing students with the actual details of work, they are required, in term time, to make visits of inspection to machine-shops, engines, mills, furnaces, and chemical works, and to important buildings and engineering constructions within convenient reach.

In the vacations more extended excursions are made for the survey of mines, and for the study of metallurgical works and noted specimens of engineering. During the past summer a three weeks' expedition was organized and carried out by Professors of the Mining department. This party visited the lead and zinc mine at Warren, N. H.; the copper mine and smelting works at Vershire, Vt., the copperas works at Strafford, Vt.; iron mines, furnaces, and bloomery forges in the Adirondac region; the Bessemer Steel Works at Troy, N. Y.; the ore beds and iron furnaces at West Stockbridge and Richmond, Mass.; the Hoosac Tunnel; and the emery mine at Chester, Mass.

THE SOCIETY OF ARTS.

One of the primary objects of the founders of the Institute of Technology, as shown by the extract from the charter given on page 4, was the establishment of a Society of Arts. This Society was organized in 1861, and now numbers about 350 members. It holds regular meetings at its rooms in the Institute Building, on the second and fourth Thursdays of each month from November to May inclusive. At these meetings are presented communications on various subjects of applied science, with the exhibition of machines and apparatus illustrating important inventions in the mechanic and useful arts. Students of the school may

be present at these meetings, by permission of the Secretary of the Institute.

THE BOSTON PUBLIC LIBRARY.

The professors and students of the Institute are allowed the full use of this extensive library. Copies of the complete catalogues of the Library are kept at the Institute for convenience of reference, and the Library Building is near at hand. The Library now contains 200,000 volumes; and its reading-room is supplied with all the best scientific and technical periodical publications. New books of value are promptly bought, on proper application to the authorities of the Library. No college or school in the country has better facilities in these respects than those which the Trustees of the Boston Public Library have put at the disposal of the officers and students of the Institute of Technology.

THE THOMAS SHERWIN SCHOLARSHIP.

This scholarship for regular students has been founded by the English High School Association, in memory of the late Thomas Sherwin, who, for more than thirty years, was the distinguished master of the English High School of the City of Boston. Mr. Sherwin was also an active and influential member of the Corporation of the Institute. The pupil to receive the benefit of this Scholarship "is to be a graduate of the English High School in the city of Boston."

ADVANCED SCHOLARSHIPS.

Five advanced scholarships, of $200 each, have been established, and will be awarded to such applicants as are recommended by the Faculty.

DIPLOMAS AND CERTIFICATES.

The diploma or certificate is intended to be not only a reward to the student for his diligence and attainments, but an assurance to the public of his knowledge and skill in the particular department to which it relates.

The degrees or diplomas corresponding to the ten Regular Courses of the School are as follows: —

I. A Degree in Civil and Topographical Engineering.
II. " " " Mechanical Engineering.
III. " " " Geology and Mining Engineering.
IV. " " " Building and Architecture.
V. " " " Chemistry.
VI. " " " Metallurgy.
VII. " " " Natural History.
VIII. " " " Physics.
IX. " " " Science and Literature.
X. " " " Philosophy.

To be entitled to either of these degrees, the student must have passed a satisfactory examination in all the prescribed studies and exercises of the four years; and in addition, a final, or degree examination, embracing all the subjects which particularly relate to his course. He must, moreover, prepare a dissertation on some subject included in his course of study, or an account of some research made by himself, or an original report upon some machine, work of engineering, industrial works, mine, or mineral survey, or an original architectural design accompanied by an explanatory memoir. This thesis or design must be approved by the Faculty.

The examinations for these degrees are held in the month of May, and are partly oral and partly in writing.

The title of the degree in these courses is S. B., or Bachelor of Science, in ————————.

The degree of S. D., or Doctor of Science, is awarded for proficiency in Advanced Courses of study.

Besides the degrees or diplomas of the Regular Courses and of

the Advanced Courses, certificates of attainment in special subjects are given to such students as on examination are found to have the required proficiency in them.

REGULATIONS OF THE SCHOOL.

School-year. The school-year begins on the last Monday in September, and ends on the Saturday preceding the first Monday in June. On legal holidays the exercises of the School are suspended. There is a recess of one week ending at 9 A.M., on the first Tuesday in February.

Bond or Deposit. Every student is required, on entering the school, either to give a bond for two hundred dollars to pay all charges accruing under the regulations of the school; or to deposit, if he prefer so to do, the sum of two hundred dollars with the Secretary of the Institute, to be accounted for at the end of the school-year, or whenever the depositor leaves the school, in case he leaves it before the end of the year. This deposit must be renewed at the beginning of each year. The bond must be executed by two bondsmen, satisfactory to the Secretary of the Institute, one of them being a citizen of Massachusetts; and it must be filed within ten days after the date at which the student joins the school.

Fees. The fee for regular students is $200 per year, payable by students who have given bonds, $125 at the beginning, and $75 at the middle (first Tuesday in February) of the school-year. For one-half, or any less fraction of the school-year, the fee is $125. Students not candidates for a degree pay, in general, the full fee; but when a few branches only are pursued, and the time required for instruction is limited, some deduction may be made. The fee for students in the advanced courses is the same as that for regular students.

Attendance. Regular students are expected to attend all the exercises of their several courses. Students not candidates for a degree are expected to attend all the exercises in the subjects they have selected. A monthly return of absences and tardinesses is made by the Secretary of the Faculty to the parent or guardian of every student not of age. Tardiness consists in entering a lecture room, drawing room, or laboratory, more than five minutes after the hour designated for the beginning of the exercise. 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. (4 1–2 P. M., in winter), except during the interval for dinner. There are no exercises on Saturday afternoon, and the building is closed.

Discipline. While within the limits of the Institute, students are expected to behave with decorum, to obey the regulations of the school, and to pay a due respect to its officers. They are required to avoid all running, loud talking, whistling, or other noise in the halls and passages of the building. Every student will be held responsible for the furniture which he uses, and the cost of repairing any damage thereto will be charged to him. In case of injury to the 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 will be assessed equally upon all the students of the school. Conduct inconsistent with the good order of the school, if repeated after admonition, will be followed by the dismissal of the offender.

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

The cost of board and rooms in Boston, and the neighboring

cities and towns, need not exceed from six to eight dollars a week; and the cost of books, drawing instruments, and paper is from twenty-five to thirty dollars a year.

FREE COURSES OF INSTRUCTION.

The Trustee of the Lowell Institute has established, under the supervision of the Institute of Technology, courses of instruction, generally in the evening, open to students of either sex, free of charge.

This department of the school will embrace a number of distinct courses, more or less varied from year to year by the omission or interchange of particular subjects, but including in their entire scope instruction in mathematics, physics, drawing, chemistry, geology, natural history, physiology, English, French, German, history, navigation and nautical astronomy, architecture, and engineering.

The subjects, and the extent of the several courses, will be made known in October of each year.

As it is the object of this branch of the school to provide substantial teaching, rather than merely popular illustration of the subjects, it is expected that all persons attending these courses will come with a serious purpose of improvement, and that they will cheerfully comply with such rules as may be prescribed in regard to attendance and to order in the class or lecture-room.

The conditions of attendance on these gratuitous courses are as follows: —

1. Candidates must have attained the age of eighteen years.
2. Their applications must be made in writing, addressed to the Secretary of the Faculty, specifying the course or courses they desire to attend; mentioning their present or prospective occupations; and, where the course is of a nature demanding preparation, stating the extent of their preliminary training.
3. The number of students in each class is necessarily limited. The selection will be made under the direction of the Faculty.

The courses for 1873–74 are on the following subjects: —

Logic: An Examination of the System of J. S. Mill. Eighteen lectures on Monday and Friday evenings, at 7½ o'clock, beginning November 17, by Prof. Howison.

Sound. Eighteen lectures, illustrated by a full series of experiments, on Wednesday and Saturday afternoons, at 3 o'clock, beginning January 7, by Prof. Cross.

Machine Drawing for advanced students. Twenty-four exercises, of two hours each, on Tuesday and Friday evenings, at 7½ o'clock, beginning November 18, by Instructor Schubert.

Elementary Descriptive Geometry. Eighteen lectures on Monday and Thursday evenings, at 7½ o'clock, beginning November 17, by Prof. Lanza.

Chemistry: Qualitative Analysis. Twenty-four laboratory exercises on Wednesday and Saturday afternoons, at 2½ o'clock, beginning February 11, by Prof. Nichols.

Architectural History and Design. Eighteen lectures on Wednesday evenings, at 7 o'clock, beginning December 3, by Prof. Ware.

Elementary German. Eighteen lessons on Monday and Wednesday evenings, at 7½ o'clock, beginning November 17, by Instructor Krauss.

The Trustee of the Lowell Institute has also made provision for a course of free instruction in Practical Design for Manufactures, open to pupils of both sexes. Students are received at the beginning of the school year in October, to whom is taught the art of making patterns for Prints, Delaines, Silks, Paper-Hangings, Carpets, Oil-Cloths, etc.

The Course embraces: — 1. Original Design, or Composition of Patterns; 2. Secondary Design, or Variation of Patterns; 3. The Making of Working Drawings; 4. Technical Manipulations.

The class is arranged in four divisions, corresponding to these four kinds of work. The student, on joining the class after passing the prescribed examination, enters the first division, and is advanced to the second, and to the third, and so on to the practice of original design, as rapidly as his proficiency permits. The more advanced students have the assistance of the lower divisions in the drawing out of their designs.

Instruction is given personally to each student over his work, with occasional general exercises. Students supply their own instruments and materials.

The class is under the personal direction of Mr. Charles Kastner, for fourteen years designer at the Pacific Mills, formerly Director of the Atelier Lebert in Paris, and nephew and pupil of M. Jean Baptiste Lebert, *Dessinateur*, of Mulhouse in Alsace.

Applicants for admission to the above Course are required to bring specimens of their work, exhibiting an acquaintance with Free-hand Drawing, and some familiarity with the use of mathematical instruments.

For circulars giving fuller information, address the Secretary of the Institute.

LIST OF MEMBERS

OF THE

SOCIETY OF ARTS

OF THE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,

JANUARY 1, 1874.

HONORARY MEMBER.

* Prof. Daniel Treadwell, Cambridge, Mass.

LIFE MEMBERS.

Allen, Stephen M. . Boston.
Amory, William . . "
Atkinson, Edward . "

Baker, William E. . "
*Bancroft, E. P. . "
Beebe, James M. . "
Bigelow, E. B. . . "
Bowditch, J. I. . . "
Bowditch, Mrs. J. I. "
Brimmer, Martin. . "
Browne, C. Allen . "
Bullard, W. S. . . "

Colby, Gardner . . "
Cummings, John . . Woburn.

Dalton, Chas. H. . Boston.
Davenport, Henry . "
Dupee, James A. . "

Edmands, J. Wiley . "
*Eldredge, E. H. . "
Endicott, Wm., Jr. . "

Fay, Joseph S. . . "
Fay, Mrs. Sarah S. . Boston.
Forbes, John M. . . "
Forbes, Robert B. . "
Foster, John . . . "

Gaffield, Thomas . . "
*Gardner, G. A. . . "
Gardner, John L. . "
Gookin, Samuel H. . "
*Grant, Michael . . "
Greenleaf, R. C. . . "
Grover, Wm. O. . . "

Hemenway, Mrs. M. "
Hoadley, J. C. . . Lawrence.
*Huntington, Ralph . Boston.

Johnson, Samuel. . "

Kidder, Henry P. . "
Kuhn, Geo. H. . . "

Lawrence, James . "
Lee, Henry . . . "
Lee, John C. . . . "
* Lee, Thomas . . "

* Deceased.

Little, James L. . . Boston.
Lowell, John A. . . "
Lyman, Geo. W. . "

Matthews, Nathan . "
McGregor, James . "
Mudge, E. R. . . . "

Nichols, Lyman . . "
Norcross, Otis . . "

*Pierce, Carlos . . Canada.
Preston, Jonathan . Boston.
Pratt, Mrs. William . "
Pratt Miss . . . . "

Richardson, Geo. C. . "
Richardson, J. B. . "
Rogers, Henry B. . "
Rogers, William B. . "
Ross, M. Denman . W. Roxbury.
Ross, Waldo O. . . "

Ruggles, S. P. . . Boston.
*Savage, James . . "
Sayles Henry . . "
Sayles, Mrs. Willard "
*Sears David . . "
Shaw, Mary S. . . "
*Skinner, Francis . "
*Stetson, Joshua . "

Thayer, Nathaniel . "
Thorndike, John H. . "
Tobey, Edward S. . "
*Turner, J. M. . . "

Upton, George B. . "

Walcott, J. H. . . "
Wales, Geo. W. . . "
Wales, T. B. . . . "
Wales, Miss . . . "
*Whitney, Joseph . "

ASSOCIATE MEMBERS.

Adams, James . . Charlestown.
Allen, James T. . . W. Newton.
Ames, Isaac . . . Boston.
Amory, T. C. . . . "
Anderson, Luther W. Quincy.
Appleton, Thos. G. . Boston.
Atkinson, Chas. F. . "
Atkinson, Wm. P. . "
Atwood, Nath'l E. . Provincet'n.
Austin, Edward . . Boston.

Bacon, John . . . "
Barber, Lyman L. . Charlestown.
Barnard, James M. . Boston.
Batchelder, John M. Cambridge.
Beal, James H. . . Boston.
Bender, Richard W. "
Bigelow, A. O. . . "
Bigelow, G. F. . . "
Bigelow, Jacob . . "
Billings, Hammatt . "
Bishop, Chas. J. . . "
Blagden, Geo. W. . "
Blaney, Henry. . . "
Bôcher, Ferdinand . "

Bolles, M. Shepard . Boston.
Bond, George W. . W. Roxbury.
Bond, W. S. . . . "
Boott, William . . Boston.
Bourne, William . . "
Bouvé, T. T. . . . "
Bowditch, Ernest W. Brookline.
Bowditch, Wm. I. . "
Boyd, Thomas . . Cambr'geport.
Braman, Jarvis D. . Boston.
Browne, Causten . . "
Buckingham, C. E. . "

Cabot, Edward C. . "
Cabot, Samuel . . "
Carpenter, Geo. O. . "
Carruth, Charles . "
Clapp, Wm. W. . . "
Clarke, E. H. . . "
Clinch, John M. . . "
Copeland, R. M. . "
Cummings, Nath'l . "
Cumston, Charles M. "
Curtis, Frederick . "
Cushing, Thomas . "

Dana, Edward A. .Boston.
Danforth, I. W. . . "
Danforth, James H.. "
Davies, Daniel . . "
Davis, Barnabas . . "
Davis, F. J. . . . Waltham.
Deane, Charles . . Cambridge.
Delano, Jos. C . . New Bedford.
Denny, Henry G. . Boston.
Derby, George . . "
Dewson, F. A. . . "
Dix, John H. . . . "
Dixwell, J. J. . . . "
Doane, Thomas . . "
Dresser, Jacob A. . "
Dunklee, B. W. . . "

Eastman, Ambrose . "
Eliot, Chas. W. . . Cambridge.
Emerson, Geo. B. . Boston.
Endicott, Henry . . "

Farley, Noah W. . "
Farmer, Moses G. . "
Fitch, Jonas . . . "
Flint, Charles L. . "
Forbes, Franklin . Clinton.
Francis, James B. . Lowell.
Fuller, H. Weld . . Boston.
Fuller, Horace W. . "

Gardner, James B. . "
Gibbens, Joseph M. . "
Goddard, Benjamin "
Goddard, Nathaniel "
Goodman, William . "
Grandgent, L. H. . "
Guild, Chester, Jr. . "
Guild, Henry . . "

Hagar, D. B. . . . Salem.
Hale, Edward E. . Boston.
Hall, Andrew T. . "
Hall, Charles B. . . "
Hall, Thomas . . . "
Hallem, William . . Waltham.
Hamblet, James . . Boston.
Haven, Franklin. . "
Hayes, A. A. . . . Longwood.
Hayes, S. Dana . . Boston.
Heard, John T. . . "
Henck, John B. . . Brookline.
Henshaw, John A. . Cambridge.

Hewins, Edmund H. Cambridge.
Higginson, J. A. . . "
Hilton, William . . "
Holmes, Jabez S. . "
Holmes, O. W. . . "
Homans, C. D. . . "
Hooper, Samuel . . "
Houghton, Charles . "
Hovey, James . . Chelsea.
Howe, S. G. . . . Boston.
Hubbard, Charles T. "
Hunt, Ephraim . . Reading.
Hyde, George B. . Boston.
Hyde, Henry D. . "

Jackson, J. B. S. . "
Jackson, Patrick T. . "
Jasper, Gustavus A. . "
Jenks, Lewis E. . . "
Jewett, D. B. . . . "
Johnson, J. Q. A. . "

Kehew, John . . . "
Kilburn, E. J. . . . "
Kneeland, Samuel . "

Lamson, Chas. D. . "
Langley, H. P. . . "
Lawrence, A. A. . "
Lee, Francis L. . . "
Lee, Thomas J. . . "
Leuchars, R. B. . . "
Lewis, Charles W. . Charlestown.
Lewis, Wm. K. . . Boston.
Lincoln, F. W. . . "
Little, James L., Jr. "
Little, John M. . . "
Lothrop, Sam'l K. . "
Lowe, N. M. . . . "
Lowell, John . . . "
Lyman, Theodore . Brookline.

Marble, G. R. . . Boston.
Markoe, G. F. H. . "
Marshall, H. N. F. . "
Martin, A. C. . . . Cambridge.
Mason, Robert M. . Boston.
May, F. W. G. . . Dorchester.
May, John J. . . . "
McBurney, Charles . Boston.
McMurtrie, Horace . "
McPherson, W. J. . "
Montgomery, Hugh . "

Moore, Alex. . . . Boston.
Morse, John T. . . "
Morse, Samuel T. . "
Munroe, William . "

Nichols, James R. . Haverhill.
Norton, Jacob . . Boston.

Ordway, John M. . W. Roxbury.

Page, Edward . . Boston.
Page, W. H. . . . "
Parsons, Wm. . . "
Paul, J. F. . . . . "
Payson, J. P. . . . Chelsea.
Peabody, O. W. . . Boston.
Peabody, W. B. O. . "
Perry, O. H. . . . "
Philbrick, Edward S. "
Philbrick, John D. . "
Pickering, E. C. . . "
Pickering, H. W. . "
Pierce, S. S. . . . "
Plumer, Avery . . "
Pope, Edward E. . "
Prang, Louis . . . "
Pratt, George W. . "
Pratt, T. Willis . . "
Putnam, C. G. . . "
Putnam, J. P. . . "

Quincy, Edmund . Dedham.
Quincy, Josiah . . Boston.

Reed, B. T. . . . "
Revere, Joseph W. . "
Rice, Alexander H. . "
Richards, R. H. . . "
Ritchie, E. S. . . . Brookline.
Robbins, James M. . Milton.
Rotch, Benj. S. . . Boston.
Royce, H. A. . . . "
Ruggles, John . . "
Runkle, John D. . Brookline.
Russell, LeBaron . Boston.

Salisbury, D. Waldo "
Sawyer, Edward . Newton.
Sawyer, Timothy T. Charlestown.
Schubert, Ernest . Boston.
Scott, Isaac R. . . Waltham.
Sears, George O. . Boston.
Sears, Philip H. . . "
Shedd, J. Herbert . Boston.
Sherwin, Thos. . . Dedham.
Shimmin, Chas. F. . Boston.
Shurtleff, A. M. . . "
Shurtleff, N. B. . . "
Sinclair, Alex. D. . "
Smith, Chauncy . . Cambridge.
Snow, S. T. . . . Boston.
Sonrel, Antoine . . "
Sprague, Chas. J. . "
Stackpole, Geo. W. "
Stearns, Jos. B. . . "
Stevens, Benj. F. . "
Stimpson, Fred. E. . "
Storer, Frank H. . "
Storer, H. R. . . . "
Storer, Jacob J. . . "
Strater, Herman, Jr. . "
Stuart, Chas. F. . . "
Sturgis, John H. . "
Sullivan, Richard . "
Sweetser, Isaac . . "

Thompson, Newell A. "
Thompson, Wm. H. "
Thornton, J. Wingate "
Trowbridge, John . Cambridge.
Tufts, John W. . . Boston.
Tuxbury, Geo. W. . "

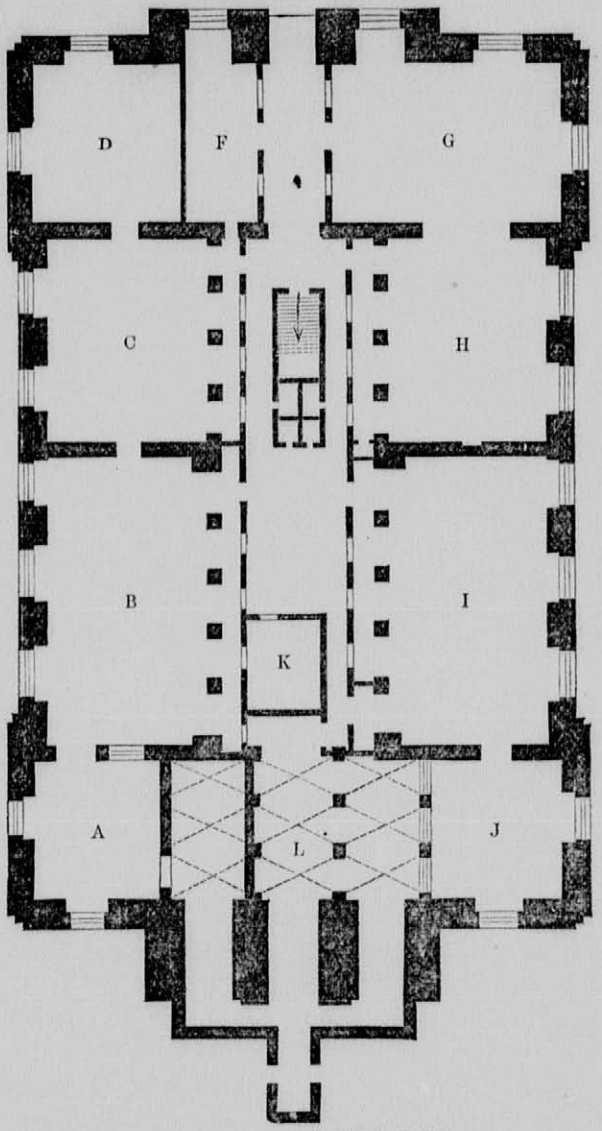
Upham, J. B. . . "
Urbino, S. R. . . . "

Walworth, J. J. . . "
Ware, Chas. E. . . "
Ware, Wm. R. . . "
Warren, Cyrus M. . Brookline.
Warren, Geo. W. . Boston.
Warren, Joseph H. . "
Warren, Sam'l D. . "
Waters, C. H. . . . Clinton.
Waterston, R. C. . Boston.
Watson, R. S. . . Milton.
Watson, Wm. . . Boston.
Weld, Stephen M. . "
Weston, David M. . "
Whipple, Edwin P. . "
Whitaker, Channing Lowell.
Whitman, Herbert T. Boston.
Whitmore, Wm. H. . "
Whiton, David . . "
Wilder, Marshall P. Dorchester.
Williams, H. W. . . Boston.

Winthrop, Robert C. Boston.
Wood, John F. . . "
Woodward, Frank L. "
Woolson, Moses . . Boston.
Wright, John H. . . "
Wyman, Morrill . . Cambridge.

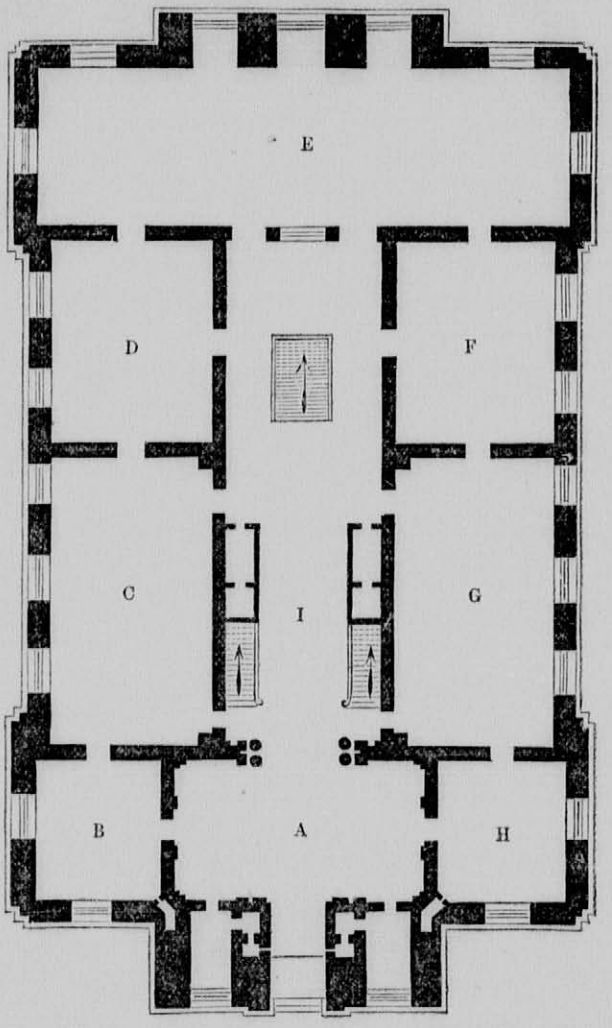
This view of the Institute Building is from a cut kindly furnished by Hon. Horace Capron, Commissioner of Agriculture, Washington, D.C.

BASEMENT FLOOR.



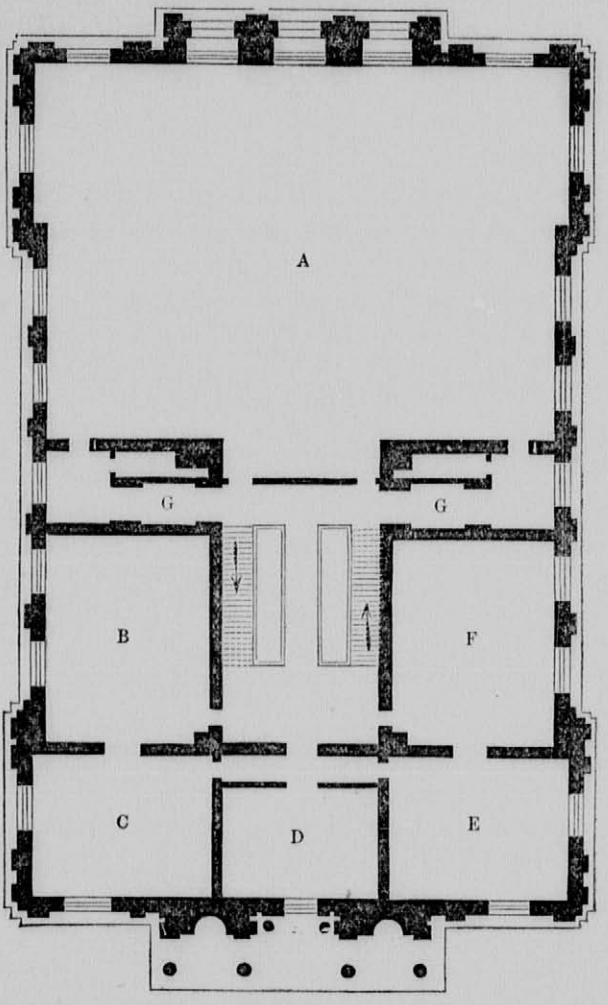
A. Professors' Chemical Laboratory, 25′ 0″ by 22′ 11″.
B. General and Qualitative Chemical Laboratory, 49′ 7″ by 34′ 0″
C. Quantitative Chemical Laboratory, 35′ 8″ by 34′ 0″.
D. Quantitative Chemical Laboratory, 26′ 4″ by 24′ 0″.
F. Professor Crafts's Private Laboratory, 34′ 0″ by 13′ 0″.
G. Mining Laboratory, 49′ 2″ by 27′ 10″.
H. Metallurgical Laboratory, 35′ 8″ by 24′ 0″.
I. Chemical Lecture Room, 49′ 7″ by 34′ 0″.
J. Mineralogical and Blowpipe Laboratory, 25′ 0″ by 22′ 11″.
K. Daily Chemical Supply Room, 14′ 6″ by 12′ 0″.
L. Engine and Boiler Room, 42′ 2″ by 25′ 0″.

FIRST STORY FLOOR.



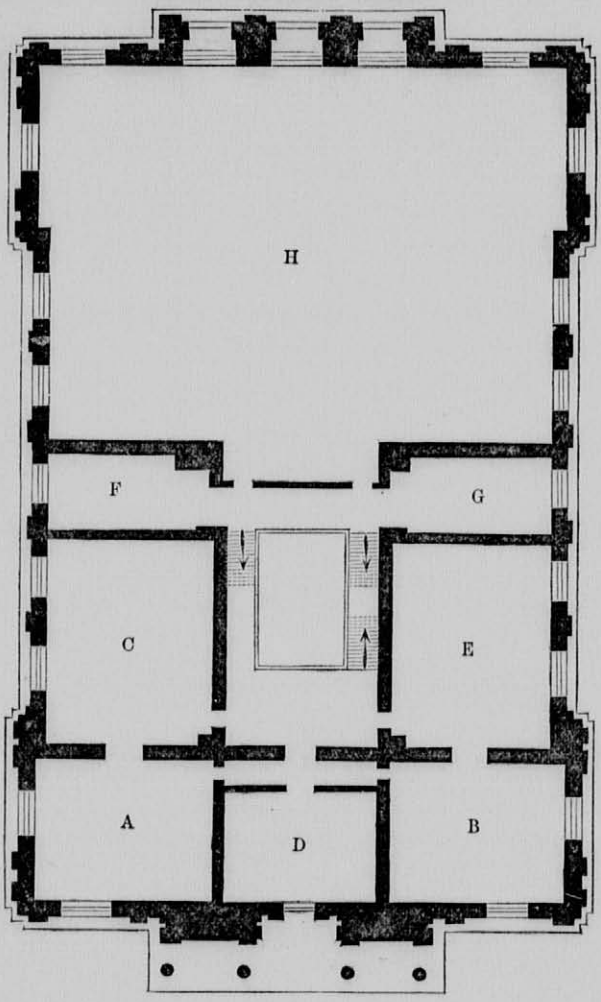
A. Entrance Hall, 42′ 2″ by 25′ 0″.
B. President's Office, 25′ 0″ by 22′ 11″.
C. Physical Lecture Room, 49′ 7″ by 28′ 3″.
D. Physical Laboratory and Apparatus Room, 35′ 8″ by 28′ 3″.
E. Physical Laboratory and Apparatus Room, 92′ 0″ by 27′ 10″.
F. Mining and Geological Lecture Room, 35′ 8″ by 28′ 3″.
G. Society of Arts Room, 49′ 7″ by 28′ 3″.
H. Secretary's Office, 25′ 0″ by 22′ 11″.
I. Stairway Hall, 87′ 3″ by 26′ 10″.

SECOND STORY FLOOR.



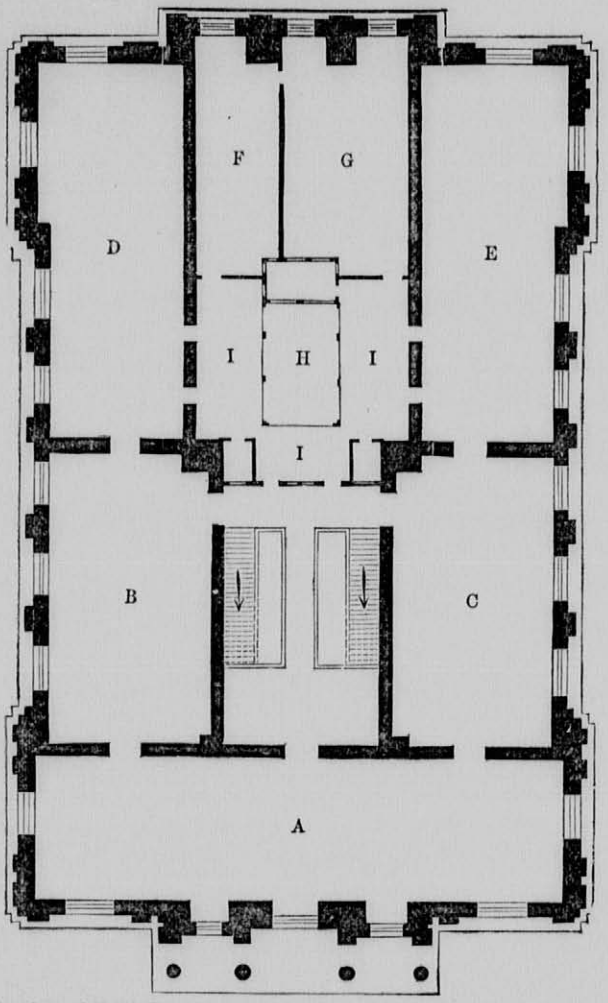
A. Huntington Hall, 92′ 0″ by 65′ 5″.
B. Mathematical Lecture Room, 34′ 9″ by 28′ 3″.
C. Civil Engineering Lecture Room, 32′ 2″ by 25′ 0″.
D. Modern Language Lecture Room, 26′ 2″ by 20′ 6″.
E. English Lecture Room, 32′ 2″ by 25′ 0″.
F. Mathematical and Astronomical Lecture Room, 34′ 9″ by 28′ 3″.
G. G. Passageways to Huntington Hall

HALF STORY FLOOR.



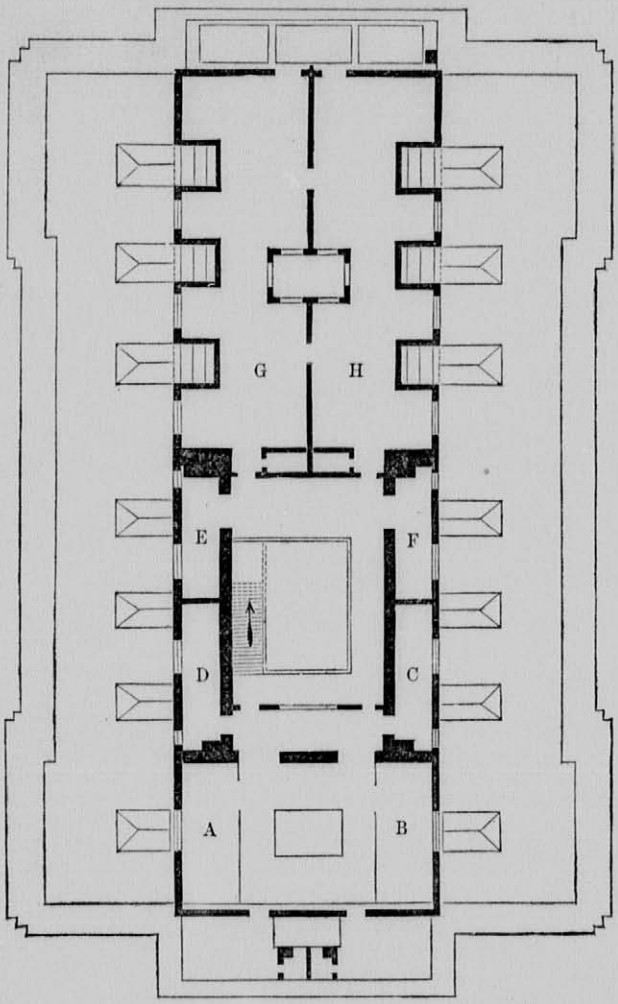
A. Architectural Museum, 32′ 2″ by 25′ 0″.
B. Architectural Library and Study Room, 32′ 2″ by 25′ 0″.
C. Architectural Museum, 34′ 9″ by 28′ 3″.
D. Natural History Lecture Room, 26′ 2″ by 20′ 6″.
E. Reading and Study Room, 34′ 9″ by 28′ 3″.
F. Prof. Atkinson's Study, 28′ 3″ by 14′ 2″.
G. Prof. Hunt's Study, 28′ 3″ by 14′ 2″.
H. Huntington Hall.

THIRD STORY FLOOR.

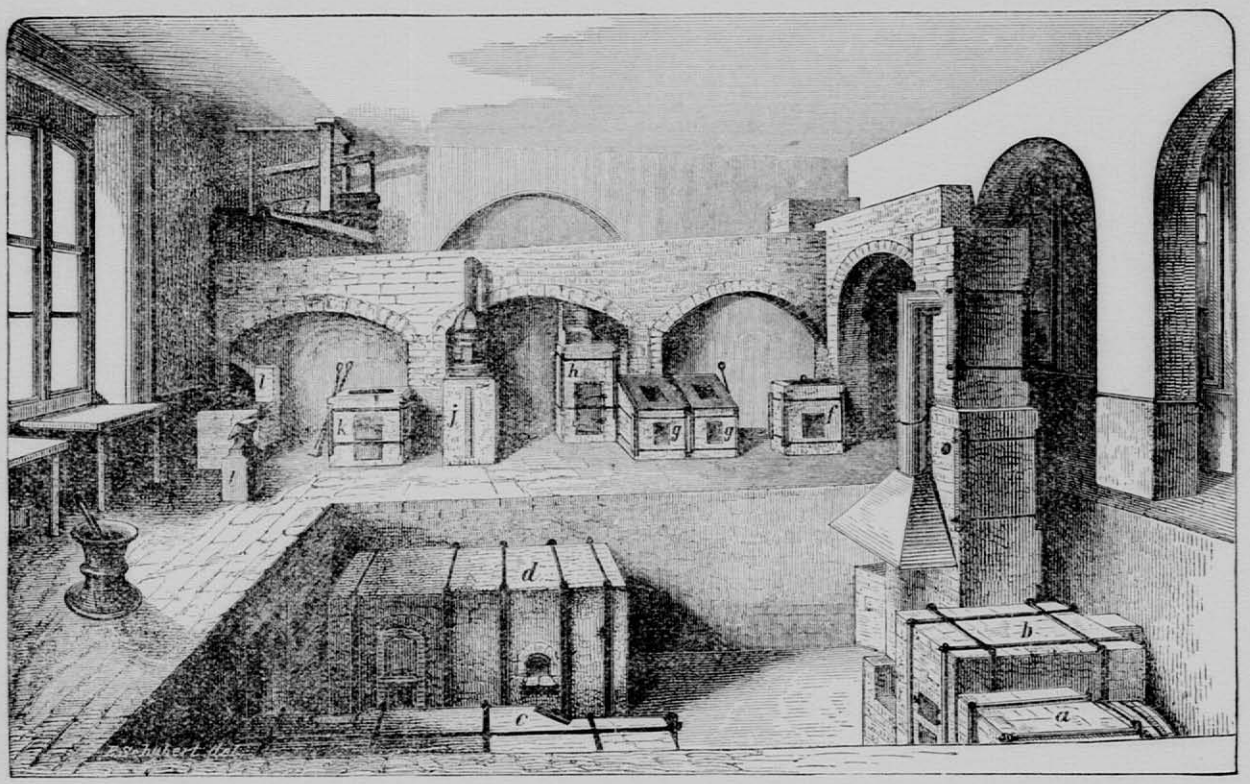


A. Second Year's Drawing Room, 92′ 0″ by 25′ 0″.
B. Third Year's Drawing Room, 49′ 7″ by 28′ 3″.
C. First Year's Drawing Room, 49′ 7″ by 28′ 3″.
D. Fourth Year's Drawing Room, 65′ 5″ by 26′ 0″.
E. First Year's Drawing Room, 65′ 5″ by 26′ 0″.
F. Mechanical Engineering Lecture Room, 37′ 0″ by 17′ 0″.
G. Mathematical and Descriptive Geometry Lecture Room, 37′ 0″ by 28′ 0″.
H. Model Room, 21′ 0″ by 13′ 0″.
I. I. I. Passageways.

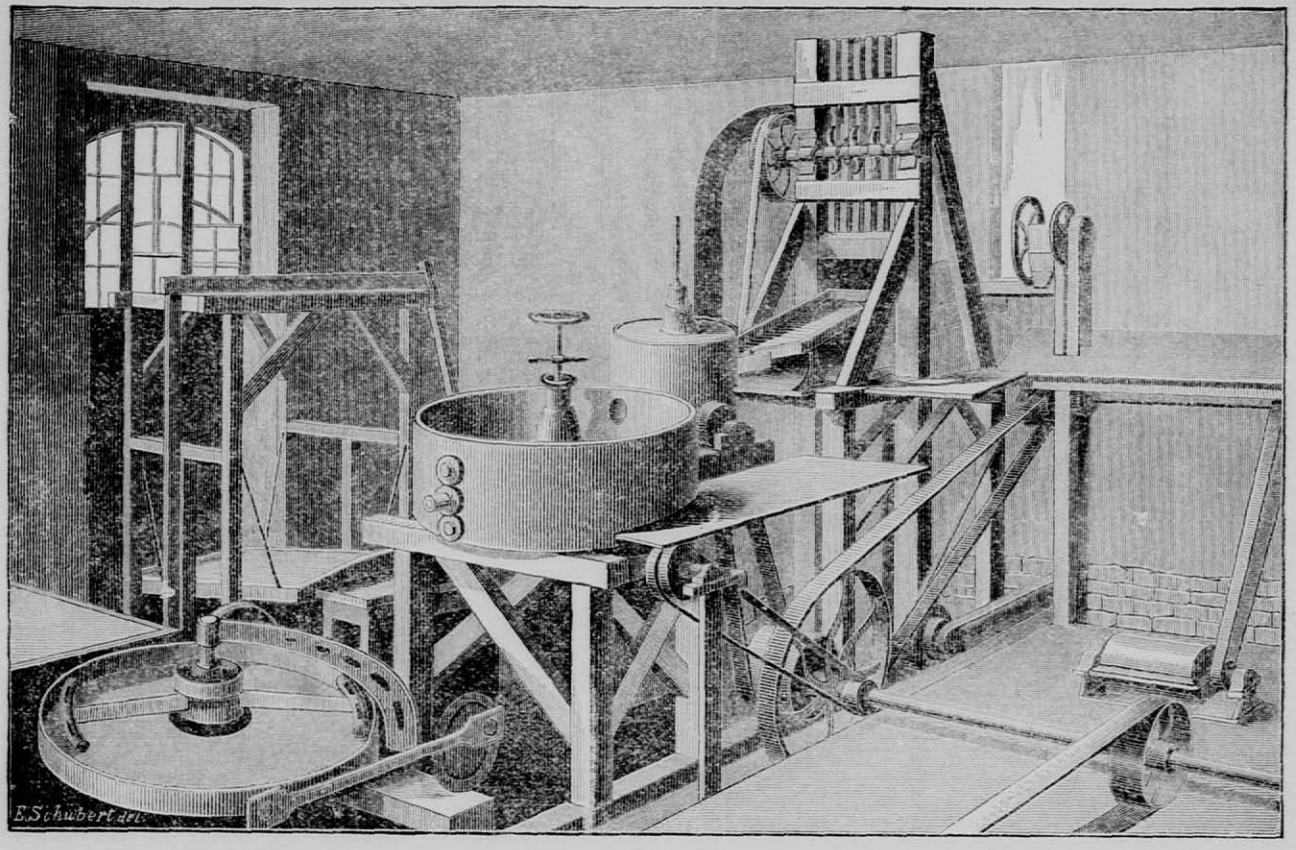
FOURTH STORY FLOOR.



A. Prof. Lanza's and Prof. Whitaker's Study, 24′ 5″ by 11′ 6″.
B. Prof. Henck's Study, 24′ 5″ by 11′ 6″.
C. Prof. Osborne's Study, 24′ 9″ by 7′ 6″.
D. Prof. Richards's and Prof. Nichols's Study, 28′ 0″ by 7′ 6″.
E. Instructor Hoyt's Study, 21′ 6″ by 7′ 6″.
F. Prof. Ware's Study, 24′ 9″ by 7′ 6″.
G. Architects' Drawing Room, 65′ 5″ by 21′ 10″.
H. Drawing Room, Free-hand and Design, 65′ 5″ by 21′ 10″.



METALLURGICAL LABORATORY.



MINING LABORATORY.