

LEARNING AND LABOR.

C I R C U L A R

OF THE

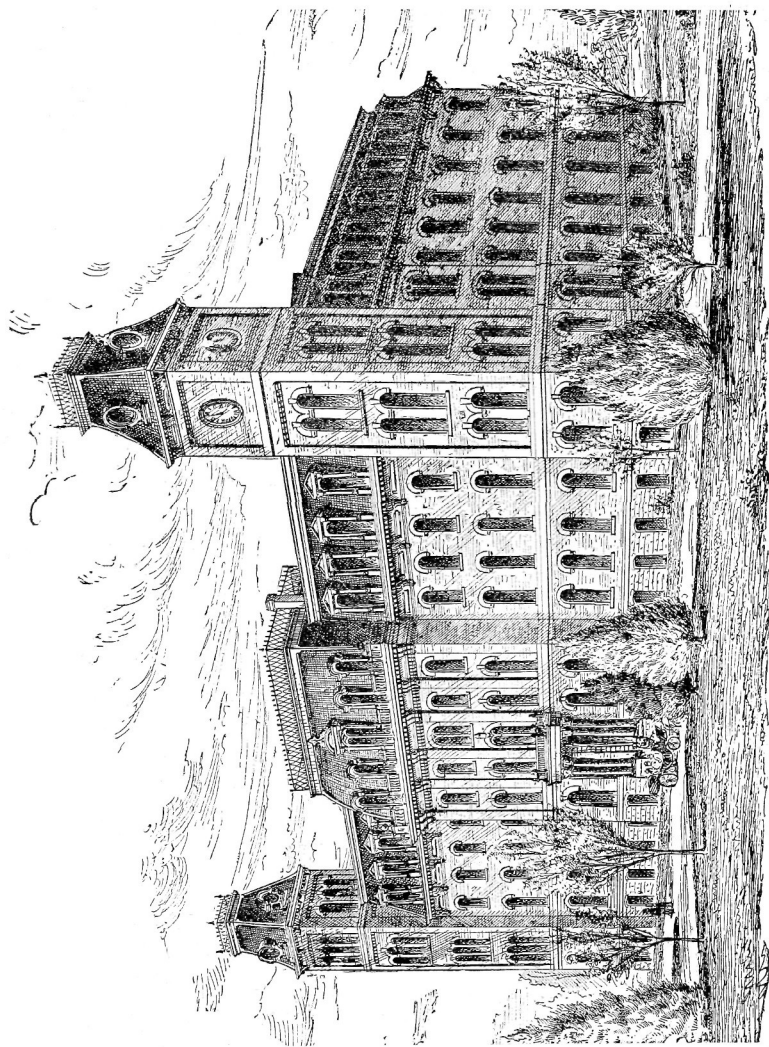
UNIVERSITY OF ILLINOIS,

URBANA, CHAMPAIGN COUNTY, ILL.

SEPTEMBER, 1885.

CHAMPAIGN.
GAZETTE STEAM PRINT.

1885



1885-86

~~1884-85~~

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UNDER LAW OF MAY 7, 1873.

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ARTHUR N. TALBOT, C. E.,
Assistant Professor of Engineering and Mathematics.

* Will enter upon duty Jan. 1, 1886.

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GEORGE W. PARKER,
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Instructor in Ancient Languages.

HELEN B. GREGORY, B. L.,
Instructor in Modern Languages.

SAMUEL W. STRATTON,
Instructor in Mathematics.

KITTIE M. BAKER, B. S.,
Teacher of Vocal and Instrumental Music.

GEORGE C. HEWES, B. S.,
First Assistant in Chemical Laboratory.

DWIGHT H. BARRETT,
Second Assistant in Chemical Laboratory.

WILLIAM H. GARMAN,
Assistant in Zoological Laboratory.

GEORGE W. McCLUER, B. S.,
Foreman Horticultural Department.

A. B. BAKER,
Janitor.

SUMMARY OF STUDENTS FOR 1884-5.

By CLASSES.	MEN.	WOMEN	TOTAL.
Resident Graduates.....	5	1	6
Seniors.....	42	13	55
Juniors.....	41	8	49
Sophomores.....	44	12	56
Freshmen.....	70	17	87
Preparatory.....	78	8	86
Special.....	12	11	23
Total	292	70	362

By COURSES.	MEN.	WOMEN	TOTAL.
Agriculture.....	21		21
Mechanical Engineering.....	56		56
Civil Engineering.....	58		58
Mining Engineering.....	1		1
Architecture.....	26		26
Chemistry.....	22	1	23
Natural History.....	15	5	20
Art and Design.....		11	11
English and Modern Languages.....	60	42	102
Ancient Languages.....	4		4
Not Specified	24	10	34
	287	69	356
Resident Graduates.....	5	1	6
Total	292	70	362

University of Illinois.

HISTORY.

The University of Illinois had its origin in a movement for the higher education of the industrial classes, begun in 1851, and resulting in the congressional grant of lands for this purpose, made to the several States in 1862, and amounting in this State to 480,000 acres. The University was chartered in February, 1867, and opened to students in March, 1868. In addition to the endowment from the land grant, over \$400,000 were donated by Champaign county in bonds, buildings, and farms. The State also has made large appropriations for fitting up and stocking the farms, for library and apparatus, and for buildings, including the large Main building erected in 1872 and 1873, the Mechanical Building and Drill Hall, and the Chemical Laboratory. Successive Colleges and schools have been added as required, until four Colleges, including ten distinct Schools, have been organized.

The whole number matriculated as students since the opening is 1,954. The number graduated from the several Colleges, including the class of 1885, is 447. In 1871 the University was opened for lady students, on the same terms as to gentlemen. In 1874 a Fine Art Gallery was established. In 1876 the University received from the Centennial Exposition at Philadelphia, three diplomas and a medal. In 1877 its exhibit at the Paris International Exposition gained a diploma and the gold medal.

LOCATION.

The University has a beautiful and healthful situation on the high grounds between the cities of Champaign and Urbana, and within the corporate limits of the latter. It is one hundred and twenty-eight miles south from Chicago,

at the junction of the Illinois Central, the Indiana, Bloomington and Western, and the Wabash railways. The country is a region of beautiful rolling prairies, with large belts of timber along the streams, and is one of the richest farming districts in the State.

BUILDINGS AND GROUNDS.

The domain occupied by the University and its several departments, embraces about 623 acres, including stock farm, experimental farm, orchards, nurseries, forest plantation, arboretum, ornamental grounds, and military parade grounds.

The University buildings, fifteen in number, include a grand Main Building, a spacious Mechanical Building and Drill Hall, a large Chemical Laboratory, a Veterinary Hall, a small Astronomical Observatory, two dormitories, three dwellings, two large barns, and a green-house.

The Main University Building, designed wholly for public uses, occupies three sides of a quadrangle, measuring 214 feet in front and 122 feet upon the wings. The Library wing is fire proof, and contains in spacious halls the Museum of Natural History, the Library, the Art Gallery, and the Museum of Engineering. The Chapel wing contains the Chapel, the Physical Laboratory and Lecture Room, and rooms for draughting and drawing. In the main front are convenient class-rooms; on the upper floor, elegant halls for literary societies. The building is warmed by steam from a boiler-house which forms the fourth side of the quadrangle in the rear.

The Mechanical Building and Drill Hall is of brick, 126 feet in length, and 88 feet in width. It contains a boiler-room, a machine shop, furnished for practical use with a steam engine, lathes, and other machinery; pattern and finishing shop; shops for carpentry and cabinet-work, furnished with wood-working machinery; paint and draughting rooms, and rooms for models, storage, etc. An addition built lately for a blacksmith shop, 32 by 36 feet, contains sixteen forges, with anvils and tools, and a cupola for melting iron. In the second story is the large Drill Hall, 124 by 80 feet, sufficient for the evolutions of a company of infantry or a section of a battery of field artillery. It is also supplied with gymnastic apparatus. One of the towers contains an armorer's shop

and an artillery room; the other contains a printing office and editor's room.

The Chemical Building erected in 1878, at a cost, including furniture, of \$40,000, contains five laboratories, and is one of the best and largest in the United States.

PROPERTY AND FUNDS.

Besides its lands, buildings, furniture, library, etc., valued at \$400,000, the University owns 15,000 acres of well selected lands in Minnesota. It has also endowment funds invested in State and County bonds amounting to \$337,000.



Museums and Collections.

The Museum of Zoology and Geology occupies a hall 61 by 79 feet, with a gallery on three sides, and is completely furnished with wall, table, and alcove cases. It already contains interesting and important collections, equaled at few, if any, of the colleges of the West. They have been specially selected and prepared to illustrate the courses of study in the school of natural history, and to present a synoptical view of the zoology of the State.

Zoology.—The mounted *mammals* comprise an unusually large and instructive collection of the ruminants of our country, including male and female moose and elk, bison, deer, antelope, etc.; and, also, several quadrumana, large carnivora and fur-bearing animals, numerous rodents, and good representative marsupials, cetaceans, edentates, and monotremes. Fifty species of this class are represented by eighty specimens.

The collection of mounted *birds* (about five hundred specimens of two hundred and forty species) includes representatives of all the orders and families of North America, together with a number of characteristic tropical forms. Many of these specimens are excellent examples of artistic taxidermy. A series of several hundred unmounted skins is available for the practical study of species.

The set of *skeletons* contains examples of all the orders of mammals and birds except Proboscidea, together with typical representatives of the principal groups of reptiles, amphibians, and fishes.

The *cold-blooded vertebrates* are also illustrated by a very useful collection of alcoholic specimens, plaster casts, and mounted skins of the larger species, both interior and marine.

Conchology is illustrated by several thousand shells belonging to seventeen hundred species; together with alcoholic specimens of all classes and orders. The collection of Illinois shells is creditable, although partly incomplete.

The *entomological cabinet* contains about three thousand species (principally American) named, labelled, and systematically arranged. The *lower invertebrates* are represented by several hundred dried specimens and alcoholics, and by a large series of the famous Blaschka glass models.

Geology.—The geological collection comprises casts of many of the largest and most remarkable fossils hitherto discovered in the various geological formations, illustrating the general progress of life in the mollusks, fishes, reptiles, and mammals, from the oldest palæozoic time to the present. A fine set of fossils from Germany, and collections, suitably arranged for practical study from this and other States, illustrate the different formations. There is a good collection of foot-prints from the Connecticut river sand-stones.

In *Entomology* numerous species have been contributed by the State Entomologist, who is required by law to deposit his first series of specimens in the cabinet of the University. Local collections and exchanges have increased the number to about three thousand species. The recent establishment at the University of the office of the State Entomologist of Illinois makes available to students of this subject the entomological library and the collections of that office, and affords an extraordinary opportunity for observation of the methods of work and research in economic entomology.

Botany.—The herbarium contains about one thousand species of plants indigenous to Illinois, including nearly complete sets of grasses and sedges. There are, besides, many other North American plants and some exotics. A collection of Fungi, includes examples of those most injurious to other plants, causing rusts, smuts, moulds, etc. A collection of wood specimens from two hundred species of North American trees, well illustrates the varieties of native wood. The trees and shrubs of Stephenson county, Illinois, are represented by a distinct collection.

Plaster casts represent fruits of many of the leading varieties, as well as interesting specimens of morphology, showing peculiarities of growth, effects of cross-fertilization, etc.

Lithology.—This collection embraces the principal kinds of metamorphic and volcanic rocks; examples of stratification in the limestone and fragmental kinds, with many samples of such rocks as are found most valuable for building purposes.

Mineralogy.—The specimens of minerals show all the groups and all the important and typical species. All the metals are represented, also many of their most important combinations. Many of the specimens are finely crystalized; these, with a complete set of imported models, fully illustrate crystallography.

Agricultural.—A large collection of soils from different portions of Illinois, and other States; many varieties of corn, wheat, and other cereals and seeds; specimens illustrating the official State Inspection of grains at Chicago, showing the quality of the different grades recognized; a collection of grains, seeds, nuts, etc., from Brazil; some hundreds of models of agricultural inventions; models illustrating modes and materials for drains; casts of ancient plows; engravings, lithographs, and photographs of typical animals of noted breeds.

The farms give good illustrations of farm buildings, implements, machinery, modes of culture, and of domestic animals of various classes.

Physics.—The Cabinets of the Physical Laboratory contain a collection of apparatus from the most celebrated European and American makers, illustrating the subjects of Mechanics, Pneumatics, Optics, and Electricity. Ample facilities are afforded to students for performing experiments of precision by which the theories of Physical Science may be tested and original work may be done.

A series of standard weights and measures has been received from the office of the Coast and Geodetic Survey of the United States Government, and may be consulted at the Physical Laboratory.

The Mechanical Laboratory is provided with a steam engine, engine and hand lathes, planer, shapers, milling-machine, drill presses, and the requisite hand tools, benches, vises, anvils, etc., for pattern-shop, blacksmith-shop, moulding-room, and bench work. Its cabinets contain several hundred models of elements of mechanism and machines from Schroeder, Riggs, the patent-office, and from the workshops of the University.

Mining Engineering is illustrated by a valuable series of models, obtained from Freiburg, illustrating sections of

mines, machinery for elevating and breaking ore, with furnaces and machinery for metallurgical processes.

ART GALLERY.

The University Art Gallery is one of the largest and finest in the West. It was the gift of citizens of Champaign and Urbana. It occupies a beautiful hall, 61x79 feet, and the large display of Art objects has surprised and delighted all visitors. In sculpture it embraces thirteen full-size casts of celebrated statues, including the Laocoon group, the Venus of Milo, etc., forty statues of reduced size, and a large number of busts, ancient and modern, bas reliefs, etc., making over 400 pieces. It includes also hundreds of large auto-types, photographs, and fine engravings, representing many of the great masterpieces of painting of nearly all the modern schools. Also a gallery of historical portraits, mostly large French lithographs of peculiar fineness, copied from the great national portrait galleries of France. The value of this splendid collection, as a means of education, is already showing itself in the work of the School of Drawing and Design of the University.

Museum of Engineering and Architecture.—A large room is devoted to the gathering of a museum of practical art, the materials for which have been constantly accumulating in the various schools of science. It will contain full lines of illustrations of the work of the shops; models made at the University or purchased abroad; drawings in all departments; patent-office models, etc.; samples of building materials, natural and artificial; with whatever may be secured that will teach or illustrate in this most important phase of University work.

A notable feature of this collection is the gift of Henry Lord Gay, Architect, of Chicago. It consists of a model in plaster, and a complete set of drawings, of a competitive design for a monument to be erected in Rome, commemorative of Victor Emanuel, first King of Italy. The monument was to be of white marble, an elaborate gothic structure, beautifully ornamented, and 300 feet high. Its estimated cost was to have been seven and a quarter million of francs. The design was placed by the art committee second on a list of 289 competitors; but both the first and second were set aside for

political reasons. Mr. Gay's generous gift occupies the place of honor in the Museum of Engineering and Architecture.

LIBRARY.

The Library, selected with reference to the literary and scientific studies required in the several courses, includes over 14,000 volumes, and additions are made every year.

The large library hall, fitted up as a reading-room, is open throughout the day for study, reading, and consulting authorities. It is intended that the use of the Library shall largely supplement the class-room instruction in all departments. Constant reference is made in classes to works contained in the Library, and their study is encouraged or required. The reading room is well provided with American, English, French, and German papers and periodicals, embracing some of the most important publications in science and art. The following periodicals are regularly received:

PERIODICALS IN THE LIBRARY, 1885.

AGRICULTURAL AND HORTICULTURAL.

Prairie Farmer.
Western Rural.
Country Gentleman.
Breeder's Gazette.
Indiana Farmer.
New England Farmer.
Michigan Farmer.
Farmer and Fruit-Grower.
Iowa Homestead.
Agricultural Gazette, *London*.
Gardeners' Chronicle, *London*.
American Agriculturist.
Western Agriculturist.
Live Stock Journal, monthly and weekly.
Horticulturist.
Farmers' Review.
Veterinary Journal.
Industrialist.
Poultry Keeper.
Farm, Field and Stockman.

ENGINEERING.

Encyclopedie d'Architecture, *Paris*.
Builder, *London*.
American Engineer.

Transactions American Society of Civil Engineers.
Engineering News.
Engineering and Mining Journal.
Scientific American.
Scientific American Supplement.
Sanitary Engineer.
Van Nostrand's Engineering Magazine.
The Workshop.
American Architect.
American Machinist.
Western Manufacturer.
Gazette of Patent Office.
Mechanics.
Locomotive.
American Artisan.

SCIENTIFIC.

Botanique.
Annales des Sciences Naturelles, Botanique, *Paris*.
Annales des Sciences Naturelles, Zoologie, *Paris*.
Science.
Nature, *London*.
American Naturalist.

Grevillea, *London*.

Journal of Microscopical Science.

Decorator and Furnisher.

Art Amateur.

Portfolio, *London*.

Comptes Rendus, *Paris*.

Chemical News, *London*.

Journal of Chemical Society, *London*.

American Journal of Chemistry.

Boston Journal of Chemistry.

Jahrbericht der Chemie, *Giessen*.

Zeitschrift für An Chemie.

Berichte der Deutschen Chemischen Gesellschaft, *Berlin*.

Lancet, *London*.

Popular Science Monthly.

American Journal of Mathematics.

American Journal of Science and Art.

Journal of Franklin Institute.

Journal de Mathematiques.

Mathematical Quarterly.

Annals of Mathematics.

Monthly Weather Review.

LITERARY AND NEWS.

International Review.

Nineteenth Century.

Edinburg Review.

Contemporary Review.

Fortnightly Review.

North American Review.

Atlantic Monthly.

Century.

Dial.

Literary World.

American Journal of Education.

Education.

Legal Adviser.

Revue des Deux Mondes, *Paris*.

Deutsche Rundschau, *Berlin*.

Nation.

Congressional Record.

Champaign County Gazette.

Champaign County Herald.

Champaign Times.

Musical Record.

Signal.

The Rock-Islander.

Country and Village Schools.

The exchanges of the *Illini* are also free to the students in the Library.



Aims of the University.

The University is both State and National in origin. Its aims are defined by the following extracts from the laws of Congress and of the State Legislature:

"Its leading objects shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and profession in life."—*Act of Congress 1862, Sec. 4.*

"The Trustees shall have the power to provide the requisite buildings, apparatus, and conveniences, to fix the rates of tuition, to appoint such professors and instructors, and establish and provide for the management of such model farms, model art, and other departments and professorships as may be required to teach, in the most thorough manner, such branches of learning as are related to agriculture and the mechanic arts, and military tactics, without excluding other scientific and practical studies."—*Act of General Assembly 1867, Sec. 7.*

In accordance with the two acts above quoted, the University holds, as its principal aim, to offer freely the most thorough instruction which its means will provide, in all the branches of learning useful in the industrial arts, or necessary to "the liberal and practical education of the industrial classes, in the several pursuits and professions in life." It includes in this all useful learning, scientific and classical—all that belongs to sound and thorough scholarship.

ORGANIZATION OF THE UNIVERSITY.

COLLEGES AND SCHOOLS.

The Institution is a University in the American sense, though differing designedly in the character of some of its

Colleges from the older Institutions of this country. It embraces four Colleges, which are subdivided into Schools. A School is understood to embrace the course of instruction needful for some one profession or vocation. Schools that are cognate in character and studies, are grouped in the same College. The following are the Colleges and Schools:

I. COLLEGE OF AGRICULTURE.

II. COLLEGE OF ENGINEERING.

School of Mechanical Engineering. School of Architecture.

School of Civil Engineering. School of Mining Engineering.

III. COLLEGE OF NATURAL SCIENCE.

School of Chemistry.

School of Natural History.

IV COLLEGE OF LITERATURE AND SCIENCE.

School of English and Modern Languages.

School of Ancient Languages.

V. ADDITIONAL SCHOOLS.

School of Military Science.

School of Art and Design.

Vocal and Instrumental Music are taught, but not as parts of the regular courses.

CHOICE OF STUDIES.

From the outset, the University has permitted great freedom in the selection of studies. It is, however, necessarily required:—that the student shall be thoroughly prepared to enter and to keep pace with the classes in the chosen studies, and that he shall take these studies in the terms in which they are taught. Candidates for a degree must take the course of study prescribed for that degree.

Each student is expected to have three distinct studies, affording three class exercises each day. On special request, the Faculty may allow less or more.

No change in studies may be made after the beginning of a term without permission of the Faculty.

Due care will be taken to prevent, as far as possible, all abuse of the liberty of choice. Students failing to pass satisfactory examinations in their chosen studies, will not be permitted to remain and take other studies without a vote of the Faculty.

REQUIRED STUDIES.

To secure the diffusion of the sciences relating to the great industries, the State Legislature, in 1873, prescribed that each student should be taught some of those sciences.

The Trustees accordingly require that each student shall take, each term, one study at least from the following list:

Physics, Chemistry, Mineralogy, Physiography, Anatomy and Physiology, Botany, Zoology, Geology, Entomology; Drawing and Designing, Mathematics, Surveying; Elements of Agriculture and Horticulture, Vegetable Physiology, Agricultural Chemistry, Agricultural Engineering and Architecture, Animal Husbandry, Rural Economy, Landscape Gardening, History of Agriculture, Veterinary Science; Architectural Drawing and designing, Elements of Construction, Graphical Statistics, History and Esthetics of Architecture, Estimates, Mining Engineering, Metallurgy, Analytical Mechanics, Geodesy, Principles of Mechanism, Hydraulics, Thermodynamics, Strength of Materials, Prime Movers, Mill Work, Machine Drawing, Roads and Railroads, Construction and Use of Machinery, Modeling and Patterns, Bridges, Stone Work, Astronomy; Military Science, and Political Economy.

EXAMINATIONS FOR ADMISSION.

Examinations of candidates for admission to the University, or any of its departments, are held at the University itself, on the two days previous to the opening of each term. These examinations embrace the following studies:

1. English Grammar, Arithmetic, Geography, and History of the United States, for all the Colleges. These examinations are as thorough as those required for second-grade certificates for teachers in the public schools.

2. Algebra, including equations of second degree and the calculus of radical qualities; Geometry, plain and solid. These are required also for all the Colleges.

3. Physiology, Botany, Natural Philosophy, English Rhetoric and Composition, These are required, in addition to the subjects specified in 1 and 2, for candidates for the Colleges of Agriculture, Engineering, and Natural Science.

4. Physiology, Botany, Natural Philosophy; Latin Grammar and Reader, Cæsar, Cicero, Virgil, and Latin Prose Composition, in addition to 1 and 2, for School of English and Modern Languages.

5. Latin (as in 4), Greek Grammar and Reader, four books Xenophon's Anabasis, and Greek Prose Composition in addition to the subjects of 1 and 2, for candidates for School of Ancient Languages.

For further information concerning terms of admission, see "*Admission*" under the several Colleges; also, "*Preliminary year*."

COUNTY SUPERINTENDENTS' CERTIFICATES.

To prevent loss to those who are not prepared to enter the University, but might come, hoping to pass the examinations for admission, the following arrangement has been made:

County Superintendents of Schools will be furnished with questions and instructions for the examination of candidates in the four common branches, Arithmetic, Geography, English Grammar, and history of the United States; applicants who pass creditably will, when they present the superintendent's certificate to that effect, be admitted to the classes of the Preliminary year.

College of Agriculture.

SPECIAL FACULTY.

THE REGENT.

PROFESSOR MORROW, Dean.	PROFESSOR FORBES.
PROFESSOR BURRILL.	PROFESSOR ROLFE.
PROFESSOR McMURTRIE.	

ADMISSION.

Candidates for admission to the College of Agriculture must be at least fifteen years of age, and must pass satisfactory examinations in the common school branches and in the studies of the preliminary year. While by law, students may be admitted at fifteen years of age, in general it is much better that they shall be eighteen or twenty. It will be well if candidates shall have pursued other studies besides those required for admission. The better the preparation the more profitable the course.

OBJECT OF THE COLLEGE.

The aim of this College is to educate scientific agriculturists and horticulturists. The frequency with which this aim is misunderstood, demands that it shall be fully explained. Many, who look upon agriculture as consisting merely in the manual work of plowing, planting, cultivating and harvesting, and in the care of stock, justly ridicule the idea of teaching these arts in a college. The practical farmer who has spent his life in farm labors, laughs at the notion of sending his son to learn these from a set of scientific professors. But all this implies a gross misunderstanding of the real object of agricultural science. It is not simply to teach *how* to plow, but the reason for plowing at all—to teach the

composition and nature of soils, the philosophy of plowing, of manures, and the adaptation of the different soils to different crops and cultures. It is not simply to teach *how* to feed, but to show the composition, action, and value of the several kinds of food and the laws of feeding, fattening, and healthful growth. In short, it is the aim of the true Agricultural College to enable the student to understand thoroughly all that man can know about soils and seeds, plants and animals, and the influences of light, heat, and moisture on his fields, his crops, and his stock; so that he may both understand the reason of the processes he uses, and may intelligently work for the improvement of those processes. Not "book farming" but a knowledge of the real nature of all true farming—of the great natural laws of the farm and its phenomena—this is the true aim of agricultural education. Agriculture involves a larger number of sciences than any other human employment, and becomes a fit sequence to any collegiate training.

The steady aim of the trustees has been to give the College of Agriculture the largest development practicable, and to meet the full demand for agricultural education, as fast as it shall arise. Agricultural students are especially invited to the University.

Boards of Agriculture, Agricultural and Horticultural Associations, State and County, are invited to co-operate with the University in its efforts to awaken a more general appreciation of the value of education, and to add, by the establishment of scholarships, or other means, to the number of those who avail themselves of its facilities for instruction.

INSTRUCTION.

The instruction unites, as far as possible, theory and practice—theory explaining practice and practice illustrating theory. The technical studies are taught mainly by lectures, with careful readings of standard agricultural books and periodicals, and frequent discussions, oral and written, of the principles taught. These are also illustrated by demonstrations and observations in the fields, stables, orchards, gardens, plant-houses, etc.

SPECIAL STUDIES.

AGRICULTURE.

Elements of Agriculture.—Outline of the general principles underlying Agriculture in its theory and practice, introductory to the technical and scientific studies of the course.

Agricultural Engineering and Architecture.—Arrangement of the farm; its improvement by mechanical means, as drainage and irrigation; its divisions, fences, hedges, etc.; its water supply; the construction of roads; arrangement, planning and construction of farm buildings; the construction, selection, care, and use of farm implements and machinery.

Animal Husbandry.—Principles of breeding and management of domestic animals; description of all important breeds and varieties, giving their history and adaptations.

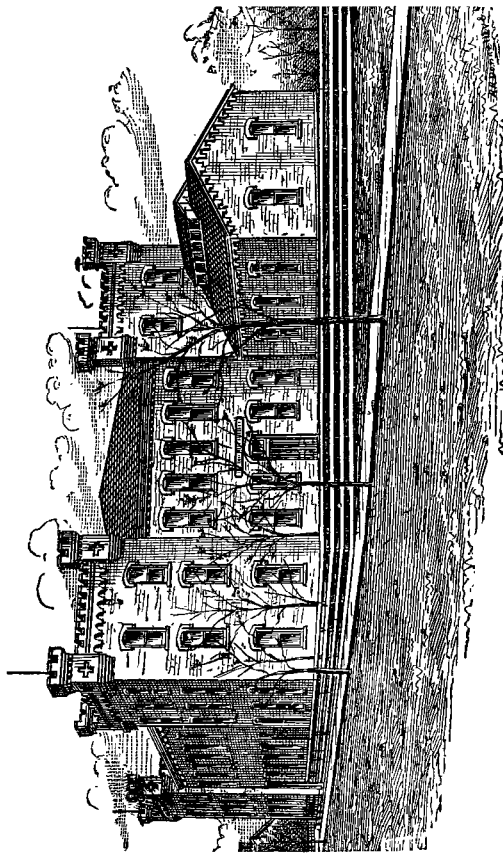
Rural Economy.—Relation of Agriculture to other industries and to national prosperity; influences which should determine the class of farming to be adopted; comparisons of special and general systems; uniting of manufacturing with farming; culture of the various farm crops—cereals, grasses, etc.; farm accounts.

History of Agriculture.—Progress and present condition in this and in other countries. Influence of climate, civilization, and legislation in advancing or retarding. Agricultural literature and organizations.

Rural Law.—Business law; laws especially affecting agriculture—tenures of real estate; road, fence, drainage laws, etc.

HORTICULTURE.

Elements of Horticulture.—The following topics are discussed: Orchard sites; the age of trees to plant; the season to plant; how to plant; what to plant; the management of the soil; pruning and care of trees; gathering and preserving fruit; disease and injuries; the nursery; ornamental trees and shrubs; flower gardens; vegetable gardens, including propagating beds and houses; the vineyard and small fruits, and timber tree plantation. Students have instruction and practice in grafting, budding, propagation by cuttings, etc. Each student has usually grafted from two hundred to one thousand root grafts of apples.



DRILL HALL AND MACHINE SHOP.

Landscape Gardening.—Lectures are given upon the general principles of the art, the history, and the styles, the kinds and uses of trees, shrubs, grass, and flowers, the introduction and management of water, the construction and laying out of drives and walks, fences, buildings, etc. The class draw first from copy; then, after the actual study of some locality with its environments, design and draw full plans for its improvement; indicating positions of all prominent objects, including the kinds and groups of trees and other plants. These plans, with specifications, are to be deposited in the library of the school. Excursions are made when found practicable, for the study of public and private grounds.

The three following studies constitute a year's work, designed for those who wish to prepare themselves for special horticultural pursuits, and may be taken as substitutes for agricultural or veterinary studies:

Floriculture.—The study of the kinds, propagation, growth, and care of flowering and other ornamental plants. Each student has practice in propagating by cuttings and otherwise, in potting and shifting, and in care of plants requiring various treatments. Insects and diseases, with the remedies, are thoroughly treated, and the means of securing vigor of growth and abundance of flowers are studied and illustrated by practice.

Pomology and Forestry.—Much of the first half of the term is spent in the orchards, nurseries, and forests, making observations and collections, and in laboratory work, determining species, varieties, etc. A large collection of apples, pears, grapes, peaches, etc., is made each year, and the chief characteristics of each is pointed out. Practice is had in making drawings and plaster casts. Written descriptions of the fruits are carefully made and compared with those given in the books, and systems of analysis and classification are put to practical tests. Students see and perform the skilled operations usually practiced in the propagation and growth of trees. Various methods of pruning and training, especially of grapes, are discussed in the class-room, and illustrated upon the grounds. Students study the injurious insects and fungi which cause or accompany diseases of

trees and fruits, and the methods of preventing or diminishing their ravages. The native forests of the vicinity and of the country at large are studied as a foundation for the lessons upon the influence and value of timber and other trees, and their artificial culture. For the latter, the forest tree plantation on the University grounds, and the aboretum, afford practical illustrations.

Plant-Houses and Management.—This study includes gardening and landscape architecture, the methods of construction, heating and ventilation, and general management, so as to secure, under the different circumstances, the best plant growth. The class-room work consists of lectures and architectural designing and drawing. Illustration and practice are afforded by the plant-houses of the University.

VETERINARY SCIENCE.

This science is taught during the third year. In the first term the Anatomy and Physiology of the domestic animals is taught by lectures, demonstrations, and dissections. Post-mortems of healthy and diseased animals are made, so that the students may become practically acquainted with the tissues in health and in disease. The first six weeks of the second term are devoted to the study of Veterinary Medicines, their action and uses; the remainder of the term to lectures on the principles and practice of Veterinary Science. During the third term practical instruction is given in clinical work, as cases present themselves, at the Veterinary Infirmary, where animals are treated or operated on free of charge for the instruction of the students. Lectures are given on Veterinary Sanitary Science and the Principles and Practice of Veterinary Surgery.

Students desiring to pursue the study of Veterinary Science further than is laid down in the agricultural course, will find ample facilities for so doing.

Text Books and Books of Reference.—Williams' Principles and Practice of Veterinary Medicine; Williams' Principles and Practice of Veterinary Surgery; Veterinary Medicines, Their Action and Uses, by Finlay Dun; Dobson on the Diseases of the Ox; Fleming's Veterinary Obstetrics; Fleming's Veterinary Sanitary Science; Chauveau's Anatomy of the Domestic Animals; Law's Farmer's Veterinary Adviser.

LABORATORY WORK.

Experiments and special investigations by each student. A Thesis is required, embodying the results of original observation and research.

For details as to the study of Botany, Chemistry, Zoology, Entomology, Geology, and Meteorology, see statements in *College of Natural Science*.

APPARATUS.

The College has for the illustration of practical agriculture, a Stock Farm of 400 acres, provided with a large stock-barn fitted up with stables, pens, yards, etc.; also an Experimental Farm of 180 acres, furnished with all necessary apparatus. It has fine specimens of neat cattle, Short-Horns and Jerseys, Berkshire and Poland-China Swine, and Shropshiredown, Southdown, and Cotswold Sheep to illustrate the problems of breeding and feeding. The Experimental Department exhibits field experiments, in the testing of the different varieties and modes of culture of field crops, and in the comparison and treatment of soils. It includes experiments in agriculture and horticulture, under the direction of the Professors of Agriculture and Horticulture, and experiments in feeding animals of different ages and development, upon the various kinds of food. In common with similar departments in the several Agricultural Colleges of the country, it attempts to create positive knowledge towards the development of an agricultural science.

The barn on the Stock Farm has north and west fronts of 80 feet each. Each limb, or L, is 40 feet wide. It is of the kind known as the hill-side barn. The barn on the Experimental Farm is of less size, but is fitted up with great convenience, and is supplied with a large windmill which furnishes power for grinding feed, and for other purposes.

A veterinary hall and stable have been provided, and a clinic is held to illustrate the lectures on veterinary science. The department has Dr. Auzoux's celebrated complete model of the horse in 97 pieces, exhibiting 3,000 details of structure; also *papier mache* models of the foot and the teeth of the horse at different ages.

Surveying and drainage are illustrated by field practice, with instruments and by models. Agricultural Chemistry is

pursued in connection with laboratory practice, in the analysis of soils, fertilizers, foods, etc. The College has fine collections of soils, seeds, plants, implements, skeletons of domestic animals, charts, and other apparatus, including a large number of models of agricultural machinery.

Upon the grounds devoted to the use of the College there are:

1. A very large specimen apple orchard, planted in 1869, and containing about 1,000 varieties—many varieties of pears, cherries, grapes, and small fruits.

2. A nursery of young trees, in which students have regular work in propagation, etc.

3. A forest tree plantation, embracing the most useful kinds of timber.

4. An arboretum in which all hardy indigenous and exotic trees are planted as fast as they can be secured, and which now contains nearly 100 varieties. The ornamental grounds which surround the University building embrace about twenty acres, and are kept in neat and attractive style. These, with all the adjuncts of trees and flowering shrubs, lawns, beds of flowers and foliage plants, walks of different materials and styles of laying out, give illustration to the class-room work in landscape gardening. A green-house contains a collection of plants of great value for the classes in floriculture and landscape gardening, besides furnishing students with practice in hot-house and green-house management. The library contains the best literature upon these subjects.

The cabinet contains a series of colored plaster-casts of fruits prepared at the University; *models plastiques* of fruits and flowers by Auzoux of Paris; collections of seeds of native and exotic plants; of specimens of native and foreign woods; of beneficial and injurious insects, and specimens showing their work; numerous dry and alcoholic specimens and preparations; maps, charts, diagrams, drawings, etc.

The College has a supply of compound microscopes and apparatus, and students have opportunity to learn their use, and to make practical investigations with them. The herbarium is rich in specimens of useful and noxious plants, including many of the fungous parasites which cause disease to cultivated crops.

AGRICULTURAL COURSE.

Required for the Degree of B. S., in College of Agriculture.

FIRST YEAR.

1. Elements of Agriculture; Chemistry; Trigonometry; Shop practice (optional).
2. Elements of Horticulture; Chemistry; British Authors, or Free Hand Drawing.
3. Economic Entomology; Chemistry; Rhetoric.

SECOND YEAR.

1. Chemistry and Laboratory Practice; Botany; German.
2. Agricultural Chemistry (Soils and Plants), Zoology or Botany; German.
3. Agricultural Chemistry (Tillage, Fertilizers, Foods); Vegetable Physiology; German.

THIRD YEAR.

1. Agricultural Engineering and Architecture; Animal Anatomy and Physiology; German.
2. Animal Husbandry; Veterinary Science; Veterinary Materia Medica (optional extra); Physics or Geology.
3. Landscape Gardening; Veterinary Science; Physics or Geology.

FOURTH YEAR.

1. Physiography; Mental Science; History of Civilization.
2. Rural Economy; Constitutional History; Logic.
3. History of Agriculture and Rural Law; Political Economy; Laboratory Work.

N. B.—Students in Horticulture will take the special branches in Horticulture described on pages 26 and 27.

FARMER'S COURSE.

Students who have not the time necessary for the full course, and yet desire to better fit themselves to be successful farmers, may give exclusive attention to the technical Agricultural studies, including Veterinary Science, and complete these in one year.

The studies of the second, or winter term of this course, are arranged so as to be profitably studied by those who can be in attendance only during that term.

Students will be admitted to this course on passing a satisfactory examination in the common school branches, but they will receive greater benefit from it if they have made better preparation, especially if they have a good knowledge of Botany and Chemistry. They should not be less than eighteen years of age.

The studies are taught in the following order:

1. Elements of Agriculture; Agricultural Engineering and Architecture; Animal Anatomy and Physiology; Shop Practice.
2. Animal Husbandry; Rural Economy; Veterinary Science.
3. History of Agriculture and Rural Law; Veterinary Science; Economic Entomology or Landscape Gardening.

College of Engineering.

SPECIAL FACULTY.

THE REGENT.

PROFESSOR RICKER, Dean.	PROFESSOR BAKER.
PROFESSOR SHATTUCK.	PROFESSOR WOODS.
PROFESSOR TALBOT.	PROFESSOR COMSTOCK.
MR. KIMBALL.	MR. PARKER.

SCHOOLS,

MECHANICAL ENGINEERING, ARCHITECTURE, CIVIL ENGINEERING, AND MINING ENGINEERING.

ADMISSION.

Applicants should be at least eighteen years of age. None are admitted under fifteen. The requirements for admission embrace the common school branches and the studies of the preliminary year. The examinations in Mathematics are especially thorough.

Those who make further preparations than that required before entering, can make their course more extensive and profitable. The following suggestions are offered to such as wish to make thorough work:

Either French or German are studied during two years; some preparation in Latin will be of great assistance in these languages. The engineer and architect should be adepts in the various departments of drawing, and some previous study of this branch will be of great advantage. "Warren's Draughting Instruments" may be used as a text book, and the drawings made on smooth paper, eight by ten inches.

STUDIES PURSUED BY ALL ENGINEERING STUDENTS.

The subjects common to all the schools in the College of Engineering will be described first; the topics peculiar to each will be noticed under their specific names.

PURE MATHEMATICS, FIRST YEAR.

Trigonometry.—Plain and spherical. Fundamental relations between trigonometrical functions of an angle or arc; relations between the functions of different angles or arcs; construction and use of tables; solution of triangles; projection of spherical triangles; angles as functions of sides and sides as functions of angles; general formulas; applications.

Analytical Geometry.—The point and right line in a plane; conic sections, their equations and properties; the tangent and subtangent, normal and subnormal, pole and polar, supplementary chords, conjugate diameters, etc. Discussion of the general equation of the second degree containing two variables.

Advanced Algebra.—Functions and their notation; series and the theory of limits; imaginary quantities; general theory of equations.

PURE MATHEMATICS, SECOND YEAR.

Differential Calculus.—Rules for the differentiation of functions of a single variable; successive differentiation; development of functions; maxima and minima of functions of a single variable; differentials of an arc, plane area, surface and volume of revolution; elementary discussion of higher plane curves; the spirals, logarithmic curve, trochoid, etc., algebraic curves.

Integral Calculus.—Integration of elementary forms and rational fractions; rectification of plane curves; quadrature of plane areas and surfaces of revolution; cubature of solids of revolution.

Advanced Analytical Geometry.—Loci in space; the point, right line, plane, and surfaces of the second order.

Advanced Calculus.—Development of the second state of functions of any number of variables; differential equations; maxima and minima of functions of two or more variables; construction and discussion of curves and surfaces; integration of irrational and transcendental differentials and of differential equations of the higher orders and degrees; applications; elements of elliptic integrals.

PHYSICS.

The course of Physics embraces the kinds of work following:

1. Recitations, five exercises a week, in which a text book is used as a guide.

2. Experiments in Physical Laboratory one day each week, in which the student uses the instruments in testing the principles taught.

3. Illustrated experiments once each week, in which the more costly apparatus is used before the whole class, in such experiments as are difficult to perform, and which are more effective when prepared for an audience.

4. Higher physical experiments by advanced classes, consisting either of researches, or of reviews of careful and elaborate experiments previously worked up by others.

The Department of Physics is provided with illustrative apparatus for use in the lecture-room, and with an extensive Physical Laboratory. The collection of instruments embraces acoustic apparatus from R. Koenig, of Paris; apparatus for neat and molecular physics from J. Salleron, of Paris; for light optics and electricity from Stoehrer, of Leipsic, and Browning and Newton, of London; pneumatic and electrical apparatus from E. S. Ritchie, of Boston; and a large number of pieces prepared at the mechanical shops of the University. It includes, also, Browning's electric lamp; and from Eliot Brothers, London, resistance coils, galvanometers, etc., for higher researchers in electricity.

DRAWING.

Projection Drawing.—Use of instruments in applying the elements of descriptive geometry; use of water colors; isometrical drawing; shades and shadows; perspective; drawing of machines, bridges, roofs, etc., finished by line shading, tints, and colors.

Free Hand Drawing.—Outline sketches; drawing from casts; sketches of machines, etc.

Lettering.—Plain and ornamental alphabets; titles and title pages; round and stump writing.

Descriptive Geometry.—Problems on the point, right line, and plane; warped surfaces; perspective; shades and shadows; practical problems.

APPLIED MATHEMATICS.

Analytical Mechanics.—Polygon of forces; equations of equilibrium of moments; center of gravity; moment of inertia; acceleration, work, momentum, impact; motion of free particles; central forces; constrained motion.

Strength of Materials.—Elasticity; safe limits; shearing stress; flexure and strength of beams and columns; practical formulas.

Hydraulics.—Amount and center of pressure upon submerged surfaces; flow of liquids through orifices, weirs, pipes, and channels; distribution of water in cities. Forms and arrangement of orifices for fountains.

REGULATION PAPER.

The following sizes and qualities of paper will be required in all the College exercises:

For manuscripts and unimportant drawings, a heavy flat-cap paper.

For ordinary drawings, not colored, a heavy, first quality, smooth drawing paper. For drawings finished in colors, the best Whatman's paper. For topographical and right-line drawings and lettering, the best three-ply Bristol board. For problems, exercises, lecture notes, theses, and other manuscripts, and for geometrical projection, topographical, railroad, typographical, and construction drawings, paper $8 \times 11\frac{1}{2}$ inches, the size of the plate being 8×10 , with $1\frac{1}{2}$ added for binding. If Bristol board is used, it must be cut 8×10 inches, and the binding margin hinged on with muslin.

THESES.

In all the schools in this College a thesis is required as a condition of graduation. It must be an original composition of suitable length, upon a subject appropriate to the school, and approved by the Professor in charge. It must be illustrated with such photographs, drawings, and sketches as may be needed, and embellished with a title page neatly lettered with India ink or colors. It must be upon regulation paper, and securely bound. It will be prepared during the latter part of the fourth year, and presented at the close of the course, after which it will be deposited in the library of the University.

CONTRIBUTIONS.

Our friends and students are invited to send us specimens of material and manufactures, and drawings, models, or photographs of machinery, bridges, and other engineering and architectural works. Finished and detailed working drawings, perhaps otherwise useless, may be of great value for instruction. Illustrated circulars and price lists of manufacturing firms are desired. Contributions will be labelled with donors' names, and placed in the Museum of Engineering and Architecture, for the inspection of students and the illustration of lectures.

SCHOOL OF MECHANICAL ENGINEERING.

OBJECT OF THE SCHOOL.

This school seeks to prepare students for the profession of Mechanical Engineering. It aims to fit them to invent, design, construct, and manage machinery for any branch of manufactures. The State needs men who, to a thorough knowledge of the principles of machinery and of the various motors, add the practical skill necessary to design and construct the machines by which these motors are made to do work.

INSTRUCTION.

The instruction, while severely scientific, is thoroughly practical. It aims at a clear understanding and mastery of all mechanical principles and devices. Practice in the Mechanical Laboratory is counted as one of the studies of the course.

In *principles* instruction is imparted by lectures, illustrated plates, and by text books. Examples are given, showing the application of the theories and principles taught. Experiments in the testing of machines and motors are undertaken by the student.

In *practice* elementary forms are produced and projects are executed, in which the student constructs machines, or parts thereof, of his own designing, and from his own working drawings.

In *designing* the student begins with elements, and proceeds with progressive exercises till he is able to design and represent complete machines.

MECHANICAL ART AND DESIGN.

An elementary course of shop practice has been carefully arranged, to familiarize the student with the forms of the parts of machines, and the mode of producing them. He is made familiar with all the ordinary cutting tools for iron or wood; with the form and condition for most effective work; with the machines and appliances by which they are put in action, and the instruments by which desired dimensions of product are obtained. This practice is obtained in the Mechanical Laboratory, and represents five different shops, viz.:

- 1—PATTERN MAKING.
- 2—BLACKSMITHING.
- 3—FOUNDRY WORK.
- 4—BENCH WORK FOR IRON.
- 5—MACHINE TOOL WORK FOR IRON.

In the 1st, the practice consists in planing, turning, chiseling, etc., in producing true surfaces in various forms in wood, and also in combining pieces by glue joint, etc., preliminary to correct pattern making. Patterns are finally made from which are cast pieces in iron, brass, etc., to be worked in the subsequent shops.

In the 2d, the student uses the forge and performs the various elementary operations, such as drawing, upsetting, bending, welding, etc.

In the 3d, the process of moulding and casting are fully illustrated.

In the 4th, there is first a course of free-hand bench work, the cold chisel and file being the only tools. After the hand and eye are sufficiently trained, fitting is begun, and the square, bevel, rule, compasses, and other auxiliary bench tools are used. Pieces are then fitted together by the file, with surfaces carefully finished.

In the 5th shop, the ordinary machine tools of the machine shop are used. The first practice employs these machines with their cutting tools or bits, in common operations, such as turning cylinders, discs, grooves, and fillets; boring, drilling, hand-turning, milling, planing, etc. Following this is a course of practice in fitting and finishing, in which calipers, rules, etc., are introduced, and many of the various fittings employed in machinery are produced.

Previous to the shop work, drawings of the pieces are made by the student, and the exact thing to be done is indicated; thus mistakes are avoided and practice facilitated.

The designing of such machine elements as pulleys, journal boxes, cranks, stuffing boxes, etc., cultivates a knowledge of proportion, and of its proper representation on paper. This course of elementary practice fits the student for the advanced shop practice in designing and construction of complete machines undertaken later in the course.

TECHNICAL STUDIES.

Kinematics and Principles of Mechanism.—Relative motion of points in a system of connected pieces; motion independent of force; velocity ratio; investigation of motion of elementary parts of machines, as friction and non-circular wheels in rolling contact, cams and curves in sliding contact; gear teeth; gearing chains; escapements; link work.

Prime Movers.—The theory and useful effects of turbine water wheels, and best form of the parts for high efficiency. Other water wheels and wind wheels. Application of thermodynamics in the study of heat engines. Relative economy of different engines.

Mill Work and Machinery.—Trains of mechanism studied with reference to their resistance and efficiency; best forms for transmission of power for short or great distances; forms of the parts for securing desired results in power and velocity; elastic and ultimate strength of parts.

Machine Drawing.—Working drawings of original designs; finishing in water colors, and in line shading; details for shop use, according to the practice of leading manufacturers.

PROJECTS AND PRACTICE.

The shop practice of the first year has already been described. The second year practice will have for its object the production of some model or machine. The students, under the immediate direction of the teachers, carefully determine the dimensions and shapes best suited for the parts of some machine, produce them in neat and accurate working drawings, and make tracings for shop use. No student will commence his advanced shop practice without working drawings. The designs are such as require execution in iron, brass, and wood, for the purpose of giving variety of practice. The

student is required to make the patterns and castings, finish the parts, and put them together in accordance with the working drawings and the required standard of workmanship. This acquaints him with the manner in which the mechanical engineer carries his designs into execution, and teaches him to so shape, proportion, and dispose the parts of a machine as to secure the greatest economy of construction and durability in use. The practice of the third year will include the careful construction of mechanical movements, strictly in accordance with the theoretical determination of the form of the parts.

The steam engine, large drill press, one engine lathe, the hand lathes, and the milling machine, now in use, were designed here, and built in the shop, by students in the department.

Besides these practical exercises, students of sufficient skill may be employed in the commercial work which is undertaken by the shop. For this work they receive compensation. This work includes all kinds of machine building and repairing, and will serve to extend and confirm the practical experience of the student.

Experiments and Practical Problems.—Experiments in the testing of prime movers and other machines, are undertaken by each student. They take indicator diagrams from the engine of the Mechanical Laboratories, and in factories in the adjoining towns, and determine from them the power developed with different degrees of expansion, and the possible defects of valve movement in distribution of steam.

APPARATUS.

This school is provided with plates and a cabinet of models illustrating mechanical movements and elementary combinations of mechanism. This collection is rapidly increasing by our own manufacture, and by purchase from abroad. It includes many of Riggs' models, and others from the celebrated manufactory of J. Schröder, of Darmstadt, Germany. About two hundred valuable models from the United States Patent Office are also included in the cabinet.

The State has provided a large Mechanical Laboratory and Workshop, furnished with complete sets of tools, benches, vises, and forges, with flasks for moulding in sand, and cupola for melting iron.

STUDIES.

The studies are given by the year and term in the tabular view of the course. The order there indicated should be closely followed, that the student may avoid interference of his hours of recitation.

MECHANICAL ENGINEERING COURSE.

Required for the Degree of B. S. in School of Mechanical Engineering.

FIRST YEAR.

1. Trigonometry; Projection Drawing; Shop Practice; German or French.
2. Analytical Geometry; Descriptive Geometry and Lettering; Shop Practice; German or French.
3. Advanced Algebra; Free Hand Drawing; Shop Practice; German or French.

SECOND YEAR.

1. Calculus; Designing and Construction of Machines; German or French.
2. Advanced Analytical Geometry; Designing and Construction of Machines; German or French.
3. Advanced Calculus; Astronomy; German or French.

THIRD YEAR.

1. Mechanism; Advanced Descriptive Geometry; Chemistry.
2. Analytical Mechanics; Chemistry; Physics.
3. Analytical Mechanics; Engineering Materials; Physics.

FOURTH YEAR.

1. Prime Movers; Resistance of Materials and Hydraulics; Mental Science.
2. Prime Movers; Construction Drawing; Constitutional History.
3. Mill Work; Designing and Laboratory Practice; Political Economy.

In this course the student will take two years of either French or German, but not one year of each.

SCHOOL OF CIVIL ENGINEERING.

OBJECT OF THE SCHOOL.

The school is designed to furnish a course of theoretical instruction, accompanied and illustrated by a large amount of practice, which will enable the student to enter intelligently upon the various and important duties of the civil engineer.

INSTRUCTION.

The student should lay a broad foundation in general culture, which will enable him to pursue his professional studies

with greater ease and advantage. With this view the subjects peculiar to civil engineering are not introduced until the second year.

The instruction is given by lectures, text books, and reading, to which are added numerous problems and practical exercises, as serving best to completely explain subjects and fix them in mind. Models and instruments are continually used, both in lectures and by the students themselves.

COURSE OF STUDIES.

The complete course occupies four years. The studies of the first three years will prepare students for undertaking many engineering operations, such as making land and topographical surveys, building railroads, canals, embankments, etc. The fourth year is intended to fit them for higher engineering operations, such as making geodetic surveys, building arches, trussed bridges, and supporting frames of all kinds.

The order of studies as given by the year and term in the tabular view of the course, should be closely followed, so that the student may avoid interference of hours of recitation, and because the studies are there given in the order which best meets the preparation of the student.

TECHNICAL STUDIES.

Astronomy.—Descriptive Astronomy is given with a text book. The equatorial telescope is in constant use during favorable weather. Practical astronomy is given by lectures and practical work with the altazimuth instrument, the astronomical transit, the sextant, and the engineer's transit adapted to astronomical calculations. It includes the instruments and their adjustment, the determination of time, latitude, longitude, and azimuth.

Bridges.—Calculation of stresses in the various forms of bridge trusses, by algebraic and graphical methods, consideration being given to weights of bridge and train, and force of wind; designing trusses and proportioning sections; details.

Geodesy.—Spirit, barometrical, and trigonometrical leveling; base lines, stations, and triangulation; parallels and meridians; projection of maps.

Land Surveying.—Areas and distances, by chain, com-

pass, and plane table; omissions and corrections; metrical system; methods of U. S. public land surveys; magnetic variation; determination of true meridian.

Railroad Surveying.—Economic location; curves and grades, and their inter-adjustment; earth work; curvature and elevation of rail; easement curves; turnouts; crossings; maintenance of way.

Stone Work.—Stone, brick, lime, mortar, cement; foundations; retaining walls; arches, etc.

Topography.—Use of stadia, plane table, and level; contours; soundings. Sketching, mapping, conventional signs; city and county maps.

Theory of Engineering Instruments.—Examination of workmanship and design; testing instrument maker's adjustments; engineer's adjustments; determination of areas with transit; inaccessible and air line distances; profiles; heights and distances with stadia; measurement of angles with sextant, etc.

PRACTICE.

In the fall term of the second year, the class will solve numerous problems in distances, areas, etc., using the chain, compass, and plane table. During the winter term the student will have practice with all the engineering instruments, and solve problems with the transit, stadia, level, and sextant. In the spring term an accurate topographical survey of a locality is made by the class, in which the stadia and plane table are used as in the United States surveys.

In the fall term of the third year the class will execute a project in railroad engineering, which will consist of preliminary surveys, location, staking out, drawings, computations of earth work, etc. The preliminary survey will consist in an examination of the locality, and in running tangent lines, with leveling and topographical sketching. The location will consist in running the line over the route decided upon, with all the necessary measurements and calculations for establishing the grade, setting slope stakes, etc. The drawings will include alignment, profile, plans, etc.

A project in geodesy or higher engineering will be executed during the fall term of the senior year. During this term the students have exercises in practical astronomy.

APPARATUS.

For Field Practice.—The school is well provided with the instruments necessary for the different branches of engineering field practice, which include chains, tape, compass, plane table, stadias, transits, levels, barometer for barometrical leveling, base rods and comparing apparatus, sextants, engineer's transits arranged for astronomical observation. An astronomical observatory is provided with an equatorial telescope, an astronomical transit, with attachment for zenith telescope work, a chronometer, and a set of meteorological instruments.

A portable altitude and azimuth instrument of the latest and best form, from the celebrated makers, Troughton & Simms, of London, is used for instruction in Geodesy and Practical Astronomy. It is read by micrometer microscopes to single seconds, both of altitude and of azimuth.

To facilitate practice in trigonometrical and land surveying, an area has been specially prepared in which the difficulties of plane surveying are presented to the beginner as he is able to meet them, and where he is taught practical methods of overcoming them.

For the Lecture Room.—The school has numerous models for illustrating its specialties, including descriptive geometry and astronomy; models of bridges, roofs, joints, and connections; a large collection of drawings, photographs, and photolithographs of bridges, roofs, and engineering structures; it has access to the Museum of Engineering and Architecture, which contains models illustrating wood, stone, and metal construction, and to a complete set of lithographs of the lectures and drawings used in the government Polytechnic Schools of France.

The Library is well supplied with the latest and best periodicals and books upon engineering subjects.

—CIVIL ENGINEERING COURSE.—

Required for Degree of B. S. in School of Civil Engineering.

FIRST YEAR.

1. Trigonometry; Projection Drawing; Shop Practice; French or German.
2. Analytical Geometry; Descriptive Geometry and Lettering; Shop Practice; French or German.
3. Advanced Algebra; Free-Hand Drawing; Shop Practice; French or German.

SECOND YEAR.

1. Calculus; Land Surveying; French or German.
2. Advanced Analytical Geometry; Surveying and Theory of Instruments; French or German.
3. Advanced Calculus; Topographical Surveying and Drawing; French or German.

THIRD YEAR.

1. Advanced Descriptive Geometry; Chemistry; Railroad Engineering.
2. Analytical Mechanics; Chemistry; Physics.
3. Analytical Mechanics; Astronomy; Physics.

FOURTH YEAR.

1. Resistance of Materials and Hydraulics; Geodesy and Practical Astronomy; Mental Science.
2. Bridges; Stone Work; Constitutional History.
3. Geology; Bridge Construction; Political Economy.

In this course the student will take two years of German or French, but not one year of each.

GEOGRAPHICAL POSITION OF THE UNIVERSITY.

The Observatory has the following position:

Latitude, $40^{\circ} 6' 29''.66$.

Longitude, West of Washington, $11^{\circ} 10' 37''.5$, or 44m. 42.5s.

Elevation above sea level, 720 feet.

SCHOOL OF MINING ENGINEERING.

OBJECT OF THE SCHOOL.

This school has been established to meet the growing demand of a very important industry for thoroughly trained engineers, fitted to solve the numerous perplexing problems which are constantly arising in all mining work. The subjects of the discovery, opening, economical working and proper ventilation of mines, the prevention of accidents, transportation above and below ground, treatment of products, with many others which fall within the scope of the mining engineer, can be mastered only by a careful study of facts and principles. This is the proper foundation for the practical work of the profession, and it is the aim of this school to present this in the most complete and thorough manner.

INSTRUCTION.

It is important that a broad basis be laid by way of general preparation for the more technical studies here

included. Whatever of general culture the student may obtain before entering the University, will not come amiss, and, although the requirement is not made, it is advised that all who can do so, should acquire a reading knowledge of French or German before beginning this course.

The course comprises the greater part of the pure and applied mathematics of the courses in Mechanical and Civil Engineering. Much time is devoted to Chemistry and Geology, with the addition of technical studies peculiar to mining engineering, and metallurgy.

Students who are graduated from this school are not supposed to be familiar with all the details of mine management from actual experience, but they will have obtained such a knowledge of the principles underlying all successful practice, and such a familiarity with the science of mining in all its branches, that the art may be acquired with the minimum of practice.

Lectures are given where desirable, but these are to be regarded as supplementary to other modes of instruction, which are made to conform as closely as possible to the routine of the engineer in practice. In every detail the student is made to feel that he is dealing with the actual problems which he will meet in his professional work.

Plans, estimates, drawings, reports, and calculations, based upon data obtained in the student's own experience, are constantly required, and no pains is spared to familiarize each member of the class with the duties and responsibilities of every grade, from miner to manager.

COURSE OF STUDIES.

In the first two years the work is similar to that required in the course in Civil Engineering, but more time is given to chemistry. In the third year geology and Mining Engineering, with assaying and metallurgy, take the places of special technical studies in the other engineering courses. In the fourth year, with the exception of two terms of Prime Movers taken with the students in Mechanical Engineering, and some studies of general character, the work is strictly technical.

TECHNICAL STUDIES.

Mine Surveying and Reconnoitering.—History, uses, and adjustment of instruments; solar compass and various solar

attachments; practical problems involving the running of surface lines and lines under ground; connecting of surface and underground surveys; practice of U. S. deputy surveyors. Details of mine surveys, setting of bench works; lines through shafts, drifts, slopes, etc.; keeping of records, plans, etc. Surveys required to determine best locations for test borings, shafts, adits, etc.; methods of reconnoitering.

Mining Engineering.—1. *Attack.*—Tools, implements, machinery, and explosives, with principles governing their use. Methods of boring, sinking, and driving through hard, soft, wet, dry, loose, and compact material.

2. *Timbering.*—Objects, methods, etc.; framing, fitting, bracing.

3. *Transportation.*—Underground haulage, hoisting, use of chutes; apparatus and appliances, cars, tracks, switches, cables, cages, motive power, connections; haulage in inclines, "man-engines," etc.

4. *Drainage.*—Pumps, pumping, sumps, ditches; drainage of working shafts and inclines.

5. *Ventilation.*—Means and appliances. Importance of subject; laws of various states and countries. Discussion of fundamental principles and practical applications, with results.

6. *Buildings and Machinery.*—Hoisting apparatus, air compressors, power drills, etc.

7. *Exploration.*—To determine general character and extent of deposits in advance of development; methods and aims.

8. *Development.*—Blocking out of deposits to prove values of partly explored ground, and to prepare for further exploration.

9. *Exploitation.*—Laying out work; trimming of coal, ore, etc.; stoping, overhand and underhand; winzes and intermediate levels; economical handling of product. Methods to be employed under various conditions.

10. *Dislocations.*—Faults, upthrows, downthrows, feeders, leaders, rolls, swells, etc. Means of overcoming difficulties.

Dressing of Products.—Coal screening; washing, sampling, and grading ore; assorting, crushing, spalling, cobbing; concentrating.

Mining Machinery.—Elements of construction, designing of plant, combining of parts; setting, arranging, adjusting. Preservation and operation, general economy.

Organization.—Economy of management. Secondary superintendence; division of labor and adjustment of responsibility. Prevention of accidents.

Administration.—Review of principles. System of reports from sub-officers and tabulation of records. Accounts, forms, analysis, pay-tolls, cost sheets, etc. Letting and measuring contracts. Miscellaneous details.

Engineering Geology.—Applications of geology to engineering and mining. Nature and distribution of deposits of economic value, as coal, water, metallic ores, etc.; advanced structural geology and lithology; discussion of principles underlying successful working of mines, placing of foundations, setting of machinery and erection of structures in various situations. Relation of geological structure to drainage, economy of working, selection of points of attack, methods of exploration, etc.

APPARATUS.

The department has a valuable collection of models of mining and metallurgical machinery, and new material will be added as fast as the development of the school will require, and the funds furnished will permit.

The extensive apparatus and collections in other departments are available, and these comprise a large amount of material which is useful for this purpose.

COURSE IN MINING ENGINEERING.

Required for the Degree of B. S. in School of Mining Engineering.

FRESHMAN YEAR.

1. Trigonometry; Projection Drawing; Chemistry; French or German.
2. Analytical Geometry; Descriptive Geometry and Lettering; Chemistry; French or German.
3. Advanced Algebra; Free-Hand Drawing; Chemistry; French or German.

SOPHOMORE YEAR.

1. Land Surveying; Calculus; Chemistry.
2. Theory of Instruments; Advanced Analytical Geometry; Physics.
3. Topographical Surveying; Advanced Calculus; Physics.

JUNIOR YEAR.

1. Mine Surveying ; Analytical Mechanics ; Mineralogy.
2. Geology ; Resistance of Materials ; Assaying.
3. Geology ; Mining Engineering ; Metallurgy.

SENIOR YEAR.

1. Engineering Geology ; Prime Movers ; Mental Science.
2. Mining Engineering ; Prime Movers ; Constitutional History.
3. Mining Engineering ; Mine Administration ; Political Economy.

SCHOOL OF ARCHITECTURE.

OBJECT OF THE SCHOOL.

The school prepares students for the profession of Architecture. For this a thorough knowledge of scientific principles applied to building, ability and correct taste in design, and a technical knowledge of the various building trades, with skill in the use of tools, are necessary, and are prominent objects of the course of instruction.

The course embraces the knowledge of theory and principles of constructive details and of the ordinary routine work of office practice, so far as these can be taught in a technical school. The technical instruction is given chiefly by lectures, with reference to text books, and is illustrated by sketches, engravings, photographs, and models; practical applications are immediately made by students.

Drawing is practiced throughout the course, and, as far as possible, original work is executed. Drawing from casts and modeling in clay give facility in sketching details and correct knowledge of form.

In shop practice, joints in carpentry and joinery, cabinet making, turning, metal and stone work, are executed; also models at reduced scale of roof and bridge trusses, ceilings, domes, and stairs.

TECHNICAL STUDIES.

Elements of Drawing.—Lectures; designs for specified problems; outline sketches and finished drawings from casts in pencil, crayon, and charcoal.

Wood Construction.—Frames, roof, ceilings, domes, heavy frames for mills, etc., roof trusses, stairs, doors, windows, external and internal finish.

Stone Construction.—Materials, mortars and cements, walls, foundations, stone cutting, tools and modes of using.

Brick Construction.—Materials, bonds, walls, arches, vaults and domes, centerings, etc.

Iron Construction.—Uses and strength of cast and wrought iron and steel; usual forms and formulæ for columns, lintels, girders, and beams.

Tinner's Work, Slating, and Plastering.

Sanitary Construction.—Scientific principles and practical methods employed in plumbing, water supply, and drainage of buildings.

Architectural Drawing.—Finishing in line, ink, sepia, and color; working out from sketches full sets of drawings for buildings; practical perspective; shades and shadows.

Architectural Designing.—Original sketches for specific projects; one full set of drawings for buildings for specified private or public purpose.

History of Architecture.—Daily lectures and recitations on principal styles, their characteristics, construction, and decoration, making especially prominent those ideas applicable in American architecture; tracing of details; designs for special problems.

Esthetics of Architecture.—Esthetics applied to architecture and allied arts, so far as yet made practical; laying out of grounds, arrangement of plans, grouping of masses; decoration, internal and external; treatment of floors, walls, ceilings; art objects, furniture, carpets, etc. About twenty-five original designs for specified objects.

Estimates.—Methods of measurement; cost of labor and materials; estimates for specified works.

Agreements and Specifications.—Preparation of sets.

Heating and Ventilation.—Usual methods, by grates, stoves, furnaces, hot water or steam apparatus; fuels, their properties, heating value, and products. Problems and applications to specified buildings.

Graphical Statics.—Elements; equilibrium polygon and its applications; roofs, loads, and wind pressures; type forms of trusses; determination of strains and dimensions of parts; details of joints; construction and use of graphical tables.

SPECIAL EXERCISES.

Specimen plates will be required of each student at the close of each term in drawing, to form a part of his record.

All such plates must be on paper of regulation size, except when otherwise directed.

SHOP PRACTICE.

To give a practical knowledge of various kinds of work, three terms are occupied in a course of instruction, which all architectural students are required to pursue unless they have already had equivalent practice.

First Term.—Carpentry and Joinery. Planing flat, square, and octagonal prisms, and cylinders; framing with single, double, and oblique tenons; splices, straight and scarfed; miter, lap, and gained joints; through and lap dovetails; mouldings, miters, and panels.

Second Term.—Turning and cabinet making; cylinders, balusters, capitals and bases of columns, vases, rosettes, etc.; fret sawing, plain and ornamental veneering; inlaying, carving, and polishing.

Third Term.—Metal work, pattern making, moulding and casting, filing and finishing, drilling, screws, hand and machine turning.

Stone work executed in plaster of Paris; production of plane, ruled, warped, and spherical surfaces; voussoirs of arches, vaults, and domes; decorative carving.

APPARATUS.

A collection of casts donated by the Spanish government, and another of casts of various architectural details from Lehr, of Berlin, belong to the Schools of Architecture and Designing; models of ceilings, roof trusses, stairs, joints, etc.; Schröder's models of joints in stone cutting, etc.

The casts, photographs, etc., of the Art Gallery. In the library, many of the best English, German, French, and American architectural works and periodicals.

A large carpenter and cabinet shop, containing full sets of tools, for shop practice; foot lathe with slide rest, chuck, drills, etc.; cross and splitting saws; planer, moulding and tenoning machine, lathe, whittler, fret saw, etc.

BUILDER'S COURSE.

The Trustees allow persons desiring to fit themselves for master builders to take a course of a single year, pursuing such technical studies of the course in architecture as they may be prepared to enter upon with profit, and as will be most advantageous to them.

Candidates for the Builder's Course must pass the examinations in the common branches, but need not pass in the studies of the preliminary year unless they shall desire to pursue other studies than those marked in the following schedule. Fee, \$10 per term.

BUILDER'S COURSE.

1. Wood Construction; Projection Drawing; Shop Practice (Carpentry and Joinery).
2. Stone, Brick, and Metal Construction; Architectural Drawing; Shop Practice (Stair Building).
3. Graphical Statics; Architectural Designing; Shop Practice (Cabinet Making).

ARCHITECTURAL COURSE.

Required for the Degree of B. S. in School of Architecture.

FIRST YEAR.

1. Trigonometry; Projection Drawing; Shop-Practice; French.
2. Analytical Geometry; Descriptive Geometry and Lettering; Shop Practice; French.
3. Advanced Algebra; Graphical Statics; Shop Practice; French.

SECOND YEAR.

1. Elements of Wood Construction; Calculus; Free Hand Drawing and Modeling.
2. Elements of Stone, Brick, and Metal Construction; Advanced Analytical Geometry; Architectural Drawing and Designing.
3. Elements of Sanitary Construction; Advanced Calculus; Water Color Sketching.

THIRD YEAR.

1. Architectural Drawing; Advanced Descriptive Geometry; Chemistry.
2. History of Architecture; Analytical Mechanics; Physics.
3. History of Architecture; Analytical Mechanics; Physics.

FOURTH YEAR.

1. Esthetics of Architecture; Resistance of Materials and Hydraulics; History of Civilization.
2. Architectural Designing; Heating and Ventilation; Constitutional History.
3. Architectural Designing; Estimates, Agreements, and Specifications; Political Economy.

College of Natural Science.

SPECIAL FACULTY.

THE REGENT.

PROFESSOR McMURTRIE, Dean.	PROFESSOR COMSTOCK.
PROFESSOR BURRILL,	PROFESSOR ROLFE.
PROFESSOR FORBES.	MR. HEWES.

SCHOOLS.

SCHOOL OF CHEMISTRY. SCHOOL OF NATURAL HISTORY.

ADMISSION.

Candidates for the College of Natural Science must be at least fifteen years of age, and must pass satisfactory examinations in the common school branches, and in the studies of the preliminary year.

Their preparation should be specially good in the scientific studies of the preliminary year. Some practice in the drawing of natural objects will greatly facilitate the student's progress. A knowledge of the Latin language is a good preparation for the mastery of the scientific terms which must be learned in the course.

SCHOOL OF CHEMISTRY.

This School aims to impart such knowledge of Chemistry as will enable the student to apply the principles of the science to the related arts, and as will fit him for original research, or for the business of the druggist, pharmacist, and practical chemist.

INSTRUCTION.

The first term of the first year is occupied by text-book instruction, lectures, and experiments in the laboratory, illus-

trating the elementary principles of chemistry, chemical physics, and inorganic chemistry. The second term is devoted to laboratory practice in qualitative analysis. In the third term recitations upon organic chemistry and illustrative synthetic experiments alternate with laboratory practice in qualitative analysis. During the next three years each student is expected to work two hours daily in the laboratory five days in the week. In order to graduate, each is required, at the end of his course, to make an original investigation, and present a Thesis.

Students who pursue Chemistry as a part of other courses, work at least two consecutive hours daily during such time as their specialties may require.

Text Books.—Roscoe's Chemistry; Remsen's Organic Chemistry; Fresenius' Analysis; Bolton's Analysis; Sutton's Volumetric Analysis; Bunsen's Gasometry; Rickett's Assaying; Gore's Electro-Metallurgy; Johnson's How Crops Grow and How Crops Feed.

Books of Reference.—Gmelin's Handbook of Chemistry; Graham-Otto's Ausfuhrliches Lehrbuch der Chemie; Watts' Dictionary of Chemistry; Roscoe and Schorlemmer's Treatise on Chemistry; Armstrong's Miller's Chemistry; Lehmann's Physiological Chemistry; Percy's Metallurgy; Mitchell's Practical Assaying; Wormley's Micro-Chemistry of Poisons; Taylor on Poisons.

Deposits.—At the beginning of each term of Laboratory practice, each student will deposit twelve dollars with the business agent of the University. At the end of the term, the balance left, after deducting payment for gas, chemicals, and apparatus used, will be refunded.

Five courses of laboratory work have been arranged, as follows:

CHEMICAL COURSE.

FIRST YEAR.

First Term.—General, theoretical, and applied chemistry. Lectures, text-book, and experiments.

Second Term.—Qualitative analysis begun; tests and separation of the bases and acids.

Third Term.—Qualitative analysis completed. Examination of 20 simple salts and 20 compound substances, natural and commercial products. Organic chemistry. Text-book and recitations.

SECOND YEAR.

First Term.—Quantitative analysis of barium chloride, sodium phosphate, Rochelle salt, calcite, ammoniumferrie sulphate. Volumetric analysis. Acidimetry and alkalimetry.

Second Term.—Quantitative analysis. Limestone, clay, spathic iron ore, calamine, copper pyrites, tetrahedrite. Volumetric analysis of iron, zinc, etc.

Third Term.—Advanced organic Chemistry. Ultimate organic analysis. Determination of carbon, hydrogen, nitrogen, chlorine, phosphorus, and sulphur, in carbon compounds.

THIRD YEAR.

First Term.—Advanced organic Chemistry, continued. Organic Synthesis and Analysis. Preparation of Carbon compounds, and determinations of composition and formulas.

Second Term.—Assaying. Dry assay of gold, silver, lead, and tin ores. Volumetric assay of silver, lead, copper, and zinc ores, bullion, etc. Blow pipe assays of silver ores.

Third Term.—Analysis of Soil. Valuation of commercial fertilizers—phosphates, nitrogenous matter, and alkaline salts. Analysis of milk, butter, corn, and wheat. Examination of alcoholic liquors.

FOURTH YEAR.

First Term.—Gas Analysis. Calibration of eudiometers. Analysis of air from lungs, atmospheric air, marsh gas, crude coal gas. Analysis of mineral water. Preparations.

Second Term.—Toxicology. Micro-Chemistry of Poisons. Testing for mineral and vegetable poisons. Separation from organic mixtures. Preparations.

Third Term.—Original researches. Thesis.

PHARMACEUTICAL COURSE.

FIRST YEAR.

Same as in Chemical course throughout the year.

SECOND YEAR.

First Term.—Same as in Chemical course.

Second Term.—Quantitative analysis of commercial drugs, bismuth subnitrate, tartar emetic, sodium bicarbonate, potassium iodide, sodium bromide, ammonium carbonate, potassium nitrate, cream tartar, phosphites. Volumetric determination.

Third Term.—Same as in Chemical course.

THIRD YEAR.

First Term.—Same as in Chemical course, substituting preparation and analysis of organic chemicals for analysis of urine.

Second Term.—Isolation and quantitative estimation of active proximate principles of vegetable drugs—oils, resins, gums, alkaloids, glucosides, etc.

Third Term.—Materia Medica. Reading and compounding prescriptions. Preparation and valuation of tinctures and extracts. Examination of commercial organic drugs.

FOURTH YEAR.

First Term.—Analysis of urine, normal and pathological. Mineral waters. Examination of alcoholic liquors.

Second Term.—Toxicology. Micro-chemistry of Poisons. Separation of poisons from organic mixtures.

Third Term.—Original researches. Thesis.

COURSE IN AGRICULTURAL CHEMISTRY.

Arranged for students desiring to make a specialty of this branch.

FIRST YEAR.

Same as in Chemical course.

SECOND YEAR.

First Term.—Quantitative analysis of barium chloride, magnesium sulphate, ammonium sulphate, calcium sulphate, dolomite, bone ash, kainit, feldspar.

Second Term.—Analysis of ashes of plants, soil, mineral waters.

Third Term.—Analysis of commercial fertilizers, manures and mineral used for manures, apatite, phosphates, guanos, nitrates.

THIRD YEAR.

First Term.—Same as in Chemical course, omitting analysis of urine. Analysis of corn, wheat, and fodder.

Second Term.—Analysis of milk, butter, cheese. Analysis of sugars by polariscope and by titration. Examination of alcoholic liquors.

Third Term.—Original researches.

COURSE IN AGRICULTURAL CHEMISTRY.

Especially arranged for students in the School of Agriculture.

FIRST YEAR.

Same as in Chemical course.

SECOND YEAR.

First Term.—Same as in Chemical course.

Second Term.—Analysis of soil, ashes of plants, commercial fertilizers, manures, and materials employed in their production—apatite, phosphates, guanos, animal matters, ammonia salts, nitrates, and marls.

Third Term.—Analysis of corn, wheat, hay, milk, butter, and cheese.

METALLURGICAL COURSE.

FIRST YEAR.

Same as in Chemical course.

SECOND YEAR.

First Term.—Same as in Chemical course.

Second Term.—Assaying.* Same as in Chemical course.

Third Term.—Analysis of calamine, spathic iron ore, magnetic iron ore, copper pyrites, galena, nickel ore, manganese ore, cinnabar, grey antimony.

* Students who take this term's work must have had a term of Mineralogy.

THIRD YEAR.

First Term.—Analysis of slags from copper, zinc, and lead; iron furnace and mill slags.

Second Term.—Analysis of pig iron, wrought iron, steel, commercial copper, lead, zinc, bullion.

Third Term.—Analysis of fuels, wood, anthracite and bituminous coals, coke, determination of heating power. Analysis of ashes and furnace cinders; mineral waters.

APPARATUS.

The facilities offered for obtaining a practical knowledge of Chemistry are believed to be unsurpassed by those of any other institution in the West. A large Laboratory Building, 75x120 feet, and four stories in height, has been erected at an expense, including furniture, of \$40,000.

The basement contains a furnace room for assaying and metallurgical operation; a mill room for storing and crushing ores; and a large room for the manufacture of chemicals and pharmaceutical preparations.

The first story contains a lecture room capable of seating 200 persons, and a qualitative laboratory, which, when completed, will accommodate 152 students; one hundred and four desks are now fitted, each having an evaporating hood, gas, and water. There are a spectroscope table, a blow pipe table for general use, and a store room stocked with apparatus and chemicals.

The second story, designed for the use of advanced students, has the following apartments: A lecture room with mineralogical cabinet, and furnace models for illustrating lectures on metallurgy; laboratory for students in agricultural chemistry; large laboratory for quantitative analysis, now containing sixty-four desks; a balance room, containing chemical balances of the manufacture of Bunge (short beams), Becker & Son, Troemner; a pharmacy, furnished like a drug store, with shelves, drawers, prescription desk, balance, graduates, etc., and containing a full set of drugs and pharmaceutical preparations made in the laboratory by students in pharmacy; private laboratory for instructors; a gas analysis room, entirely cut off from the system of heating and ventilating, to avoid undue fluctuations of temperature, furnished with a table specially constructed, and con-

taining a full set of Bunsen's gasometric apparatus, an induction coil, battery, mercury, etc.; and a store room with apparatus for all kinds of work in quantitative analysis.

The apparatus for general use includes a large platinum retort for the preparation of hydrofluoric acid; a Geissler's mercurial air pump; Hoffman's apparatus for illustrating the composition of compound gases; a Soliel-Scheibler's saccharimeter; an excellent set of aeometers; a Haüy's goniometer; a camera with Ross' lenses; a Ruhmkorff's coil; galvanic batteries of Grove and Bunsen, and a potassium dichromate battery; a galvanometer; a spectroscope; microscopes; a gas combustion furnace for organic analysis, etc.

On the mansard floor ample provision has been made for the study of Photography.

COURSE IN CHEMISTRY.

Required for Degree of B. S. in School of Chemistry.

FIRST YEAR.

1. Chemistry, General and Applied; Trigonometry; American Authors or French.
2. Chemistry and Laboratory Practice; Conic Sections; British Authors or French.
3. Organic Chemistry and Laboratory Practice; Free Hand Drawing; Rhetoric or French.

SECOND YEAR.

1. Chemistry and Laboratory Practice; Physiology or Botany; German.
2. Agricultural Chemistry and Laboratory Practice; Microscopy; German.
3. Agricultural Chemistry and Laboratory Practice; Vegetable Physiology; German.

THIRD YEAR.

1. Laboratory Practice; Mineralogy; German.
2. Laboratory Practice; Physics; German.
3. Laboratory Practice; Physics; German.

FOURTH YEAR.

1. Laboratory Practice; Mental Science; Physiography.
2. Laboratory Practice; Constitutional History; Logic.
3. Laboratory Practice; Political Economy; Geology.

{ Students who are candidates for the degree of B. S. in the School of Chemistry must perform the laboratory work as laid down in some one of the prescribed chemical courses. }

A term of Photography will be provided for students who desire it; it will consist of text-book work, with recitations and daily practice.

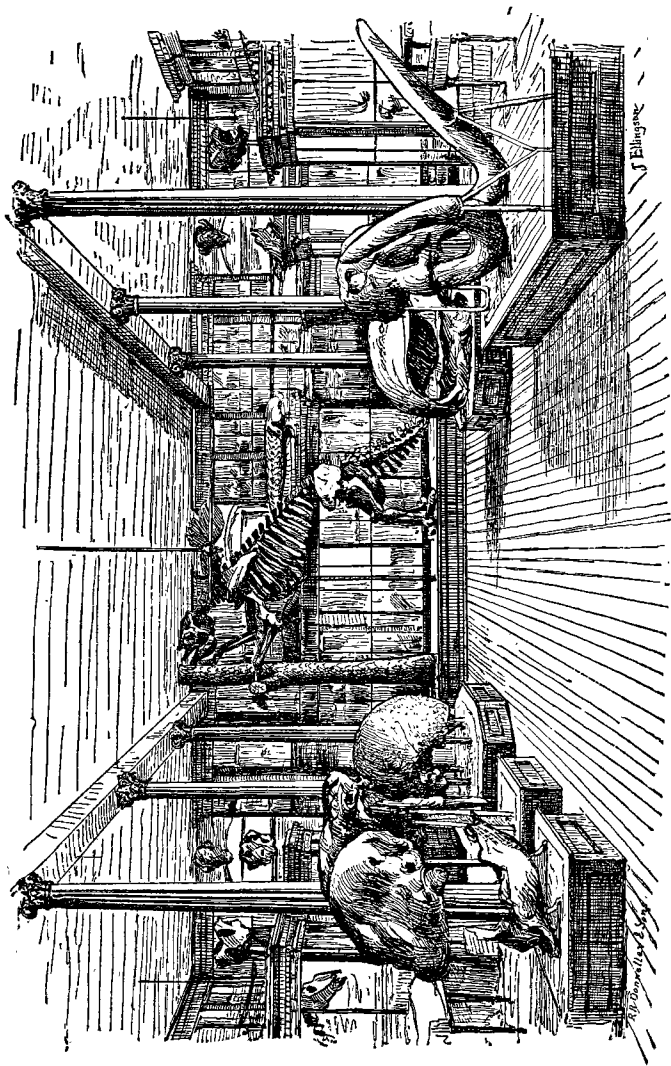
SCHOOL OF NATURAL HISTORY.

The aim of this School is to give a liberal scientific education. It acquaints the student with the latest researches in respect to the structure of the earth and to the origin and distribution of its organic products; teaches him to collect and preserve specimens, and arrange them for study, and to conduct original investigations.

SPECIAL STUDIES.

Botany.—Candidates for admission are examined upon Gray's Lessons in Botany, or an equivalent, and are expected to be able to analyze readily common wild flowers. Beginning with the Fall term of the Sophomore year, systematic and structural Botany is continued by recitations, illustrated lectures, and laboratory work upon fresh, dried, and alcoholic specimens. Students, throughout the course, are required to observe for themselves, and to make notes and drawings of their investigations. A series of these drawings, upon a uniform scale, together with the accompanying descriptions, is deposited in the Laboratory. Each student provides himself with suitable pencils, drawing pens, and paper, needles in handles, glass slides for mounting objects, and razor for making thin sections.

For the first term, a Manual of Botany (Gray's or Wood's) and Bessey's Botany are required. Before using the compound microscopes and other apparatus furnished by the University, a deposit of three dollars is required, but no charge is made except for damage and material used. The first half of the term is devoted to the study of the natural orders of flowering plants, their geographical distribution, importance, etc., together with a history of a few special plants and their products. During this time, students analyze in the Laboratory flowering plants of the more difficult orders, Compositæ, Gramineæ, etc., especially such as are best obtained in Autumn. During the last half of the term the general morphology of plants, including vegetable anatomy and history, is studied, practical laboratory work being the basis of the instruction. Tests are made from time to time by the use of disguised vegetable substances.



MUSEUM.

The special morphology of the great divisions of the vegetable kingdom, their chief characteristics, their classifications, and the identification of species of flowerless plants, constitute the work of the second term. Special attention is given to injurious fungi, from specimens in the herbarium, or grown in the laboratory. Aquaria furnish numerous kinds of fresh water algæ, and the green-houses supply specimens in nearly all the groups studied.

The most important books of reference in the English language are Sach's Text-Book of Botany, LeMaout and Decaisne's Botany, Gray's Structural Botany, Lindley's Introduction to Botany, Berkley's Cryptogamic Botany and Fungology, Cook's Fungi and Handbook of British Fungi.

Vegetable Physiology is studied in the third term. The instruction is given by lectures and experimental practice. The work includes: The food of plants and its absorption and assimilation; fluids, their kinds, uses, causes of movement, transpiration, respiration, etc.; processes, peculiarities, and results of growth; relations and effects of temperature, light, gravitation, etc.; self and cross fertilization, relation of plants and insects; movements, "sleep of plants," tendrils, climbing vines, etc.; origin and development.

Throughout the course the attempt is made to introduce the students to the literature of the various subjects, and to acquaint them with the authorities for the facts stated.

Microscopy.—Students have in this study further practice in the use of the compound microscope, the management of light for particular purposes, the testing of lenses, measurement of magnifying powers and angles of aperture, drawing and photographing objects, the preparation and mounting of material, etc. The application is mainly but not exclusively devoted to vegetable tissues and products.

The special aim is to afford the opportunity of gaining a skillful and rational use of the instrument, and an acquaintance with the best methods and processes of preparing and mounting objects. Students provide themselves with slides and covers, needles, forceps, brushes, and razors. Microscopes, section cutters, turn tables, etc., are furnished by the University.

Anatomy and Physiology.—This subject is presented during the first term of the Junior year. Anatomy is taught by lectures illustrated by skeletons, manikin, models in *papier mache*, and microscopical preparations. Fresh specimens of various organs are dissected and demonstrated before the class during the term. Physiology is taught by lectures, demonstrations, and recitations from Martin's treatise, *The Human Body*.

The library contains many of the best books of reference, including works on Anatomy by Gray, Holden, Quain, Ellis, and Morton; and on Physiology by Flint, Dalton, Kuss, McKendrick, Kirk, Draper, and Marshall.

Zoology.—The object of the Zoological course is primarily to give the students command of the methods of Zoological research and study, and to derive from these their distinctive discipline. The subject is taught during the whole of the Sophomore year, the course being based throughout on individual work in the Zoological laboratory, and in the field. The results thus arrived at are supplemented by lectures and demonstrations, and by the study of text.

The first term is devoted to comparative dissections of types of the great groups, and to a study of the subkingdoms and classes of animals; the second term to comparative histology and the elements of embryology—both based on individual work with the microscope—and the third, to the determination and description of species, to the study of life histories, and to collections, field observations, and laboratory experiments, the course closing with lectures and discussions on the final generalizations and fundamental principles of Zoological science.

The natural history students electing a Zoological subject for their term's work in "natural history laboratory," in the senior year, are furnished all necessary appliances for the pursuit of whatever subject they may select, as a piece of original work, with such guidance, oversight, and suggestion as each may seem to require.

Geology is taught during the second and third terms of the Junior year. LeConte's *Geology* is used as a text book. The first term is given to instruction upon the dynamical

effects of water in eroding, transporting, and depositing materials; upon the action of heat as manifested in metamorphism, crystallization, consolidation, and the production of mountain folds; upon the nature and material of rocks, veins, dykes, etc., and upon the arrangement and distribution of metals and their ores. The second term is devoted to the consideration of the historic development of the earth as revealed by the study of the animals and plants entombed therein; and to a discussion of the elements of time, the system of life, the origin of species, and the antiquity of man.

Physiography, or the "study of nature," is taught by illustrated lectures during the first term of the Senior year. The subjects considered are: The origin of the earth, and its relation to other worlds; the distribution of land and water; the direction and extent of mountain chains and of ocean currents; the influences which determine the climate of any locality; the systematic distribution of animals and plants; and especially the biological position of man, and his relation to the animate and inanimate worlds around him. Anthropology is taught as a distinct part of the term's work; for this a text book is used.

Entomology.—The study of Entomology, pursued during a single term of the Freshman year, is necessarily made largely empirical and practical, the subject to which it is principally directed being the place of the insect world in the general system of organic life; and, incidentally to this, the relations of insects to the interests of man.

The foundation for a knowledge of structural Entomology is laid by the discussion and detailed study of a typical insect; and for that of the orders, by a generalization of the characters of selected groups of specimens representing each.

A large part of the time is devoted to the study of the characters, life histories, habits, and economic relations of one hundred species of especially important insects. Specimens of these in their different stages, together with synopses and descriptions of the families to which they belong, are furnished the students, and the essential facts not discoverable by direct observation, are given in lectures or acquired by study of text.

Practice in field observations is given as opportunity offers, and all are taught the ordinary methods of the collection, preparation, and care of specimens, together with the approved methods of controlling the ravages of the injurious species. A careful and complete description of some one species, illustrated by drawings of important parts, is made by each student and deposited in the library of the school.

Besides the collections, apparatus, and entomological library of the University, the students in this course have access to the collections and library of the State Entomologist, and the practical use of the many thousand duplicate insects belonging to the office. In the field and laboratory operations of the office, an extraordinary opportunity is afforded competent students of this course to observe and assist in practical entomological work and original research.

Mineralogy.—Fourteen weeks; about six weeks are occupied in lectures on crystallography; Nauman's system of symbols is used and explained. A collection of models, comprising the most important forms and combinations in the various systems of crystalization, is used for illustration and study. The remainder of the term is occupied by the descriptive determination of minerals, and the use of the blow pipe. A very complete collection of minerals, both American and foreign, has been furnished for this purpose.

APPARATUS.

In *Botany*, the school has a collection of about one thousand species of the plants indigenous to the State of Illinois, including a very nearly complete set of the grasses; a collection of Rocky Mountain and Western plants; a collection of plants from Dr. Vasey, Botanist of the Department of Agriculture, Washington, D. C.; and others obtained by exchange from various parts of the United States. A collection of fungi contains numerous species. The green-houses and out-door plantations furnish a large amount of illustrative material for the classes. Enlarged *paper-mache* models of flowers and fruits, exhibiting structure and development, are in the cabinet.

In *Entomology* numerous species have been contributed by the State Entomologist, who is required by law to deposit

his first series of specimens in the cabinet of the University. Local collections and exchanges have increased the number to about three thousand species.

The University has twenty compound microscopes, four different styles from Europe, instruments by all prominent American makers, and others of which the glasses were made to order in Europe, and the stands manufactured in the shops of the University.

Zoology.—The Museum is particularly fortunate in its collections in Zoology, possessing, in mounted specimens of skeletons, nearly all the ruminants of North America, and representatives of all orders of mammals except Proboscidea; exhibiting fifty species by eighty mounted specimens, with numerous skeletons. In birds it represents all the families of North America, having two hundred and forty species, represented by over four hundred specimens. Its Articulates number more than three thousand specimens; its fishes, four hundred; its radiates, three hundred, and its reptiles nearly one hundred. Sea, land, and fluviatile shells are represented by seventeen hundred species. The Museum also contains nearly one hundred specimens, representing the osteology of vertebrates; a large collection of the nests and eggs of birds; a collection of Indian implements; and a manikin, a dissected eye, and a trachea, in *papier-mache*.

Geology.—The Geological Cabinet contains Prof. Ward's celebrated college series of casts of famous fossils, including the gigantic *Megatherium* nearly eighteen feet in length; the *Elephas Ganesa* with tusks ten-and-a-half feet long; the *Colossochelys Atlas*,—a gigantic tortoise with a shell eight feet by six; and the *Plesiosaurus Cramptoni*, twenty-two and a half feet. It also contains a series of tracks in the sandstone of the Connecticut river; a large collection of carboniferous ferns from the celebrated locality at Morris, Ill.; several thousand specimens of fossils from the State Geological Survey, and from purchase in Europe; and a large number of specimens illustrating building materials, dikes, veins, metamorphism, drift boulders, etc.

Mineralogy.—The Cabinet of Minerals consists of a valuable and extensive collection of the leads of the State, and accompanying minerals; a collection of models, compris-

ing the most important forms and combinations in the various systems of crystallization; and a very complete collection of minerals, both American and foreign.

COURSE IN SCHOOL OF NATURAL HISTORY.

Required for the Degree of B. S. in School of Natural History.

FIRST YEAR.

1. Chemistry; Free-Hand Drawing (optional); Trigonometry; French.
2. Chemistry; Free-Hand Drawing (optional); Conic Sections; French.
3. Chemistry or Free-Hand Drawing; Economic Entomology; Rhetoric; French (extra).

SECOND YEAR.

1. Zoology; Botany; German.
2. Zoology; Botany; German.
3. Zoology; Vegetable Physiology; German.

THIRD YEAR.

1. Anatomy and Physiology; Mineralogy; German; Ancient History (optional, extra).
2. Geology; Physics; German; Mediæval History (optional, extra).
3. Geology; Physics; Modern History.

FOURTH YEAR.

1. Physiography; History of Civilization; Mental Science.
2. Microscopy; Constitutional History; Logic.
3. Natural History Laboratory Work; Astronomy; Political Economy.

In this course three terms of University Latin will be accepted in lieu of three terms of French; and five terms of such Latin for five terms of German.



College of Literature and Science.

SPECIAL FACULTY.

THE REGENT.

PROFESSOR SNYDER, Dean.	PROFESSOR CRAWFORD,
PROFESSOR SHATTUCK,	PROFESSOR ROOS.
PROFESSOR PICKARD,	MISS GREGORY.
MISS CASS,	

SCHOOLS.

ENGLISH AND MODERN LANGUAGES.

ANCIENT LANGUAGES AND LITERATURE.

ADMISSION.

Candidates for the School of English and Modern Languages will be examined in Algebra, Geometry, Natural Philosophy, Physiology, and Botany, and the Latin mentioned below, but not the Greek. Students not prepared in the Latin for this School will be allowed to make up the required Latin after entering, with the aid of private tutors, but such students will be required to pass an examination in English Composition and Rhetoric.

Candidates for the School of Ancient Languages will be examined in Greek, but not in the elements of Botany, Physiology, or Natural Philosophy. The examinations in Latin and Greek will be as follows:

LATIN.

Latin Grammar, including Prosody (Harkness,' or Allen and Greenough's); Latin prose composition (forty-four exercises, to the passive voice, in Arnold's Latin Prose Composition, or parts one and two, to page 196, of Harkness' Introduction to Elementary Latin Prose Composition, or an equivalent in Allen and Greenough's Latin Composition); four books of Cæsar's Commentaries, six orations of Cicero, and six books of Æneid. *Real equivalents* for any of the above mentioned works will be accepted.

GREEK.

Greek Grammar (Goodwin's or Hadley's) Greek Prose Composition (Jones' Exercises in Greek Prose Composition or an equivalent in Arnold's), and four books of Xenophon's Anabasis. Writing Greek with the accents will be required. *The Greek Etymology must be thoroughly learned*

The so-called Continental sounds of the vowels and diphthongs, and pronounciation according to the accent, are recommended.

OBJECT OF THE SCHOOLS.

The object of the Schools in this College is to furnish a sound and liberal education to fit students for the general duties of life, and especially to prepare them for those business pursuits which require a large measure of literary and scientific knowledge and training. They meet the wants of those who wish to prepare themselves for the labors of the press as editors and publishers, for teachers in the higher institutions or for the transaction of public business.

Students in the Agricultural and other Technical Schools, desiring to educate themselves as teachers, and professors, in their special departments, require a knowledge of the ancient, as well as of modern languages, to give them a full command of all the instruments and facilities required for the highest proficiency in their studies and proposed work. The University seeks through the Schools to provide for this important part of its mission—the furnishing of teachers to industrial schools of the country, and investigators and writers for the arts.

INSTRUCTION.

The plan of instruction embraces, besides the ordinary text-book study, lectures and practical exercises in all the departments, including original researches, essays, criticism, and other work intended to illustrate the studies pursued, and to exercise the student's own powers.

A prominent aim will be to teach the right use of books, and thus prepare the students for self-directed investigation and study, which will extend beyond the curriculum of his school and the period of his graduation. With this view, constant use of the already ample and continually enlarging stores of the Library will be required and encouraged. As a further aid in this direction, members of the advanced classes

are usually selected to act as assistant librarians. In this service they are able to obtain much valuable knowledge of various departments of literature and science, of prominent authors, and the extent and scope of their writings. Of special value as an incentive to, and the means of, practice in English Composition should be mentioned *THE ILLINI*, a semi-monthly paper edited and published by the students of the several colleges, each of which is appropriately represented in its columns. A printing office has been provided in the mechanical building, and a press with a requisite supply of type.

The Library is well supplied with works illustrating the several periods of English, American, French, and German Literature, as also those of Ancient Literature. It contains at present over fourteen thousand well selected volumes, and is constantly growing by purchase at home and abroad. Valuable American and Foreign periodicals are received regularly in the Reading Room. (See list on pages 18 and 19.)

SUBJECTS COMMON TO THE SCHOOLS OF THIS COLLEGE.

MATHEMATICS.

First Term.—Trigonometry, plane and spherical ; fundamental relations between the trigonometrical functions of an angle or arc ; relations between the functions of different angles or arcs ; construction and use of tables ; solution of triangles ; angles as functions of sides, and sides as functions of angles ; applications.

Second Term.—Conic Sections, geometrical method. Definitions and general properties of the ellipse, hyperbola, and parabola ; curvature of the conic sections. Analytical Geometry, elements of. Properties and relations of the point and right line in a plane ; of the conic sections.

Third Term.—Advanced Geometry ; Modern Geometry. Harmonic proportion and harmonic pencils ; anharmonic ratio and involution ; poles and polars in relation to a circle ; the radial axes and centers of similitude of two circles ; the principle of continuity ; elementary principles of projection.

Text Books.—Coffin's Conic Sections and Analytical Geometry ; Mulcahy's Modern Geometry.

PHYSICS AND ASTRONOMY.

For these subjects, see College of Engineering.

NATURAL SCIENCE.

See College of Natural Science.

HISTORY AND SOCIAL SCIENCE.

The historical studies are designed to afford a general view of the history, social organization, and progress of the race. They embrace also the history of the arts and sciences, and of civilization, the principles of civil polity and law, the philosophy of history, and the principles of political economy and constitutional law.

The course occupies six terms in the Junior and Senior years of the University Course.

JUNIOR YEAR.

Ancient History of Greece and Rome, with notices of other nations; Ancient Geography; Mediæval History; Modern History; European Geography.

SENIOR YEAR.

Constitutional History of England and the United States; History of Civilization; Analysis of Historical Forces and Phenomena, Notices of the Arts and of the Inductive Sciences; Political Economy.

PHILOSOPHY AND LOGIC.

The studies of this department require much maturity of powers and are therefore confined to the Senior year of the University Course.

Mental Philosophy. Analysis and classification of mental phenomena; theories of perception, consciousness, imagination, memory, judgment, reason. Mental physiology, or connection of body and mind, healthful condition of thought, growth and decay of mental and moral powers. Philosophy of education, theory of conscience; nature of moral obligation; moral feeling. The Right. The Good. Practical ethics; duties. Formation of character. Ancient schools of philosophy; modern schools of philosophy. Influence of philosophy on the progress of civilization, and on modern sciences and arts.

Principles of Logic; conditions of valid thinking; forms of arguments; fallacies and their classification. Inductive and scientific reasoning; principles and methods of investigation. Practical applications of logic in the construction of arguments, in the detection and answer of fallacies, and the formation of the habits of thinking and common judgment of life.

SCHOOL OF ENGLISH AND MODERN LANGUAGES.

ENGLISH LANGUAGE AND LITERATURE.

Studies of the School — In the arrangement of the studies the endeavor is to present a thorough and extended drill in grammatical and philological study, and in the authors and history of the English language, affording a training equivalent to the ordinary studies of the classical languages. This drill extends through three years of the course, but may be shortened according to the ability and preparation of the student.

The first two terms of the first year are given to a general survey of the whole field of British and American literature from the middle of the sixteenth century to the present time. All the representative writers come into notice, and representative specimens from the writings of each are carefully read in class. Moreover, each student is required each term to read an entire work of some classic author, making choice from a prescribed list. Frequent exercises in writing abstracts, or original compositions on themes assigned, are also required. The study of Rhetoric occupies the third term.

During the second year four or five of the great masters are studied, their work analyzed, and the shaping forces of their times, with their influences upon succeeding times, are investigated. Lectures are given from time to time on poetry, epic, lyric, dramatic, etc. Writing and reading required as in first year.

In the Senior year attention is given to Old English ; to the Anglo-Saxon, for which the way has been prepared by the study of both English and German, and to Philology. Essays, forensics, and orations are required.

French and German. — The modern languages taught in this School are confined to one year of French and two years of German. Abundant practical exercises are given both in composition and translation, and the diligent student gains the power to read with ease scientific and other works in these languages, and may, with a little practice write and speak them with correctness. Constant attention is also given to the etymologies common to these languages and the English, and thereby a large advantage in linguistic culture is gained by the student. "He who knows no foreign tongue," said Goethe, "knows nothing of his own."

In the first year the student passes over a complete grammar and reader, acquiring a knowledge of the technicalities of the idiom, with a sufficient vocabulary for the use of books of reference within the course. The second year is devoted to a critical study of the languages and philological analysis, and to a course of select reading, composition, and conversation.

COURSE IN SCHOOL OF ENGLISH AND MODERN LANGUAGES.

Required for the Degree of B. L.

FIRST YEAR.

1. American Authors or Cicero de Amicitia ; French ; Trigonometry.
2. British Authors or Livy ; French ; Conic Sections.
3. Rhetoric ; French ; Advanced Geometry, or Free-Hand Drawing ; Horace (optional, extra).

SECOND YEAR.

1. English Classics ; German ; Physiology or Botany.
2. English Classics ; German ; Zoology or Botany.
3. English Classics ; German ; Astronomy.

THIRD YEAR.

1. German ; Chemistry ; Ancient History.
2. German ; Physics ; Mediæval History.
3. German ; Physics or Chemistry ; Modern History.

FOURTH YEAR.

1. Anglo-Saxon ; Mental Science ; History of Civilization.
2. Early English ; Logic ; Constitutional History.
3. Philology ; Political Economy ; Geology.

SCHOOL OF ANCIENT LANGUAGES AND LITERATURE.

In the School of Ancient Languages and Literature, the methods of instruction, without swerving from their proper aim, to impart a sufficiently full and critical knowledge of the Latin and Greek languages and writings, will make the study of these tongues subservient, in a more than usual degree, to a critical and correct use of the English. With this view, written translations, carefully prepared, with due attention to differences, equivalences, and substitutions of idioms, and the comparison and discrimination of synonyms, will form part of the entire course.

The study of Latin and Greek Composition will constitute a weekly exercise through the first year, and will be continued, to some extent, through the course. Essays, historical and critical, will be required from time to time, in connection with the works read, and a free use of the library is urged. It is intended that each student who contemplates the course in

Ancient Languages shall have a clear knowledge of the history of Greek and Latin Literature, and of the principal authors in both languages. As an aid to the appreciation of the literature of the two peoples, Greek and Roman history will form an important part of the course, and will be taken up in the beginning, illustrating the works read. In the first term of the third year Ancient History is taken up as a separate study, and especial attention is then given to the history of Greece and Rome, and the nations with whom they came in contact. Classes will be formed for the students who wish to carry their classical study farther than the prescribed course, and every assistance will be given them.

COURSE IN SCHOOL OF ANCIENT LANGUAGES.

Required for Degree of B. A.

FIRST YEAR.

1. Cicero de Amicitia and prose composition ; Iliad and prose composition ; Trigonometry.
2. Livy and prose composition ; Odyssey and prose composition ; Conic Sections.
3. Odes of Horace and prose composition ; Memorabilia and prose composition ; Advanced Geometry.

SECOND YEAR.

1. Satiræ of Horace ; Thucydides or German ; Physiology.
2. Terrence ; Sophocles or German ; Zoology.
3. Tacitus ; Demosthenes or German ; Astronomy.

THIRD YEAR.

1. Juvenal or French ; Chemistry ; Ancient History.
2. Quintilian or French ; Physics ; Mediæval History.
3. De Officiis or French ; Physics ; Modern History.

FOURTH YEAR.

1. Mental Science ; History of Civilization ; Physiography.
2. Logic ; Constitutional History ; Early English.
3. Political Economy ; Philology ; Geology.

RHETORIC AND ORATORY.

Particular attention will be given to training in writing and speaking, in which all students of all departments will be required to participate. It is intended to give such a course of instruction both elementary and advanced as shall make it probable that all students who have taken any full course of instruction in literature or in science may write clearly and intelligently, and may speak without affectation or embarrassment. Prof. J. H. Brownlee will enter upon this work at the beginning of the next year.

Additional Schools.

NOT INCLUDED IN THE FOUR COLLEGES.

SCHOOL OF MILITARY SCIENCE.

PROFESSOR CHARLES MCCLURE.

2ND LIEUT. 1STH INFANTRY, U. S. A.

By the law of Congress, and of the State, the University is required to teach Military Tactics to its students. All able-bodied male students of the Preparatory year and of College classes of the first, second, and third years are enrolled in the companies of the University battalion, and receive instruction in the following military exercises :

School of the Soldier ; Manual of Arms.

School of the Company ; Movements by Platoons, Firings, etc.

School of the Battalion ; Ployment and Deployment of Close Columns.

Battalion and Company Skirmish Drill ; Bugle Calls.

Bayonet Fencing ; Target Practice.

Guard and Picket Duties of Sentinels.

CLASS IN MILITARY SCIENCE.

Classes are taught in military science and tactics, as far as is requisite for officers of the line. From these classes are selected the officers of the several companies, for which they act as instructors. The military instruction is under the charge of Lieut. Charles McClure, a graduate of the U. S. Military Academy, and an officer of the regular army of the United States. A full supply of arms and ammunition is furnished by the War Department, including 300 cadet rifles and accoutrements, two pieces of field artillery, 1,000 ball cartridges and 1,000 blank cartridges annually for target practice, with 100 cartridges and 300 friction primers for artillery.

No student is eligible to the military class till he has reached the third term of the Freshman year, nor unless he is in good standing in all his studies. The course of instruction is confined strictly to two years. No student will be permitted to retain a command who does not maintain a good standing in conduct and scholarship.

The instruction and class exercises occupy about three hours each week, arranged as far as possible so as not to interfere with any other course of study. Students must be careful, however, to ascertain, before entering the military class, that the proper studies and exercises of their chosen courses will not be interfered with.

Commissions.—The Governor of the State is accustomed to commission as captains, by brevet, in the State militia, such graduates of the University as have completed the studies of the military classes and have obtained the requisite experience in command in the University battalion. In order to obtain the commission the student must be approved by the Faculty and pass satisfactorily an examination in military science and tactics before a committee appointed by the Faculty of the University. It is expected that in order to get the required experience in command, the members of the military class of the third or Junior year will serve as commissioned officers of the several companies of the battalion.

University Uniforms.—Under the authority of the acts of incorporation, the Trustees have prescribed that all male students, after the first term of their attendance, shall wear the University uniform. The University cap is to be worn from the first. The uniform consists of a suit and cap of cadet gray cloth. Students can procure them ready made on their arrival here. The University cap is ornamented in front with the initials U. of I., surrounded by a wreath. Students will always wear their uniforms on parade, but in their rooms and at recitations may wear other clothing.

The University Library contains many books on Military Science, Military History, and Engineering.

Gymnasium.—The Drill Hall is furnished with a full set of gymnastic apparatus, and classes in gymnastic exercises are organized in the fall and winter terms, under careful leaders. Fee, 50 cents.

The University Cornet Band is composed of students who, while members of the band, are excused from drill. Instruments and music are furnished by the University, and the band plays at drill, and other college exercises.

COURSE IN SCHOOL OF MILITARY SCIENCE.

FIRST YEAR.

1. School of the Soldier and Company ; Bayonet Fencing.

SECOND YEAR.

1. School of Battalion ; Skirmish Drill.
2. Ceremonies and Reviews ; Military Signaling ; Sword Fencing.
3. Guard, Outpost, and Picket Duty ; Military Signaling ; Sword Fencing.

THIRD YEAR.

1. Military Administration ; Reports and Returns ; Theory of Fire-Arms ; Target Practice ; Artillery Drill.
2. Organization of Armies ; Art of War ; Field Fortifications ; Artillery Drill.

SCHOOL OF ART AND DESIGN.

PROFESSOR PETER ROOS.

This School is to subserve a two-fold purpose: 1. It affords to the students of the several colleges the opportunity to acquire such a knowledge of free-hand drawing as their chosen course may require. 2. It offers to such as have a talent or taste for art the best facilities for pursuing studies in industrial designing or other branches of fine art. Schools of design, in Europe and in this country, have been found important aids to the higher manufactures, adding to the beauty of fabrics, and to the skill and taste of workmen.

The increased interest in the decorative arts, and in the manufactures which they require, has added new importance to the study of drawing and designing. It is the purpose to keep this school of design abreast with the best movements in this direction.

COURSE OF INSTRUCTION.

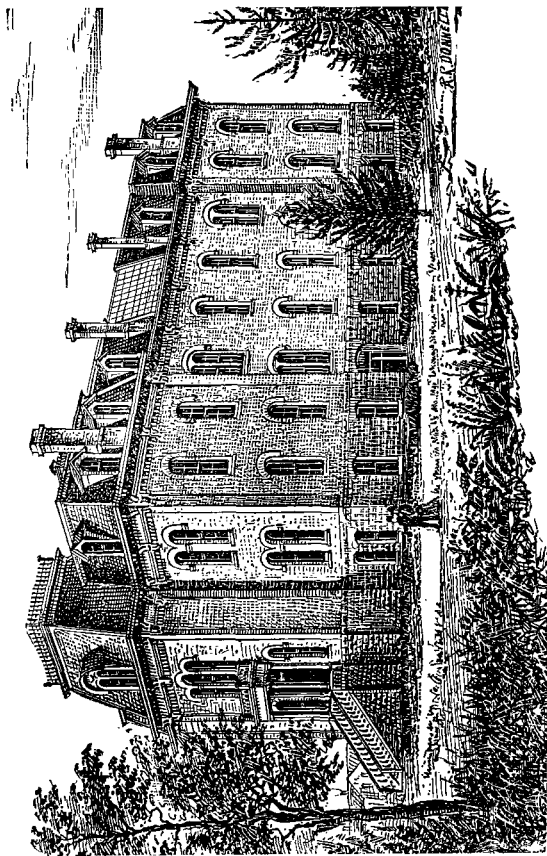
FIRST YEAR.

1. Form Analysis and Construction ; Elementary Perspective ; Combination Drawing.
2. Shading from Objects ; Science of Perspective ; Clay Modeling.
3. Drawing from Casts ; Tinted Designs ; Modeling of Ornaments.

SECOND YEAR.

1. Historic Styles of Ornament ; Science of Color ; Mould-making and Casting in Plaster.
2. Monochrome Painting ; Designs from Plants ; Modeling from Shaded Examples.
3. Constructive Designs ; Water Color Drawing ; Modeling from Nature.

Students having passed the above course may enter either of the following courses :



CHEMICAL LABORATORY.

COURSE IN DESIGNING.

THIRD YEAR.

1. Decoration in Historic Styles; Drawing of Common Objects; Modeling.
2. Designs for Specified Material; Study of Drapery; Art Anatomy.
3. Designs for Furniture; Water Color Drawing; Art Anatomy.

FOURTH YEAR.

1. Tempera Painting; Designs for Monuments; Modeling.
2. Drawing from Life; Designs for Memorial Windows; Modeling.
3. Ecclesiastic Decoration; Emblems and Still Life in Tempera Color; Modeling or Oil Painting.

COURSE IN PAINTING.

THIRD YEAR.

1. Drawing from Statuary; Water Color Painting; Art Anatomy.
2. Imitation of Various Stuffs and Materials; Drawing from Life.
3. Painting from Groups; Sketching from Nature; Art Anatomy.

FOURTH YEAR.

1. Drawing from Life; Composition; Painting of Still Life.
2. Painting from Life; Pictures from Description.
3. Painting from Nature; Illustration of Prescribed Subjects.

As a preparation for entering the course in Art and Design, the study of Plane Geometry and Projection Drawing is recommended.

Topics for reading upon art subjects are given weekly.

Detail Studies and Sketches such as are necessary to the successful rendering of things, will be required outside of the regular exercises.

For admission to advanced classes the student must show proficiency in preliminary work.

The authorities of the University have provided that persons not connected with the Institution may join the drawing and painting classes on very moderate terms.

MUSIC.

Music constitutes no part of any University course of studies, and is therefore not provided by the Trustees. But as many students, especially young ladies, desire instruction in music, competent teachers are selected by the Trustees; and rooms set apart for instruction.

COURSE OF INSTRUCTION.

Bertini's Instructor ; Clementi's Sonatines, Op. 36, 37, 38 ; Heller's Studies, Op. 36, Books 1 and 2 ; Duvenary's Studies, Books 1, 2, 3 ; Löscher's Klavier-Technik ; Czerny's Etudos de la Velocite, Op. 299, Books 1, 2, 3, 4 ; Czerny's Fifty Finishing Studies, Op. 740, Books 1, 2, 3 ; Cramer's Studies, Books 1, 2, 3, 4 ; Mendelssohn's Lieder ohne Worte ; Clementi's Gradus ad Parnassum.

TUITION.

Instruction term of ten weeks—2 lessons a week	\$10.00
For term of ten weeks, one lesson a week	6.00
Practice on piano, one hour daily, per term	2.00

MISS KITTIE M. BAKER,

Teacher of Vocal Music and Voice Culture, follows the Italian method, giving individual instruction.

TERMS.

Ten weeks—two lessons a week	\$12.00
Ten weeks—one lesson a week	7.00

No deductions on account of absence in either course, except in case of protracted illness.

Special students in music will also be charged the regular term fee charged other students of the University.

PREPARATORY CLASSES.

To meet an urgent demand, the Trustees consented to provide temporarily for teaching the preparatory studies lying between the work of the common school and that of the University.

Candidates for these classes should not be less than fifteen years old. They must pass satisfactory examinations in Arithmetic, Geography, English Grammar, and History of the United States. The examination in these branches should be equal to that usually required for a second grade certificate for teachers. This examination may be made by county superintendents.

PREPARATORY STUDIES.

The studies taught in the preliminary year are as follows:

FOR COLLEGES OF AGRICULTURE, ENGINEERING, AND NATURAL SCIENCE.

First Term.—*Algebra.*—(Olney's.) Fundamental rules ; factoring ; common divisors and multiples ; powers and roots ; calculus of radicals ; simple equations ; proportion and progression. *Physiology.*—(Dunglison's, or an equivalent. *Natural Philosophy.*—(Norton's, or an equivalent.)

Second Term.—*Algebra.*—Quadratic equations, etc. *Geometry.*—(Chauvenet's.) Plane Geometry, lines, circumferences, angles, polygons, as far as equality. *English.*—Elements of composition. (Gilmore's Art of Expression, or equivalent.) Orthoepy and word analysis. (Introduction to Webster's Academic Dictionary.)

Third Term.—*Geometry* completed, including solid Geometry and the sphere. *English*, as in the second term, with addition of Goldsmith's Traveler, or an equivalent, read for analysis. *Botany.*—Gray's Lessons in Botany, or an equivalent.

FOR COLLEGE OF LITERATURE AND SCIENCE.

First Term.—*Algebra*, as above. *Latin.*—Cicero's Oration. *Greek.*—Grammar and Reader.

Second Term.—*Algebra and Geometry*, as above given. *Latin.*—Virgil. *Greek.*—Xenophon's Anabasis.

Third Term.—*Geometry* completed. *Latin.*—Virgil's Æneid. *Greek.*—The Anabasis.

N. B.—Greek is required for only the School of Ancient Languages. The School of English and Modern Languages requires Physiology, Natural Philosophy, and Botany, instead of Greek.

Students in the preparatory studies are not matriculated as members of the University. They pay no entrance fee, but are charged a tuition fee of five dollars a term, and the incidental fee of seven and a half dollars a term. They have all the privileges of the library, and of the public lectures, and are required to drill.

N. B.—No student is matriculated as a college student until all preparatory studies are completed.

ACCREDITED HIGH SCHOOLS.

The faculty, after personal examination, appoints accredited High Schools, whose graduates may be admitted to the University without further examination within one year after date of their graduation. These must be schools of first rate character, whose course of instruction include all the studies required for admission to some one of the colleges of the University. On application, a member of the Faculty is sent to examine the school making application, as to its facilities for teaching, its course and methods of instruction, and the general proficiency shown. If the report is favorable, the name of the school is entered in the published list of High Schools, accredited by the University. The graduates of these schools are admitted to any of the colleges for which their studies may have prepared them. The appointment continues as long as the work of the school is found satisfactory. Annual reports are asked from these schools.

ACCREDITED HIGH SCHOOLS,

	Principal.
Princeton High School.....	Chas. Raymond,
Lake View High School.....	A. F. Nightingale,
Champaign, West High School....	M. Moore,
Decatur High School.....	John W. Gibson,
Urbana High School.....	J. W. Hays,
Oak Park High School.....	B. L. Dodge,
Chicago S. Division High School...	Jeremiah Slocum,
Chicago N. Division High School...	O. S. Westcott,
Chicago W. Division High School...	Geo. P. Welles,
Hyde Park High School.....	Leslie Lewis, Supt.
Marengo High School.....	C. M. Bardwell,
Kankakee High School.....	F. M. Tracey,
Mattoon E. Side High School.....	I. L. Betzer,
Springfield High School.....	F. R. Feitshans, Supt.
Monticello High School.....	F. V. Dilatush,
Warren High School.....	D. E. Carver,
Peru High School.....	Joseph Carter,
Peoria High School.....	Geo. E. Knepper,
Galena High School.....	O. P. Bostwick,
Shelbyville High School.....	
Sycamore High School.....	A. J. Blanchard,
Rochelle High School.....	A. V. Greenman,
Rossville High School.....	S. B. Messer,
Bement High School.....	C. W. Groves,
Oakland High School.....	Moses Andrews,
Jacksonville High School.....	H. M. Hamill, Supt.
Danville High School.....	S. Y. Gillan,

Charleston High School.....	E. J. Hoenshel,	Principal.
Tuscola High School.....	W. B. Wilson,	"
Streator High School....	R. Williams,	"
Ottawa High School.....	D. R. A. Thorpe,	"
Bloomington High School.....	J. W. Heninger,	"
Aurora E. Side High School.....	N. A. Prentiss, Supt.	
Paris High School.....	A. Harvey, Supt.	

EXAMINATIONS.

Written examinations are held at the close of each term or oftener, and whenever any study has been finally completed. Any student failing to answer correctly 75 per cent. of the questions proposed, loses all credit for that study, and is precluded from proceeding with any other studies without special permission.

A record is kept of each student's term work and standing, and from this his final certificate of graduation is made up.

A statement of the scholarship and conduct of each student will be sent to his parent or guardian as soon as may be after the end of each term.

DEGREES AND CERTIFICATES.

The law provides that, "on recommendation of the Faculty, the Trustees may authorize the Regent, as president of the University, to issue diplomas to such persons as shall have completed satisfactorily the required studies; and sustained the examination therein, conferring such Literary and Scientific Degrees as are usually conferred by Universities for similar or equivalent courses of studies, or such as the Trustees may deem appropriate." Approved May 11, 1877.

In accordance with the law, the following system of Degrees has been adopted for the University :

1. All studies will remain, as heretofore, free. Each student may choose and pursue such studies as he may desire, subject only to such conditions as to preparation, times of study, and number of studies, as may be necessary to secure efficiency in classes and economy in teaching.

2. But students who wish to be candidates for any degree must complete fully the course of studies prescribed for such degree, and must present an accepted thesis.

3. Students not candidates for any degree will be

enrolled as special students, and will receive at the close of their attendance, if not less than a year, the certificates provided by law, with statements of work done and credits attained.

4. It is designed that the requirements for all the Bachelor's Degrees shall be, as nearly as possible, equal in amount and value.

5. The Degree of Bachelor of Science, B. S., will be given to those who complete either of their courses of studies in the Colleges of Engineering, Agriculture, or Natural Science. The name of the School will be inserted after the degree.

6. The degree of Bachelor of Letters, B. L., will be given to those who complete the course of the School of English and Modern Languages.

7. The degree of Bachelor of Arts, B. A., will be given to those who complete the course in the School of Ancient Languages.

8. The Masters' Degrees, M. S., M. L., and M. A., and the equivalent degrees of C. E., M. E., etc., will be given only to those who have pursued a year of prescribed post-graduate studies, and passed examinations thereon, or after a term of three years' successful practice. In either case an accepted thesis will be required.

BOARD.

There are many boarding-houses in Urbana and Champaign, within reasonable distance of the University, where students can obtain either table board, or board and rooms, with the advantages of the family circle. Boarding clubs are also formed by the students, by which the cost of meals may be reduced to \$2 per week. Some students prepare their own meals, and thus reduce expenses still farther.

For estimates of annual expenses, see page 85.

The Young Men's Christian Association of the University will aid new students in procuring rooms and boarding places.

LABOR.

Labor is furnished as far as possible to all who desire. It is classified into educational and remunerative labor.

Educational labor is designed as practical instruction, and constitutes a part of the course in several schools. Students are credited with their proficiency in it as in other studies. Nothing is paid for it.

Remunerative labor is prosecuted for its products, and students are paid what their work is worth. The maximum rate paid for farm, garden, and shop labor, is *ten cents*, and for that about the buildings and ornamental grounds, *eight cents per hour*. Students of sufficient experience may be allowed to work by the piece or job, and thus by diligence or skill secure more pay.

Some students who have the requisite *skill, industry, and economy*, pay their entire expenses by their labor; but, in general, young men cannot count upon doing this at first, without a capital to begin with, either of skill or of money, to serve them till a degree of skill is acquired. As the number of students increases, it is found more and more difficult to furnish the labor needed, and students cannot count so certainly upon finding employment.

GENERAL DIRECTIONS TO STUDENTS.

Young men or women desiring a liberal education, and living at a distance from College or University, are often puzzled to understand precisely what they will be required to know and do in order to gain admission. To such, these words are addressed :

1. Notice that a College or a University (which is properly a collection of Colleges) is designed for the higher education only, and not for the study of common branches. None of the common branches, such as Arithmetic, Geography, English Grammar, Reading, and Spelling, are taught in this University. These must all be finished before you come.

2. In order to pursue profitably the true College studies, and to keep pace with the classes, you must be ready to pass a strict examination in the common branches just mentioned, and in certain other preparatory studies, differing with the different Colleges of the University. (See pages 22 and 23.)

3. If well prepared only in the common branches above named, you may be admitted, not to the College, but to the Preparatory Classes, in which you will study the other prepar-

atory studies required for admission to College (See pp. 76-7.) All preparatory studies must be completed before you can be admitted, as a matriculated student, to any College class.

4. All College studies are arranged in regular courses, in which each term's work is designed to prepare for the next. You should enter at the beginning of the College year, in September. If unable to enter at that time, you may enter at any later time by making up the studies already passed over by the class.

5. Enter College with the purpose of going through, and make your course regular as far as you go. If obliged to leave before you have finished the course, you will have done the best thing for yourself in the meantime; while if you remain, the regular course is in nine cases out of ten the most useful and effective.

Students desiring only a winter's schooling should go to some high school.

EXPENSES.

THE TUITION IS FREE in all the University Classes.

THE MATRICULATION FEE entitles the student to membership in the University until he completes his studies, and must be paid before he enters. Amount \$10.00

THE TERM FEE for Incidental Expenses is for each student..... 7.50

ROOM Rent in University Dormitory, each student per term.....\$2.00 to 6.00

Each student working in Laboratories, or in the Draughting and Engineering Classes, is required to make a deposit varying from 50 cents to \$12, to pay for chemicals and apparatus used, and for any breakages or damages.

ALL BILLS due the University *must be paid before the student can enter* Classes.

The following are estimated maximum and minimum annual expenses, exclusive of books and clothing, of a residence of thirty-six weeks at the University:

	MIN.	MAX.
Term Fees and Room Rent for each student.....	\$ 28.50	\$ 34.50
Table Board in Boarding Houses and Clubs.....	72.00	144.00
Fuel and Light.....	10.00	15.00
Washing at 75 cents per dozen.....	13.50	27.00
Total amount.....	\$124.00	\$220.50
Board and Room in Private Houses, per week.....	4.00	6.00

FEES IN THE PRELIMINARY YEAR.

Tuition per Term.....	\$ 5.00
Incidental Fee, per Term.....	7.50

SPECIAL 'FEES.

For Music, for 20 Lessons.....	\$10.00
For Painting or Drawing, to Special Students.....	10.00
Matriculation Fee.....	10.00
Graduation Fee.....	5.00

CAUTION TO PARENTS—STUDENTS' FUNDS.

The Business Agent will receive on deposit any funds parents may intrust to him to meet the expenses of their sons. *No greater error can be committed than to send boys from home with large amounts of spending money, without the authoritative care of some prudent friend.* Half the dissipation in colleges springs from excessive allowances of money. Students have little real need for money, beyond that required for fees, board bills, and books. The attention of parents and guardians is earnestly requested to this matter, and especially in the case of those students who are under twenty years of age.



CALENDAR FOR 1885-86.

Examinations for Admission.....Monday, September 14
 First or Fall Term begins.....Wednesday, September 16
 First Term ends.....Wednesday, December 23

WINTER VACATION.

FOR 1886.

Examination for Admission to Advanced Classes, Tuesday, January 5
 Opening of the Second or Winter Term.....Wednesday, January 6
 Anniversary Day.....March 11
 Second Term ends.....Wednesday, March 24
 Third or Spring Term begins.....Thursday, March 25
 Baccalaureate Address in University Chapel....Sunday, June 6
 Class Day.....Monday, June 7
 Alumni Day.....Tuesday, June 8
 Commencement.....Wednesday, June 9

SUMMER VACATION.

Examinations for Admission.....Monday, September 13
 First or Fall Term begins.....Wednesday, September 15

UNIVERSITY DIRECTORY.

SPRING TERM, 1885.

ILLINI BOARD.

J. O. Davis, T. H. Schleder,
Geo. H. Ellis, Lottie Switzer,
W. H. Babcock, Rozina Fairchild,
J. L. Mackay, F. R. Edwards,
J. S. Jacobson, E. W. Pickard.

Grant Frederick.

Editor-in-chief, John E. Wright.

Business Manager, E. Leland Morse.

For 1885-6.

Editor-in-chief, Chas. H. Kammann.

Business Manager, J. O. Davis.

UNIVERSITY BATTALION.

Lieut. Chas. McClure, U. S. A.,
Commander, and Professor of Military Science.

CAPTAINS :

Co. A, J. L. Mackay.
Co. B, A. Philbrick.
Co. C, H. W. Wilder.
Co. D, A. N. Abbott.
Co. E, Hugo S. Speidel.
Adjutant, J. O. Davis.

LITERARY SOCIETIES, ETC.

ALETHENAI.

Young Ladies' Literary Society.
Motto: "*Live.*" Organized October 4th, 1871; chartered October 10, 1881. Meets in Society Hall every Friday evening.

President, Etta C. Wills.

Secretary, May Walden.

PHILOMATHEAN.

Young Men's Literary Society.
Motto: "*Come Up Higher.*" Organized March 7th, 1868: chartered October 23, 1877. Meets in Society's Hall every Friday evening.

President, Wm. H. Smith.

Secretary, Merton Waite.

ADELPHIC.

Young Men's Literary Society.
Motto: "*Aninis opibusque parati.*" Organized March 7th, 1868: chartered December 7th, 1872. Meets in Society's Hall every Friday evening.

President, W. F. Kendall.

Secretary, W. C. Sanford.

Y. M. C. A.

Devotional meetings Wednesday, 3 P. M., and Sundays, 9 A. M. All students are invited to attend. Room 40 Main Building.

President, G. S. Bannister.

Secretary, A. M. Troyer.

Y. W. C. A. meets every Monday. Room 40 Main Building, at 4 P. M. All students welcome.

President, Mary Williamson.

Secretary, Ella Connet.

UNIVERSITY CORNET BAND.

Meets Tuesday and Friday evenings. Fifteen instruments.

Wm. B. Braucher, leader.