1905

Bulletin of the Iowa State College of Agriculture and The Mechanic Arts

Iowa State University

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CALENDAR FOR 1905-1906

1905.

Second Semester of College Year began .......... Thur., Jan. 19
Easter Vacation .............. Thur. night to Mon. night, April 20-24
Memorial Day................................. Tues., May 30
Baccalaureate Address ...................... Sunday, June 4
Annual Alumni Meeting ..................... Wed., Thur., June 7-8
Commencement ................................. Thur., June 8
Good Roads School ......................... June 12-17

1905-6.

First Semester of College Year begins .......... Thur., Aug. 31
Entrance Examinations ..................... Thur.-Fri., Aug. 31-Sept. 1
Recitations begin ............................. Mon., Sept. 4
Thanksgiving Vacation ...................... Thur., Nov. 30
Term Examinations ............................. Dec. 20-21
Short Courses in Stock and Grain Judging and Domestic Science ......................... Jan. 1-13
Second Semester of College year begins ........ Thur., Jan. 18
Registration and Classification Days .......... Thur.-Sat., Jan. 13-20
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BOARD OF TRUSTEES

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E. W. Stanton, Ames................................Secretary
Herman Knapp, Ames................................Treasurer
W. A. Helsell, Odebolt.................................Financial Secretary
Benjamin Edwards, Ames.................................Custodian

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Ex-officio—Hon. John F. Riggs, Superintendent of Public Instruction.

Term Expires
First District—Hon. H. M. Letts, Columbus Junction........1910
Second District—Hon. Vincent Zimmer, Iowa City............1910
Third District—Hon. E. A. Alexander, Clarion...............1908
Fourth District—Hon. E. J. Orr, Waukon....................1910
Fifth District—Hon. W. R. Moninger, Marshalltown..........1906
Sixth District—Hon. W. O. McElroy, Newton..................1908
Seventh District—Hon. W. K. Boardman, Nevada..............1906
Eighth District—Hon. G. S. Allyn, Mt. Ayr..................1910
Ninth District—Hon. James H. Wilson, Adair.................1908
Tenth District—Hon. J. B. Hungerford, Carroll..............1906
Eleventh District—Hon. W. J. Dixon, Sac City..............1906

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GROUP II.

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Committee on Engineering Departments and Physics: Trustees Zmunt, Supt. Riggs, Orr, McElroy and Dixon.

Committee on College Hospital and Sanitary Arrangements: Supt. Riggs, Trustees Zmunt and Wilson.

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Committee on College Lands and Investments: Trustees Allyn, Gov. Cummins and Moninger.

Committee on Rules: Trustees Orr, Zmunt and McElroy.

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Committee on Bonds: Trustees Moninger and Wilson.
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JOSEPH EDWARD GUTHRIE, M. Sc.,
Assistant Professor of Zoology.

FRANK WILLIAM BOUSKA, M. S. A.,
Assistant Professor of Bacteriology

CHRISTIAN LARSEN, B. S. A.,
Assistant Professor of Dairying.

*Granted leave of absence
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Assistant Professor of Civil Engineering

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PAUL SKEELS PEIRCE, Ph. D.,
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FREDERICK R. AHLERS, D. V. M.,
Assistant Professor of Anatomy and Obstetrics

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Assistant Professor of Physiology and Sanitary Science.

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Assistant Professor of Soils

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Acting Assistant Professor of Electrical Engineering

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Instructor in Pattern Shop.

MRS. MARY ELIZABETH RESLER, B. PH.,
Instructor in Instrumental Music

ERNEST ALANSON PATTENGILL, B. S. ,
Instructor in Mathematics

ELBERT BARRETT TUTTLE, B. S. IN E. E.,
Instructor in Physics.

MISS JULIA COLPITTS, M. A.,
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Instructor in English.

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Instructor in Domestic Art

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Photographer.

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S. W. BEYER, B. Sc., Ph. D.,
Mining Engineer.

W. H. MEEKER, M. E.,
Associate Mechanical Engineer.
HISTORICAL

LOCATION

BUILDINGS, GROUNDS AND EQUIPMENTS
In 1858 the Legislature of Iowa passed an act to establish "A State Agricultural College and Model Farm," to be connected with the entire agricultural interests of the State; appointed a board of commissioners to buy a farm and erect a college building, and elected a board of trustees to select a faculty and organize a college. In 1859 a farm of six hundred and forty acres, situated near Ames, was purchased for the use of the college. The farm now exceeds one thousand acres.

In 1862 a bill was passed by Congress, entitled, "An act donating public lands to the several States and Territories, which may provide colleges for the benefit of Agriculture and the Mechanic Arts."

Section 1 of this act provides that for the support of such colleges there be granted "an amount of public land, to be apportioned to each State in quantity equal to thirty thousand acres for each Senator and Representative in Congress to which the States are respectively entitled by the apportionment under the census of 1860; provided that no mineral lands shall be selected or purchased under the provisions of this act."

Section 4 requires: "That all moneys derived from the sale of land aforesaid by the States to which lands are apportioned, and from the sale of land script, hereinbefore provided for, shall constitute a perpetual fund, the capital of which shall remain forever undiminished (except as may be provided for in Section fifth of this act), and the interest of which shall inviolably be apportioned by each State which may take and claim the benefit of this act, to the endowment, support and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislature of the State may provide, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

Section 5 says: "And be it further enacted, that the grant of land and land script hereby authorized, shall be made on the
following conditions, to which, as well as the provisions herein-before contained, the previous assent of the several States shall be signified by legislative acts; first, if any portion of the fund, invested as provided by the foregoing section, or any portion of the interest thereon, shall, by any action or contingency, be diminished or lost, it shall be replaced by the State to which it belongs, so that the capital of the fund shall remain forever undiminished; and the annual interest shall be regularly applied without diminution to the purposes mentioned in the fourth section of this act, except that a sum not exceeding ten per centum upon the amount received by any State under the provisions of this act, may be expended for the purchase of land for sites or experimental farms, wherever authorized by the respective Legislatures of said States. Second, no portion of said fund nor the interest thereon shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation or repair of any building or buildings."

The General Assembly of Iowa, September 11, 1862, accepted the grant upon the conditions and under the restrictions contained in the act of Congress, and by so doing entered into contract with the General Government to erect and keep in repair all buildings necessary for the use of the College. By this action of the General Assembly the College was changed from an agricultural institution into a College of Agriculture and Mechanic Arts, with the broad and liberal course of study outlined in the following paragraph.

In 1882 the General Assembly passed an act defining the course of study to be pursued as follows: Section 1. That Section 1621 of the Code is hereby repealed and the following is enacted in lieu thereof: "Section 1621. There shall be adopted and taught in the State Agricultural College, a broad, liberal and practical course of study, in which the leading branches of learning shall relate to agriculture and the mechanic arts, and which shall also embrace such other branches of learning as will most practically and liberally educate the agricultural and industrial classes in the several pursuits and professions of life, including military tactics. Section 2. That all acts, and parts of acts inconsistent with this act are hereby repealed."

August 30th the following act was approved by President Harrison: "Be it enacted by the Senate and House of Represen-
tatives of the United States in Congress assembled, that there shall be and hereby is, annually appropriated, out of any moneys in the treasury not otherwise appropriated, arising from the sales of public lands, to be paid as hereinafter provided, to each State and Territory for the more complete endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts now established, or which may hereafter be established, in accordance with an act of Congress approved July second, eighteen hundred and sixty-two, the sum of fifteen thousand dollars for the year ending June thirtieth, eighteen hundred and ninety, and an annual increase of the amount of such appropriation thereafter for ten years by an additional sum of one thousand dollars over the preceding year, and the annual amount to be paid thereafter to each State and Territory shall be twenty-five thousand dollars, to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their application in the industries of life, and to facilities for such instruction."

The income of the College from National grants is therefore expended in instruction, experimentation and illustration in agriculture and in the mechanic arts, and in underlying and related science and literature.

All buildings are erected and all repairs thereon are made by the State of Iowa, the cost down to date being about $750,000.

The College was formally opened on the 17th of March, 1869.
The College occupies a delightful and healthful location upon high rolling land, just west of Ames, Story County. The railroad facilities for reaching Ames from every part of the State are excellent. It is at the junction of the Des Moines and the northwestern branches and the main line of the Chicago & Northwestern Railroad. The main line of the Chicago, Milwaukee & St. Paul intersects the Northwestern at Slater, eleven miles south, and the through line of the same system at Algona on the north. The main line of the Illinois Central intersects the Chicago & Northwestern at Webster City, just north, and the main line of the Iowa Central makes good connections at Marshalltown on the east. All the railway connections of Des Moines have thirty-seven miles to Ames. The Chicago & Northwestern Railway has frequent trains, Des Moines to Ames and return. A steam motor railway connects Ames and the College with efficient service. Ames is a most desirable town for wholesome college influences. Its people are enterprising, thrifty and cordial. The town has an excellent system of public schools, numerous churches, water works, electric lights, and a good city government. It affords wholesome surroundings for the students. It is an inviting community for families who wish to educate their children, enjoy the better elements of society and an environment of reasonable expenses. The town and College are on very cordial terms, and its citizens take marked pains in the efforts of the students and the highest interests of the College. It is a model location for factories and business enterprises.
BUILDINGS, GROUNDS AND EQUIPMENTS

BUILDINGS.

Twenty-two commodious buildings have been erected by the State, for the exclusive use of the various departments of the College, besides the dwelling houses and buildings for farm stock, machinery and work.

All these buildings are heated by steam and lighted by electricity. Pure water is supplied to all of the buildings.

There are two rooming cottages, brick buildings, affording rooms for ninety-four students.

The other buildings are as follows, used for recitation and lecture rooms and laboratories:

Chemical Hall: Brick, Three stories throughout; steam heat; water and gas. Laboratory outfit complete for 100 students in Chemistry.

Veterinary Hospital: Brick, three stories, containing offices, dissecting rooms, and all modern appliances for the treatment of diseased animals.

Sanitary Hall: Frame, two stories; lower floor, office, kitchen and dining room for the hospital patients and rooms for convalescents; upper floor, seven rooms for care of sick among the students.

Engineering Laboratory: Brick, four stories, including basement, and large "L," containing machine shops, and the engineering laboratory, for the departments of Mechanical and Civil Engineering.

The Wood Shop: Brick, containing carpenter and pattern shops, with power and hand tools complete for wood-work, and outfit of tools for individual work.

Forge Shop and Foundry: Brick, containing complete equipment for forging and moulding.

Engineering Hall: The Engineering Departments occupy the new Engineering Hall. This is a fire-proof building in which
all the engineering departments have offices, recitation and lecture rooms, laboratories and engineering museum. This building is of Bedford stone, has plate glass windows, and modern conveniences and furnishings throughout. It is the best engineering building at present west of the Mississippi river.

**Power House:** Brick, one story, contains engine and boiler, furnishing power for the shops, and accommodates experimental work of the course in Mechanical Engineering. The dynamos and motor power for electric engineering are now in this building, also the deep well pump.

**Locomotive Laboratory:** This building contains an eight-wheel locomotive and tender presented by the Chicago & Northwestern Railway Company.

**Music Hall:** Brick, two stories, fitted up with apparatus and instruments for practice and instruction.

**The Administrative Building:** Brick, for the use of trustees and faculty, and for offices of the president, secretary and treasurer.

**Dwelling Houses:** Eighteen comfortable dwelling houses on the grounds are occupied by professors' families, and several others by foremen and employees.

**Morrill Hall** is named in honor of Hon. Justin S. Morrill, the originator of the "Land Grant" for Colleges of Agriculture and Mechanic Arts. The building cost about $35,000, including water supply, steam heat and electric light. It is of deep red brick, with stone foundation, and stone, brick and terra cotta trimmings interblended.

It stands on the high ground of the beautiful campus, north of and near the main building. It is for Chapel, capacity, 650; Library, containing 18,000 volumes; the Museum, Lecture Rooms and Laboratories of the Department of Zoology.

**Agricultural Hall** is a four-story building. The lower stories are composed of stone from the State quarries at Anamosa, and the upper stories are brick. It contains rooms for Horticulture, Agriculture, Agricultural Chemistry, Experiment Station work and Veterinary Medicine. It is finely lighted and heated and contains modern improvements.

**Greenhouses:** The present plant, including recent additions, contains 10,000 square feet under glass. The houses are of cypress construction throughout with an interior supporting
structure of steel. They are heated by steam, operated on the Paul system, with varying temperatures for the propagating house, growing houses, and seed testing rooms. Adjoining the greenhouses are four commodious work rooms, with benches for potting, transplanting, and general greenhouse handicraft operations.

The Horticultural Laboratory is a building 35 x 50 feet, two stories with basement. It is connected with the greenhouse. The main room contains desk room and lockers for 25 students. Adjoining is a pomology room with bench room for 25 students to work in the study of fruits. The building is provided with two refrigerators, one for experimental work in cold storage and the other for storing fruits for class purposes. The second floor is provided with horticultural museum and facilities for photography.

Horse Barns and Stock Pavilion: The barn, composed of brick with slate roof, is for horses, the storage of grain and general farm purposes. One of the best stock pavilions in the country, accommodating several hundred students at a time, is located near this barn and gives first class advantages for stock judging and animal husbandry. It is circular in form, well heated and lighted.

Station Barn: The Experiment Station barn is one of the best and most modern buildings of its kind to be found anywhere in the world. It is 50 feet wide, 100 feet long and has a round silo, 18 feet in diameter, on the northwest corner. It is veneered with buff pressed brick, has a slate roof and built in every way to provide for protection against fire.

The lower story is devoted to live stock and is conveniently arranged for the housing of beef cattle, dairy cattle and horses. The floors are paved brick. The second story is used for the storage of vehicles, machinery, storage and grinding room for feed, and a complete set of seed rooms used by the Agronomy Section for the drying of corn and the storage of the different kinds of grain and feed stuffs used in experimental work. The third story is used as a storage room for hay and other coarse feed stuffs. The building has an electric motor, a complete water system and is lighted by electricity.

Judging Pavilion: In connection with the Experiment Station barn is a two-story octagonal judging pavilion. It is 65 feet
in diameter, built of buff pressed brick with a slate roof. The lower story is used for stock judging and has every available convenience which would add to the comfort of the students and the effectiveness of the work—such as good light, comfortable seats, good ventilation and ample means of supplying warmth.

The second story is used for the study of grain judging. It also is well equipped in every way. This building is conceded to be the most complete structure of its kind to be found anywhere on the continent.

The Farm Mechanics Building: This building has been erected for the newly created department of Farm Mechanics. The building is 60 x 100 feet, four stories high, having two main floors and two balconies. Being built out of steel and pressed brick, it is entirely fire-proof. The cost of the building with equipment is about $70,000.00 and it is no doubt the best building ever constructed for the teaching of farm mechanics.

On the lower floor are private workshops for the construction and repair of implements on the college farm, also tool rooms in which all the tools and instruments of the department are kept. The blacksmith shop and a room for the study and care of traction engines and other farm motors are also located on the lower floor. On the balcony above is located the carpenter shop.

On the second floor are the offices and class rooms of the professor in charge of the department. Also a drafting room and a students' reading room. A large machine operating room on this floor is devoted to the erection, care, and testing of the various kinds of farm implements such as binders, mowers, rakes, corn-huskers and shredders, plows, harrows, etc.

The second balcony is devoted to experiments with corn planters and for exhibitions of various kinds of small farm tools. On this floor are also located bulletin rooms, a photographic department and offices for the assistants in the department as well as office room for the Iowa Agriculturist.

The Dairy Building is a three-story structure with a basement and an attic. Its dimensions are 110 x 60 feet. It is built of buff pressed brick, trimmed with Bedford stone. On the ground or first floor are located the factory, butter and cheese rooms, bottling room, testing room, refrigerators, lunch room, toilet and bath rooms. On the second floor are the offices, re-
search laboratory, farm dairy room, students' testing laboratory, and a lecture room. Most of the rooms on the third floor are devoted to dairy bacteriology. The dairy library and reading room are also on this floor. The building will be heated, ventilated, and the cold storage rooms refrigerated according to the most modern methods.

The Horticulture Barn, which was completed the past summer, is a substantial three-story frame building covered with brick veneer and slate roof.

On the basement floor, stalls are provided for the teams belonging to the department, also for the public grounds work. The second story is devoted to the storage of spray implements and other farm machinery.

Adjoining the Horticulture barn, is a machine shed 25 x 35 which is devoted to the storage of road machinery and other implements used on the public grounds and campus.

Other buildings. Stables, barns, sheep and swine houses, seed houses, etc., sufficient for the requirements of the farm, are conveniently grouped near the College campus.

MARGARET HALL.

A commodious and inviting building has been opened for the young women in the College. It is well designed for its purpose, built of brick, roofed with slate and is architecturally pleasing. It occupies one of the most sightly locations on the campus, giving the most pleasing outlook to its occupants. It is provided with steam heat, electric lights, ample parlors, bath rooms and the most improved modern conveniences. It is neatly and tastefully furnished throughout. The Department of Domestic Economy is also located in the building and open to all young women of the College. Rooms will be assigned to new students in the order of their application. The young women are under the direction of an efficient dean of women.

THE COLLEGE GROUNDS.

The College domain includes over 1,000 acres. Of this about 125 acres are set apart for College grounds. These occupy the high land of the southwest part of the farm, and include the campus, shrubbery, plantations, young forestry plantations, the flower borders and gardens, with the beginnings of a botanical
garden, and the surroundings of the professors' dwellings. Gravel drives, cement and gravel walks, lead to all parts of the grounds and to the various buildings, and the true principles of landscape gardening have been so faithfully observed in the gardening and in the location of buildings and drives as to make of the entire campus a large and beautiful park. The view of the surrounding country from the upper stories of the large buildings is one of wide extent and beauty.
DIRECTIONS TO CANDIDATES AND STUDENTS

REQUIREMENTS FOR ADMISSION

CLASSIFICATION AND GRADING

UNDERGRADUATE COURSES OF STUDY AND DEGREES

POST-GRADUATE COURSES OF STUDY AND ADVANCED DEGREES
ADMISSION TO THE COLLEGE

METHODS OF ADMISSION.

Students are admitted to the freshman year by meeting the conditions set forth in any one of the following plans:

(1) By graduation from a high school belonging to the list of accredited schools prepared by the committee on college entrance requirements appointed by the State Teachers' Association. Graduates of such schools who present the UNIFORM BLANK CERTIFICATE of preparatory grades properly filled out and certified are admitted without examination. (See page 44 for list of schools together with accepted credits).

(2) Upon the completion of the studies of the academic year of the college, and the studies necessary for entrance to the same, students are admitted to freshmen standing without examination. (For work covered in the academic year and entrance requirements thereto, see page 33).

(3) Experience has proven that a large number of students have secured admission to the College by examinations taken either at their homes or at the College. The heads of the various departments cheerfully unite with county superintendents and principals of schools in arranging for such examinations at home as will admit students to our classes. By special arrangements questions for examination will be sent to county or city superintendents who are willing to conduct the examination. In all cases the manuscripts are returned to the College for marking and due notice sent the applicant of the record received. The attention of applicants for admission is particularly called to this arrangement by which all their entrance examinations can be taken at convenient places near home.

Students preferring to do so may take their examinations at the College; such examinations are held the first and second days of each semester. It is of the very greatest importance that all examinations necessary and classification be completed not later than the close of the third day of each semester.
ADMISSION TO ADVANCED STANDING.

Graduate and undergraduate students of other colleges are admitted and granted such credits as their work will justify. Work of recognized merit that has been taken at colleges or universities of good rank and standing will be credited for an equivalent amount of work so far as it applies in any of the courses offered at this College. Students taking up work in this way will consult the president and heads of departments and ascertain the credits to be allowed; these credits may at the option of the head of the department be conditioned on satisfactory work during the student's first term in College.

ADMISSION TO ACADEMIC CLASSES.

The one academic year, introductory to the various courses, covers in thorough review the more important branches of preparatory studies such as are given in the advanced years of the high school, and makes it possible to require, and possible to insure, adequate preparation of all students before entering them to the freshman year. Students falling to present the proofs of work done as above suggested, will be expected to write the examinations. Examinations for admission will be held on the first three days of the school year, or may be conducted prior to the opening of the college year at the home of the candidate under the supervision of the city or county superintendent. In so far as teachers' certificates or standings from high schools cover the entrance requirement subjects, they will be accepted in lieu of the examinations. In order to ascertain the capabilities of students, members of the new academic classes are often given a brief review in essential subjects. By this method students are easily and quickly assigned to just such work as they possess ability to do with greatest profit to themselves.

The subjects taught are arranged with reference to their importance in preparing students for the regular college courses and in order to concentrate the work of the students upon a limited field and produce results most beneficial, are few in number.

Graduates of accredited high schools with less than twenty-eight semester credits, and graduates of small high schools who have had two or three years of high school work will be ad-
mitted to review or regular work in the first or second term academic classes. The brief review given in the more important studies is most highly beneficial to students; the College authorities learn their ability and can the more easily render them assistance in their work.

In all cases students are promoted as rapidly as they demonstrate their ability to do work in advanced classes.

Since the student's success or failure in a technical institution depends to a very great extent upon an adequate preparation in mathematics, great importance is attached to the subject and the most careful training and drill are afforded in both algebra and geometry.

The work in English is designed to give the student facility in the use of the language and the ability to express his thoughts clearly and forcibly as well as a critical knowledge of the English classics.

Emphasis is placed on the value of the study of history, both from the standpoint of culture and that of usefulness. The aim of the year's work is to give students the broadest outlook and a sympathetic appreciation of what the world has already achieved.

The instruction in each branch is under the direct supervision of the head of the department of the College and is in every way as carefully conducted as that in the regular college classes. In all cases students are under the immediate charge and oversight of the College faculty and receive counsel, direction and assistance as needed from its individual members. The experience of years shows that students who have taken the academic work are often better fitted for the subsequent courses of study than some of those who have secured their training elsewhere.

When an examination in grammar is required of first term academic students it will cover the following subjects: The eight parts of speech, the classification of nouns, pronouns, adjectives and adverbs, the declension of nouns and pronouns, the comparison of adjectives and adverbs, and the rules of spelling that apply in grammatical inflection.

Students seeking admission to the second term of the academic year will need to meet the requirements for admission to the first term and in addition thereto, pass a satisfactory ex-
amination in the studies of that term. In lieu of examinations in
drawing standings of approved high schools will be accepted.
No student assigned to the algebra of the first term will be
allowed to take plane geometry.

The examination in algebra will include addition, subtraction,
multiplication, division, factoring, highest common factor, lowest
common multiple, fractions, simple equations containing one
or more unknown quantities, problems involving equations of
the first degree, and the discussion of such equations.

The examinations in English will cover the entire field of
grammar, except prosody. In this examination much will depend
upon the candidate's ability to analyze a passage of good modern
prose, and to punctuate his paper correctly. In analyzing he
should be prepared to treat phrases and clauses as units, and
to state the exact function of conjunctive words. He should
show a ready and accurate knowledge of the structure of the
prose sentence and the relation of its various parts to one
another.

The examination in history will cover general history. The
student is expected to be familiar with the leading facts of the
history of the Eastern nations, of Greece and Rome, and
medieval and modern Europe.

HOW TO ENTER THE COLLEGE.

Persons who desire to enter the College as new students
should comply with the following directions:

1. Study carefully "Methods of Admission." Then write
the president, giving age, preparation for college work, and the
course you desire to take. If a graduate of any high school in
the list of "Accredited High Schools" in this state, or of similarly
accredited high schools in any other state, no preliminary exam-
inations will be required for entrance to the freshman year in
any course, provided, proper certificate showing twenty-eight
or thirty acceptable semester credits is presented. See para-
graphs (a) and (b) under "Accredited High Schools" below.
If not a graduate of an accredited high school the conditions of
entrance given on page 33 should be carefully followed.

2. When you arrive, at the opening of the term, go to the
president's office for a card of directions.

3. Students who do not bring certificates of proficiency in
the studies required such as meet the approval of the examining committee will be examined here. When all the examinations are completed and your standings therein are marked on your examination card take it to the classification committee in the office of Dean Stanton. If you have passed the studies required you will then secure a card of classification, which certifies your admission to the College and assignment to class work. Your name will be entered at once upon the official class lists and will be included in the roll call of the following day. You will be expected to attend thereafter ever recitation of the term.

4. Information concerning board and rooms may be secured by writing Mr. Benjamin Edwards, the "College Custodian," Ames, Iowa.
The requirements for admission are stated in terms of semesters. The term semester as herein used means the equivalent of eighteen weeks, five days a week, on the basis of four studies a day. Thirty semesters are required for unconditioned admission to freshman year. The following are the minimum entrance requirements as adopted by the college section of the Iowa State Teachers' Association in December, 1904:

**SCIENTIFIC COURSE.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>5 semesters</td>
</tr>
<tr>
<td>English</td>
<td>6 semesters</td>
</tr>
<tr>
<td>Science</td>
<td>2 semesters</td>
</tr>
<tr>
<td>History</td>
<td>2 semesters</td>
</tr>
<tr>
<td>Foreign language</td>
<td>4 semesters</td>
</tr>
</tbody>
</table>

Total required units: 19
Elective units: 11

Total: 30

**CLASSICAL COURSE.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics (Alg. 3 and Geom. 2)</td>
<td>5 semesters</td>
</tr>
<tr>
<td>English</td>
<td>6 semesters</td>
</tr>
<tr>
<td>Science</td>
<td>2 semesters</td>
</tr>
<tr>
<td>History</td>
<td>2 semesters</td>
</tr>
<tr>
<td>Latin or Greek</td>
<td>8 semesters</td>
</tr>
</tbody>
</table>

Total required units: 23
Electives: 7

Total: 30

Electives to make up the required number of units as above indicated may be selected from the following list of subjects:

In addition to semester credits required as set forth above elective credits may be made up in science, history, foreign
language, Greek, physiography, civil government, political economy, physiology, commercial geography, drawing and manual training.

While the State College does not offer classical courses nor give the classical degrees, Greek and Latin taken in high schools are given full value and recognition towards meeting entrance requirements for any of the College courses counting as elective or foreign language credit.

Students from high schools presenting credits in excess of the number required for admission may receive credit for the same only upon passing a satisfactory examination under the direction of the department concerned, the amount of credit granted to be determined by the head of the department interested.

As previously stated the requirements for all courses include graduation from a high school belonging to the list of accredited schools prepared by the committee on college entrance requirements appointed by the State Teachers' Association, approved standings in the studies of the academic year and the studies necessary for entrance to that year, or the passing of a satisfactory examination.

For all the engineering courses students will be required to present one year's work in either French or German.*

Mathematics, English and history are among the studies most strongly emphasized in preparation for the work of the freshman year, and students from schools with less than twenty-eight semester credits will be expected to pass an examination in them. Credits granted in lieu of these examinations must be upon work approved by the heads of departments.

Students may enter the beginning work of the Freshman year, Second Semester as well as the first, except in German.

The students admitted to freshman standing will take review work in English, history and algebra during the first few days of the term.

In English this work will be a series of written exercises designed to test the student's general preparation in English, including spelling, grammar, punctuation and elementary rhetoric. This test is intended as a practical one, not as a review

*Two years' work will be required beginning with September, 1906.
in mere theory; memorized rules and principles will count for little; readiness in applying them is the real test. A student whose sentences are notably incorrect needs further drill in grammar; one whose paragraphing shows no definite plan needs additional practice in elementary composition.

In algebra all subjects up to and including quadratics will be treated, and the ability of the student to demonstrate principles and solve examples and problems will be tested.

Students may enter the beginning work of the freshman year the second semester as well as the first.

For information concerning admission to the veterinary course the student will consult the references cited in the general index.

**SUGGESTIVE LIST OF EXAMINATION QUESTIONS.**

**ALGEBRA.**

1. From \(5xy - (m-n)(k+1) - (a+b)(d+c)\) subtract \((d+c)(a-b) + 5(k+1) - acy - mny.\)

2. Remove the parentheses and simplify

\[
7x^2 - \frac{a+b}{c-d} - y - 4 - (n-m) - \frac{2(y+4)}{3}
\]

\[
= 7x^2 - \frac{a+b}{c-d} - \frac{m-8+n}{3} + 8
\]

State the rule by which parentheses preceded by the plus or minus sign are removed.

3. Divide \(-45a-2x^2b^{-2}c^x(m+n)^2 + abxc^1+x(m^2+2mn+n^2)^8\) by \(3a^7b^8c^x(m+n)^8.\)

4. Write the product of \((3x-2)(3x+5)\), of and also of \((3y+1)(3y-1)\) and give the special rules of multiplication used.

5. Resolve \(a^{12} - a^8b^4 - a^4b^8 + b^{18}\) into its prime factors.

6. Find the lowest common multiple of \(2x^4 + 3x^3 + 3x - 2\) and \(3x^4 + 5x^3 + x^2 + 5x - 2.\)

7. Simplify

\[
\frac{a^3-b}{(a-b)(a-1)} + \frac{b^2+a}{(b+1)(b-a)} + \frac{1+ab}{(1-a)(1+b)}
\]
What is the effect on a fraction of changing:
(a) Any two of the three following signs: sign of numerator, sign of denominator, or apparent sign of the fraction.
(b) The signs of an odd number of factors in the numerator.
(c) The signs of an even number of factors in the numerator.

8. Solve the following equation,
\[
\frac{3(x-5)}{x-\frac{4}{3}} = \frac{2(x+16)}{8x-\frac{17}{6}}
\]

9. A man rowing at a certain rate makes the round trip from A up stream to B, 24 miles distant, and return, in 5 hours. Having six hours at his disposal, he starts to make the trip, but when 16 miles from A, the boat springs a leak which causes him to land. In so doing he loses 40 minutes, but by walking at three-fourths the speed the boat would have carried him, he is able to spend an hour in B, and reach home in the required time by a train moving at twice the speed which the boat would have moved down stream. What is the rate in miles per hour of the man rowing in still water and what is the rate of the current?

10. Find the values of a and b in the following:
\[
\frac{3}{2a} - \frac{4b}{b-2a+3} = 2.5
\]

11. Find the value of \((-5a^{-y}b^{k+1}c^a)^{-3}\) freeing the result of negative exponents.

12. Find the cube root of:
\[8a^3 - 12a^2 b + 42a b - 37a^3 - 63a^2 + 27a - 27a^3 + 27a^3\]

13. Find the sum of:
\[\sqrt[2n]{54a^{-3}y^6}, \sqrt[n]{16a^4y^3}, \text{ and } \sqrt[3n]{2x^4a^3} \]

14. Multiply \(\sqrt{x^3}\) by \(\sqrt{x}\) by \(\sqrt{x^3}\)

15. Find the cube root of \(\frac{\sqrt{3}}{5}\).
16. Multiply $\sqrt{2} - 3\sqrt{5}$ by $\sqrt{5} + \sqrt{3}$

17. Find the square root of the binominal surd $67 + 7\sqrt{72}$

18. Solve $\sqrt{x^2 - 6x - 5} \sqrt{x^2 - 6x + 6} = 0$

19. Solve $9x^2 - 5xy = 21$ and $xy - y^2 = 4$, solving for $x$ and $y$.

20. Two trains starting at the same time and going in opposite directions between M and N, upon meeting, have differed in the distance covered by 20 miles. It is found that the train from M will reach N in one and one-half hours from the time of meeting and the train from N will reach M in 40 minutes. How far apart are M and N, and what is the rate of each train?

FRENCH AND GERMAN.

Students who take Freshman German of the second year in the Engineering course will be required to have a thorough knowledge of the principles of German grammar, such as are given in Vos's Essentials of German, and to have read one simple book like Storm's "Immensee." They must be prepared to read a book as difficult as Hilern's "Hoher Als Die Kirche."

Students taking Freshman French, or the second year in the engineering courses, will be required to have a thorough knowledge of the principles of French grammar as given in the first part of Fraser and Squair's French Grammar. They must have read at least one simple book like Bruno's "Le Tour de la France."

ENGLISH.

The examinations in English will include questions in grammar and elementary rhetoric and also one or more essays, to test the student's readiness and accuracy of expression. The following list of questions indicates the general nature of the examination:

I. In the following sentence, (a) state the exact grammatical relationship of each phrase and clause; (b) parse the words in black; (c) account for punctuation: "What if their palaces were grand, and their villas beautiful, and their dresses magnificent, and their furniture costly, if their lives were spent in ignoble and enervating pleasures, as is generally admitted?"

II. In the following sentences name the part of speech and state the office of the words in black:
(a) I believe him to be unprejudiced.
(b) Alice, did you go boating yesterday?
(c) It cost me a struggle to give up the trip.
(d) They let him stay.
(e) "Ask yourself seriously whether you are fit to read such revelations as are to follow."

III. Discuss fully and carefully four of the following topics:
(a) The topic sentence and its development.
(b) The respective advantages of the long sentence, the periodic sentence, the balanced sentence.
(c) Unity in the paragraph.
(d) Coherence in the composition.
(e) Emphasis in the sentence.

IV. Write an essay of from 250 to 350 words on one of the following topics:
(a) A Reminiscence of My Childhood.
(b) Why I like—a book, an eminent man, a place.
(c) Describe a view from .
(d) All Students Should be Required to Take Athletics.

NOTE.—These essays are considered an important part of the examination. They will be graded mainly on diction, sentence structure and connection, and paragraphing. Good penmanship, neatness of manuscript, and correct spelling and punctuation are also important.

HISTORY.

In addition to American history the requirements cover the entire European field, including the three grand divisions—ancient, mediaeval, and modern. The questions below indicate the general character of the examination in European history:

1. Discuss (a) the significance of the Nile in the history of Egypt, and (b) the arts and industries of ancient Egypt. (c) Outline the work of a famous Egyptian king.

2. Give the date, important facts, and results of the Persian invasion of Greece in the reign of Darius.

3. The Athenian Empire: (a) trace its origin; (b) when was it at its height? (c) State the effect of the Peloponnesian war upon it.

4. Discuss the influence of the geographical features of
Italy upon Roman history. Name the races of people in Italy at the dawn of the Italian history.

5. Outline the chief features of the Roman constitution in the reign of Augustus.

6. Feudalism: (a) its origin; (b) classes in feudal society; (c) feudal rights and obligations; (d) value of feudalism.

7. Give date, causes, and results of the Crusades.

8. Discuss the rise and growth of the Italian city republics.

9. Magna Charta: (a) circumstances under which it was secured; (b) chief provisions.

10. Reformation in Germany: (a) leading men; (b) principal steps in the movement.

11. Discuss fully the causes of the French revolution.

12. Something of importance concerning each of the following: Cardinal Wolsey, William the Silent, Cardinal Richelieu, Gustavus Adolphus, Charles Martel, Peter the Great, Oliver Cromwell, Lord Nelson, Bismarck.

ADVANTAGES OF ENTERING IN JANUARY.

Students may enter College at the opening of the second semester in January as advantageously as in the fall. For many who need to review the work of the academic year before entering the freshman year this affords an excellent opportunity.

Many students will find it desirable to begin their work in college in this term. Those who have had considerable Algebra in the preparatory school should review its fundamental principles and become acquainted with their application in the wider and more difficult field of college work, and those who have had experience in plane geometry can to advantage supplement such study by a review of some standard text and a thorough drill on the original geometric propositions. The classes in these studies established at the beginning of the spring term furnish an excellent opportunity for students to prepare themselves thoroughly for entering upon collegiate work at the opening of the next school year.

In like manner, students who have completed grammar and have had a high school course in rhetoric, have an opportunity in this term to review the principles of style and correct whatever errors they still make in expressing their thoughts. Without a thorough grounding in the principles of style and a con-
siderable degree of accuracy in choosing words and constructing sentences, also in planning and developing paragraphs, it is practically impossible for a student to do creditable work in Freshman English. To begin work in this term would prepare many for a better standing throughout their course than would otherwise be possible.

**ACCREDITED HIGH SCHOOLS.**

(a) Below is printed the list of high schools whose work is accredited by the committee on secondary school relations, together with the maximum number of semesters credits allowed each on the last analysis of their course of study. Graduates of these high schools may be classed as unconditioned freshmen upon the presentation of the proper certificates showing completion of not less than thirty semesters credits in studies acceptable to the College, and enter into one or more of its courses.

(b) Graduates who present twenty-eight acceptable semester credits may classify as conditioned freshmen at the opening of the college year, the conditions to be made up as soon as possible after entrance. No one can be admitted to the freshman class in any course with less than twenty-eight semester credits.

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STUDENTS’ EXPENSES AND EQUIPMENT.

No charge is made for tuition to Iowa students. To those who come from outside the state $24.00 tuition per year is charged.

Furnished rooms and board can be secured in clubs and private families adjacent to the College grounds at from $3.50 to $4.00 per week.

Every student entering College shall, before being classified, pay a—

**Janitor fee of ................................ $ 5.00

The current expenses of students who occupy rooms in the College dormitories during the year are as follows:

In Margaret Hall—
Lighting, heating and incidentals, per week... $ .55
Room rent, per term. ......................... 3.00
*Hospital fee, per term ................... 2.50

In the Cottages—
Fuel, lighting and incidentals, per week .... $ .40
Room rent, per term ......................... 3.00
*Hospital fee, per term ................... 2.50

**Students who fail to register and classify during the classification period ending with the first Saturday of each semester, will be charged a Janitor and Incidental fee of $8.00 instead of $5.00.

*See terms of Hospital Department page 49.
As security for the payment of bills, students living in the College buildings are required to deposit with the Treasurer.................$10.00

This deposit will be returned on final settlement at the close of term.

In the assignment of the rooms in the College dormitories, students who wish to take the regular four year courses will be given the preference.

All bills for each month must, without fail, be settled at the Treasurer's office by the second Saturday of the month following.

Students using laboratories in the various departments of the College are required to pay a laboratory fee at the beginning of each term to cover expenses of breakage, etc., thus incurred and the professors in charge require the Treasurer's receipt for such fee before admitting the students to laboratory practice.

For amounts of such fees see department courses.

Students purchasing military uniforms will deposit $5.00 with the merchant tailor at the time measures are taken, paying the remainder on delivery.

For heating, lighting, cleaning and care of the College buildings students pay less than the items actually cost the institution. Injury to College property, of whatever sort, is charged to the author, when known; otherwise to the section or to the entire body of students, as may seem just in the given case.

Students who board in any of the College buildings furnish their own bedding, and all furniture for their rooms, excepting bedsteads, washstands, tables and wardrobes.

Students are earnestly advised to make their rooms comfortable and cheerful. Male students in the two lower classes, not physically disabled, are required by law to take the military drill and purchase uniforms therefor. "Physical disability" must be certified to by the College Physician, on examination.

Text books and stationery may be purchased at the College Book Store, at about twenty-five per cent. below the average retail price.

COLLEGE HOSPITAL.

The actual sanitary condition of the College is excellent. The buildings are situated on high ground with good natural drainage. The water supply is exceptionally pure and abundant. The sewer system and sewage disposal plant are the best that
modern sanitary engineering can devise. Nevertheless in this, as in other like institutions, whose students are drawn from a wide territory, various diseases are brought here by the students themselves. In order to control epidemics and properly care for other cases of illness or injury a hospital is provided. This hospital is under the charge of the College physician, assisted by a professional nurse, a competent housekeeper, and a student hospital steward.

The expenses of the hospital are defrayed from a fund accruing from hospital fees paid by students.

The hospital fee for the term is fixed at $2.50, and is required of all students living in College buildings.

The privileges of the hospital are also extended to students not rooming in the College buildings, provided, 1st, that the physician shall be paid for calls at their residences, and 2nd, that the usual hospital fee shall be paid within the first ten days of the student's arrival.

Students not making the hospital deposit will be admitted to the hospital upon the basis of $10.00 per week, within the discretion of the college physician.

The hospital fee insures to the payer thereof, medical attendance, nursing and medicine in illness or accident, and consultation and medicine for minor ailments, in accordance with the regulations herein published.

The charges named are based upon the probable actual cost of medical attendance and hospital service, and the fund created is carefully devoted to these purposes. The College can not assume any liability beyond the extent of the fund so created. The hospital has proved to be a great blessing to the students.

The following regulations apply to the privileges of the hospital:

1st. Students entering the hospital shall be charged $3.00 per week for board, room, light and heat. But for any time in excess of three consecutive weeks per term spent in the hospital an additional charge above that mentioned shall be made of $4.00 per week.

2nd. In case a special nurse or physician is employed the expense shall be borne by the particular patient, the selection of such nurse or physician to be approved by the College physician.

3rd. The College assumes no responsibility whatever nor
shall the privileges of the hospital be extended to cases of smallpox.

4th. The President and College Physician shall require of students entering the college a certificate of a reputable physician showing successful vaccination.

5th. The College physician is authorized to exclude from the College dormitories and recitation rooms any person afflicted with a contagious disease.

MANUAL LABOR.

SHOP LABORATORY AND FIELD PRACTICE.

The following regulations in regard to manual labor have been adopted by the Board of Trustees:

1. The manual labor of students is divided into two kinds, viz.: Uninstructive labor, which shall be paid for in money, and instructive labor, which shall be compensated by the instruction given and the skill acquired.

2. Uninstructive labor shall comprise all the operations in the workshop, the garden, upon the farm and elsewhere, in which the work done accrues to the benefit of the College, and not to that of the student. Instructive labor shall embrace all those operations in the workshop, museum, laboratories, veterinary hospital, experimental kitchen, upon the farm, garden and experimental stations, in which the sole purpose is the acquisition of knowledge and skill.

3. Students shall engage in instructive labor in the presence and under the instruction of the professor in charge according to the statement made in each of the courses of study.

The compensated labor furnished by the Divisions of Agriculture, Veterinary Medicine and of Engineering, is given by each to its own students, and is eagerly sought. The "details" of compensated labor supplied by the needs of the various departments are given to the most faithful and meritorious students in each department. Uninstructive labor is paid for according to its value to the College, but no student should expect to pay the main part of his expenses by labor while here. The College cannot furnish the work, and even if it could, the student's time is chiefly needed for study. Still, many worthy and industrious students pay a considerable part of their ex-
penses by labor, over $4,000 being paid out by the College thus each year to students and post-graduate assistants.

**GOVERNMENT.**

The relations of our college buildings, and the nature of the exercises, complicated as they are, by laboratory work, shop practice and labor, make order, punctuality and systematic effort indispensable. This institution, therefore, offers no inducement to the idler or self-indulgent. All who are too independent to submit to needful authority, or too reckless to accept wholesome restraint, are not advised to come. The discipline of the College is confined mainly to sending away promptly those who prove on fair trial to be of the said class.

The use of tobacco by students on the college premises is forbidden. Those who are already so addicted to its use that they cannot cheerfully submit to this regulation are advised not to come. Of course the use of intoxicating beverages and of profane and obscene language is forbidden.

**PUBLIC WORSHIP.**

Officers and students gather daily in the chapel at 11:45 A. M., for public worship. On Sunday morning at 10:45 a discourse is given in the chapel by a clergyman invited for the occasion. The object of these services is to emphasize and enforce the principles of morality and of the Christian religion. Being a state institution we give the utmost freedom to all creeds and forms of belief, avoiding the controversies of sectarianism.

The faculty requires on Sundays such conduct and decorum in and about the college buildings as befit the observance of the Sabbath.

**RELIGIOUS ASSOCIATIONS.**

The Young Men's and Young Women's Christian Associations of the College are voluntary organizations, composed of students and members of the faculty. The membership is large. The Sunday Bible classes and prayer meetings are under their direction, and are well attended and profitable. This voluntary Christian influence in the College is strong and healthful.
LITERARY SOCIETIES.

Seven literary societies hold their meetings each Friday evening, a time kept free from other college functions. These societies supplement the literary work of the College, and besides provide a training in appearing before an audience such as every college graduate needs, a training that is not secured in the class room. Every student is advised to join one of these societies. The societies collectively constitute the Oratorical Association, whose duty it is to provide for four general programs each year; an oratorical contest in the fall term, a declamatory contest in the spring term, and a joint program at the beginning of each term. Six of the societies constitute the I. S. C. Debating League, an organization which arranges for inter-society and inter-collegiate debates. The inter-society debates call out twenty-four debaters each term, four from each society, two of whom maintain the affirmative and two the negative of a given question against opposing teams from other societies. For nine years the League has engaged in annual debate with the students of the Iowa State Normal School. Last year there was a debate with Drake University; this year one has been arranged with Iowa College.

COURSES OF STUDY.

Courses of study leading to the following degrees are offered:
1. The course in Agriculture—Department of Agronomy.
2. The course in Agriculture—Department of Dairying.
3. The course in Agriculture—Department of Animal Husbandry.
4. The course in Agriculture—Department of Horticulture.
5. The course in Science and Agriculture.

Each of the foregoing is a four years' course leading to the degree of Bachelor of Scientific Agriculture, (B. S. A.).
6. The course in Veterinary Science, of four years, leading to the degree of Doctor of Veterinary Medicine, (D. V. M.).
7. The course in Mechanical Engineering, of four years, leads to the degree of Bachelor of Mechanical Engineering, (B. M. E.).
8. The course in Civil Engineering, of four years, leads to the degree of Bachelor of Civil Engineering, (B. C. E.).
9. The course in Electrical Engineering, of four years, leads to the degree of Bachelor of Science in Electrical Engineering, (B. Sc. in E. E.).

10. The course in Mining Engineering, of four years, leads to the degree of Bachelor of Science in Mining Engineering, (B. Sc. in Mn. E.).

11. The course in Science as Related to the Industries, of four years, leads to the degree of Bachelor of Science, (B. Sc.).

12. The course in General and Domestic Science, for women, of four years, leads to the degree of Bachelor of Science, (B. Sc.). Women may take any other course desired.

13. The course in Domestic Science, of four years, leads to the degree of Bachelor of Domestic Science, (B. D. S.).

For the short courses in Agriculture and Dairying certificates properly indicating the completion of certain studies will be given.

For the short courses in Mining and Ceramics, certificates will be given.

SPECIAL LINES OF STUDY.

Students taking special work in any of the College courses must be at least twenty years of age, must give good and sufficient reason for desiring such special classification and must furnish satisfactory evidence that they are thoroughly prepared to pursue the work chosen. Permission to take such special course and the subjects included therein must receive the approval of the President of the College and the Dean or Head of the Department in which the student seeks enrollment.

Special students when not qualified to enter above the Freshman year will be required to take the first year of their work from Junior College studies.* During their second year they may be admitted to the Senior College studies in accordance with the rules governing admission to each study or course.*

Special students will be subject to the same rules governing

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*Special interpretation for Agricultural Students. An exception to this rule will be made in case of Animal Husbandry X and XI, which may be taken the first year in lieu of Animal Husbandry II and III, which cannot be taken until the work in Animal Husbandry I and II has been completed.
conditions on back work that apply to all other students. Students wishing to change from a regular to a special course either in the same or another department will be required to remove conditions on back work.

GENERAL REGULATIONS REGARDING CLASSIFICATION.

Number of Hours.—No student shall be allowed to classify in more hours than are specified in the catalog for the term of the course taken unless he has an exceptionally high record in his previous college work and gives satisfactory reason for desiring to take the additional study. The taking of such additional work is subject to approval by the President of the College and the dean or head of the department in which the student is enrolled.

Back Studies.—Students shall be classified in back studies in all cases where such studies are taught. Any exception to this rule must be for good and sufficient reasons approved by the President of the College and the dean or head of the department in which the student is enrolled. Ten hours or more of back work will hold a student back in his class.

Junior and Senior College.—The students are now classified in “Junior and Senior Colleges.” The “Junior College” is composed of all students in Academic, Freshman and Sophomore years; the “Senior College,” of all in the Junior and Senior years.

Professor E. W. Stanton is Dean of the “Junior College” students; Professor C. F. Curtiss is Dean of the “Senior College” students in all the agricultural courses and Professor P. G. Holden, Vice Dean; Dr. J. H. McNeil is Dean of Veterinary students in the “Senior College.”

Professor A. Marston is Dean of students in the “Senior College” of all Engineering Courses and Professor G. W. Bissell, Vice Dean. The President of the College is acting Dean of Junior and Senior students in the courses in general science and general and domestic science. Special students take their work under direction of heads of departments in which they specialize.

For information and in classifying, students should write or consult personally with the President.
GRADUATING THESSES.

The subjects of theses shall be selected under direction of the professor in whose department they are written, and submitted to the Thesis Committee, with signed approval of the Professor, on or before the first Monday in October.

It is expected that each thesis shall represent an amount of work equivalent to at least one exercise per week through the Senior Year; that it shall show the result of the student's personal study or investigation and be throughout original in matter and treatment so far as the nature of the subject will permit; that it shall be prepared under the supervision of the professor in charge, the student making frequent reports of progress and having an outline of matter ready for approval by the first week of the last term.

The thesis, ready for examination and marking, with its specific title and the written approval of the professor in charge, shall be presented to the Thesis Committee at a date fixed by the committee during the four weeks preceding the Commencement Day.

ADMISSION TO ADVANCED STANDING.

Graduate and undergraduate students of other colleges will be admitted and granted such credits as their work will justify. Work of recognized merit that has been taken at colleges or universities of good rank and standing will be credited for an equivalent amount of work so far as it applies in any of the courses offered at this college. Students taking up work in this way will consult the heads of departments to ascertain the credits to be allowed; these credits may at the option of the head of the department, be conditioned on satisfactory work during the student's first term in College.

POST GRADUATE COURSES.

The advanced degrees which are conferred by the faculty of this college are as follows:

1. The degree of Master of Scientific Agriculture (M. S. A.) is open to Bachelors of Scientific Agriculture who are graduates of this College or other colleges offering equivalent courses of study.
2. The degree of Master of Science (M. S.) is open to Bachelors of Science who are graduates of this College or other colleges offering equivalent courses.

3. Professional degrees in Engineering. (See below).

REGULATIONS FOR MASTER'S DEGREES.

1. The opportunity for resident study after graduation is a privilege granted only upon the recommendation of the President with the advice and consent of the committee on post-graduate study and the professors in charge of the departments in which the studies are to pursued.

2. Between the baccalaureate degree and the master's degree there shall intervene not less than two years, of which the candidate shall devote not less than one year (the second preferred) to resident study at this College.

3. Two lines of work shall be selected, designated as major and minor studies, the former to be given two-thirds and the latter one-third of the time. The major study shall be research work, the results of which shall be incorporated in a thesis.

4. The major and minor studies shall be so selected as to support and strengthen each other.

5. No undergraduate study shall be selected as a major study. Undergraduate studies may be taken for part of the minor work only with the approval of the committee on post-graduate study, and the heads of the departments in which the work is to be done.

6. The candidate shall have a reading knowledge of French or German.

7. Application for graduate study, specifying the departments in which the major and minor subjects are to be taken, shall be filed with the President within four weeks of the beginning of the first term's resident work, and not later than October 1st, next preceding the commencement at which the degree is to be granted.

ADVANCED DEGREES IN ENGINEERING.

The several departments of the Division of Engineering confer the professional degrees as follows:

In Mechanical Engineering, the degree of Mechanical Engineer, (M. E.).
In Civil Engineering, the degree of Civil Engineer, (C. E.).
In Electrical Engineering, the degree of Electrical Engineer, (E. E.).
In Mining Engineering, the degree of Mining Engineer, (E. M.).
The above degrees are conferred subject to the following regulations:
Applications for professional engineering degrees will be received from graduates of the engineering departments of this College or from graduates in engineering from other colleges offering equivalent courses of study in engineering.
To be entitled to the professional degree, the applicant therefor shall have devoted not less than one year to resident study along lines satisfactory to the engineering faculty, shall have been engaged for not less than one year in a responsible professional position, and shall present a satisfactory thesis, or he shall have been engaged for not less than five years in a responsible professional position and shall present a satisfactory thesis.
In this connection a responsible professional position means practical engineering experience, requiring the exercise of skill or executive ability in designing or construction work. References or personal knowledge of the facts will be required by the engineering faculty.
Further information as to the lines of work open to graduate students can be found under the several courses of study described elsewhere.
DIVISION OF AGRICULTURE

AGRONOMY.
DAIRYING.
ANIMAL HUSBANDRY.
HORTICULTURE.
SCIENCE AND AGRICULTURE.
AGRICULTURAL CHEMISTRY.
OFFICERS OF INSTRUCTION

ALBERT BOYNTON STORMS, A. M., D. D.,
President.

JAMES WILSON, M. S. A.,
Lecturer.

CHARLES FRANKLIN CURTISS, B. Sc., M. S. A.,
Director of Experiment Station and Dean of Agriculture.

PERRY G. HOLDEN, M. S., B. Ph.,
Professor of Agronomy and Vice Dean of Agriculture.

W. J. KENNEDY, B. S. A.,
Professor of Animal Husbandry and Vice Director of Experiment Station.

GEORGE LEWIS MCKAY,
Professor of Dairying.

SPENCER A. BEACH, M. S. A.,
Professor of Horticulture.

ARTHUR THOMAS ERWIN, M. Sc.,
Associate Professor of Horticulture and Forestry.

W. H. STEVENSON, A. B.,
Professor of Soils.

C. J. ZINTHEO, B. Sc.,
Professor of Farm Mechanics.

JOHN H. McNEALL, V. M. D.,
Dean of Veterinary Science and Professor of Anatomy and Surgery.

WALTER A. STUHR, V. M. D.,
Assistant Professor in Pathology and Histology.

FRANK W. BOUSKA, B. S. A.,
Instructor in Dairy Bacteriology.

W. J. RUTHERFORD, B. S. A.,
Associate Professor of Animal Husbandry.
DIVISION OF AGRICULTURE

L. S. KLINCK, B. S. A.,
Instructor in Farm Crops.

C. LARSEN, B. S. A.,
Instructor in Dairying.

LOUIS G. MICHAEL, B. S. A.,
Agricultural Chemist.

WAYNE DINSMORE, B. S. A.,
Instructor in Animal Husbandry.

G. I. CHRISTIE, B. S. A.,
Assistant in Soils.

I. O. SCHAUB, B. S. A.,
Assistant Professor of Soils.

H. M. BAINER, M. S. A.,
Instructor in Field Engineering.

EDWARD E. LITTLE, M. S. A.
Assistant in Horticulture.

J. W. JONES,
Assistant in Field Experiments.

A. C. ATHERTON,
Assistant in Carpentry.

JOHN HOOVER,
Assistant in Shop Work.

EDGAR WILLIAM STANTON, M. Sc.,
Professor of Mathematics and Economic Science.

ALFRED ALLEN BENNETT, M. Sc.,
Professor of Chemistry.

W. F. COOVER, A. B., A. M.,
Assistant Professor of Chemistry.

GEN. JAMES RUSH LINCOLN,
Professor of Military Science.

LOUIS HERMAN PAMMEL, B. Ag., M. Sc., Ph. D.,
Professor of Botany.

MISS LIZZIE MAY ALLIS, M. A.,
Professor of French and German.

SAMUEL WALKER BEYER, B. Sc., Ph. D.,
Professor of Geology.

ALVIN B. NOBLE, B. Ph.,
Professor of Rhetoric and English Literature.

HENRY E. SUMMERS, B. S.,
Professor of Zoology.
ADRIAN M. NEWENS, B. O.,  
Professor of Public Speaking.

ORANGE HOWARD CESSNA, A. M., D. D.,  
Professor of History and Psychology.

RICHARD CORNELIUS BARRETT, A. M., LL. B.,  
Professor of Civics and Rural Law.

PAUL SKEELS PIERCE, Ph. D.,  
Assistant Professor of History.

JOSEPH E. GUTHRIE,  
Assistant Professor of Zoology.

BENJAMIN H. Hibbard, Ph. D.,  
Associate Professor of Economic Science.

*MISS BESSIE B. LARRABEE, A. B.,  
Assistant Professor of English.

MISS ELIZABETH MACLEAN, M. Dr.,  
Assistant Professor of English.

ERNEST ALANSON PATTENGILL, B. S.,  
Instructor in Mathematics.

MISS HELEN G. REED, Ph. B.,  
Instructor in English.

MISS MAE MILLER, B. S.,  
Instructor in History.

MISS GRACE NORTON, A. B.,  
Instructor in German.

JOSEPH E. GUTHRIE, M. S.,  
Instructor in Zoology.

MISS JULIA COLPITTS, M. A.,  
Instructor in Mathematics.

MISS EFFIE ALENE WHITE, A. B.,  
Instructor in English.

MISS ROSE ABEL, A. B.,  
Instructor in English.

MISS BLANCHE T. THOBURN, A. B.,  
Instructor in English.

MISS ELIZABETH MOORE, A. M.,  
Instructor in English.

*Granted leave of absence.
THE DIVISION OF AGRICULTURE

CHARLES F. CURTISS, DEAN.
PERRY G. HOLDEN, VICE DEAN.

COURSES OF STUDY.

The instruction in agriculture is divided into the following departments:

I. Department of Agronomy.
II. Department of Dairying.
III. Department of Animal Husbandry.
IV. Department of Horticulture.
V. Department of Science and Agriculture.

The courses in these several departments unite in making a foundation for the student upon which he can build a successful career as a farmer, or develop into a specialist in the many possible lines that are branches of the farming industry. The studies pursued in each department are equally recognized as being necessary to fully equip the student for the highest order of work in any division of agriculture, and the only difference between the shorter and the longer courses is due to the degree
to which the student wishes to specialize and develop himself for a single line of work. The farm as it is commonly conducted is a union of many divisions of industry and the shorter course confines itself to laying a foundation that will secure success in all of these, while the longer course seeks to direct the student into that line which will call forth and centralize his special ability and at the same time enable him to meet the variety of conditions that under all circumstances surround a successful life.

Past experience with the courses of these departments shows that they have met with more than the usual success in attaining their objects; as the shorter course has been productive of many successful farmers, and the longer course has been unusually successful in developing better farmers and more capable men in practical life and also in securing for our graduates prominent positions in the agricultural faculties of other colleges.

In practical agriculture, a field unsurpassed by any other college in the United States is open to the students. The national government gives to the college about thirty-five thousand dollars annually for original experimentation and instruction in agriculture and the sciences related to the industries. This supplemented by liberal state aid, enables the College authorities to make the fields and the barns veritable laboratories of extensive and most practical investigation and observation. The range is from the soil that produces, through all of its natural characteristics, to whatever is grown in agriculture from germ to finish. Two commodious, well-lighted stock judging pavilions have recently been constructed, into which live animals are brought in the presence of the teacher and the class for careful study and intimate knowledge. An experimental barn with the recent and most approved methods of stalls, feeding and ventilation, is devoted exclusively to the original work of animal husbandry and agronomy. This work ranges over all the question of breeding and maturing domestic animals.

The agricultural college is designed to teach the sciences that underlie practical agriculture, and sufficient English literature, mathematics, history, and other supplementary studies to sustain both scientific and practical agriculture and to develop the agricultural students to the intellectual level of the educated in any profession. Special attention is given to the improved method in all of the various operations of farming, farm building,
use of tools and machinery, and management of all kinds of stock and crops. The instruction of this department embraces principles and practice of agriculture.

The farm consists of 1,040 acres of rolling prairies, bottom, and woodland, and is stocked with good representatives of six breeds of horses, six breeds of cattle, seven breeds of sheep, and six breeds of hogs. These animals are used in class illustration and for the various experiments in breeding and feeding for milk, meat, wool, growth and maintenance, conducted by the Experiment Station as a department of the College. All the crops of the farm are grown for some educational purpose; all the animals are fed by rule and system, and the result of their management reported upon, and used in class work. Labor is not compulsory, but students in the agricultural course are given work that is educational and parallel with their studies. Some students pay for their board by work in the mornings and evenings. Under direction of the professor in charge, students assist in conducting experiments in lines related to their studies.

**DEPARTMENT OF AGRONYM.**

PERRY G. HOLDEN, PROFESSOR OF AGRONYM, AND VICE-DEAN; W. H. STEVENSON, PROFESSOR OF SOILS; C. J. ZINTHEO, PROFESSOR OF FARM MECHANICS.

L. S. KLINCK, ASSISTANT PROFESSOR OF FARM CROPS; I. O. SCAB, ASSISTANT PROFESSOR OF SOILS; G. I. CHRISTIE, ASSISTANT IN SOILS; J. W. JONES, ASSISTANT IN FIELD EXPERIMENTS; JOHN HOOVER, ASSISTANT IN SHOP WORK; A. AHERTON, ASSISTANT IN CARPENTRY AND DRAWING; H. M. BAINEB, INSTRUCTOR IN FIELD ENGINEERING.

Agronomy is the science of the field and its crops, and treats of: (a) Farm Management; the application of economic business methods to farm practices. (b) Field Crops; their classification, production and improvement. (c) Soils; their fertility, cultivation, and improvement. (d) Farm Mechanics; the tools, machinery, fences and drains of the farm.
COURSES IN AGRICULTURE.

AGRONOMY.

Academic Year.

FIRST SEMESTER.

Algebra, 5
English, 5
History, Western Europe, 5
Elementary Speech, 2

(SECOND SEMESTER.

Advanced Algebra & Plane Geometry, 5 (Mathematics, XIII & V.)
Elementary Botany, 2
Elementary Rhetoric, 5
History, Advanced American, 4
Gesture and Voice, 1

Freshman Year.

FIRST SEMESTER.

Corn and Grain Judging, 5
Live Stock and Score Card Practice, 2
Market and Home Gardening, 2
German, 5 or French, 5
Advanced Rhetoric, 5
History, English, 1
Military, 2
Library work, 4 hours per term.

(SECOND SEMESTER.

Field Crops, 5
Live Stock and Score Card Practice, 2
Plant Propagation and Small Fruits, 3
Solid Geometry, 2*
German, 5 or

*Graduates of accredited schools who are deficient in algebra, but have a grade in solid geometry, will take advanced algebra two hours in the Freshman year in lieu of solid geometry.
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Department/Subject</th>
<th>Notes</th>
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<tbody>
<tr>
<td>French, 5</td>
<td></td>
<td>Language, II</td>
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<tr>
<td>History, Formation of the Union, 1</td>
<td></td>
<td>History, XVIII</td>
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<tr>
<td>Entomology, 2</td>
<td></td>
<td>Zoology, I</td>
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<tr>
<td>Composition, 1</td>
<td></td>
<td>English, IV</td>
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<tr>
<td>Military, 2</td>
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**Sophomore Year.**

**FIRST SEMESTER.**

<table>
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<tr>
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<tbody>
<tr>
<td>Farm Mechanics, 5</td>
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<td>Agronomy, III</td>
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<td>Live Stock and Score Card Practice, 4</td>
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<td>Animal Husbandry, III</td>
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<tr>
<td>Pomology, 3</td>
<td></td>
<td>Horticulture, III</td>
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<tr>
<td>Chemistry, 5</td>
<td></td>
<td>Agricultural Chemistry, XXI</td>
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<tr>
<td>Meteorology, 3</td>
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<td>Geology, I</td>
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<tr>
<td>Composition, 1</td>
<td></td>
<td>English, V</td>
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<tr>
<td>Military, 2</td>
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**SECOND SEMESTER.**

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
<th>Department/Subject</th>
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<tbody>
<tr>
<td>Live Stock and Score Card Practice, 4</td>
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<td>Animal Husbandry, IV</td>
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<tr>
<td>Farm Mechanics, 5</td>
<td></td>
<td>Agronomy, IV</td>
</tr>
<tr>
<td>Forestry, 3</td>
<td></td>
<td>Horticulture, XIV</td>
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<tr>
<td>Histology, 4</td>
<td></td>
<td>Botany, III</td>
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<tr>
<td>Chemistry, 5</td>
<td></td>
<td>Agricultural Chemistry, XXIII</td>
</tr>
<tr>
<td>Composition, 1</td>
<td></td>
<td>English, VI</td>
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<tr>
<td>Military, 2</td>
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<td>Military, IV</td>
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**Junior Year.**

**FIRST SEMESTER.**

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Soils, 5</td>
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<td>Agronomy, V</td>
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<tr>
<td>Chemistry, 4</td>
<td></td>
<td>Agricultural Chemistry, XXV</td>
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<tr>
<td>Farm Dairying, 3</td>
<td></td>
<td>Dairying, XII</td>
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<tr>
<td>Principles of Breeding, 2</td>
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<td>Animal Husbandry, VIII</td>
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**Elective.**

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
<th>Department/Subject</th>
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<tbody>
<tr>
<td>Advanced Corn and Grain Judging, 2</td>
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<td>Agronomy, XI</td>
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<tr>
<td>Farm Implement Design, 4</td>
<td></td>
<td>Agronomy, XII</td>
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<tr>
<td>Histology, 2</td>
<td></td>
<td>Veterinary Science, XXXIII</td>
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<tr>
<td>Comparative Physiology, 1</td>
<td></td>
<td>Veterinary Science, XXI</td>
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<tr>
<td>Economic Entomology, 5</td>
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<td>Zoology, IV</td>
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Geology, 5
Physical Laboratory, 1 or 2
Political Economy, 5
Drama, 3
The Drama in Translation, 2
Debating, 1
Advanced Interpretation, 2
German, 5 or
French, 5
History, Europe in 16th, 17th, 18th Centuries, 3
History, The Renaissance, 2
Military Science, 1

(Geology, II)
(Physics, XIV.)
(Economic Science, I.)
(Literature, I.)
(Literature, VIII.)
(English, VII.)
(Public Speaking, III.)
(Language, V.)
(Language, I.)
(History, V.)
(History, X.)
(Military, V.)

SECOND SEMESTER.

Soils, 5
Research Work, 2
Bacteriology, 2

(Agronomy, VI.)
(Agronomy, VII, IX, or X.)
(Botany, VII.)

Elective.

Advanced Work in Soils, 2
Comparative Physiology, 1
Rural Law, 1
Forestry, 3
Plant Breeding, 3
Advanced Public Speech, 1
Vegetable Cytology, 3 or 5
Histology, 4
Mineralogy, 4
Finance, 3
Money and Banking, 2
Plane Trigonometry, 3
Epic and Lyric Poetry, 5
Expression in Oratory, 2
French, 5 or
German, 5
Debating, 1
Rural Architecture, 4
History, French Revolution and XIXth Century, 3
History, Constitutional History of England, 2

(Agronomy, VII.)
(Veterinary Science, XXII.)
(Horticulture, VI.)
(Horticulture, IV.)
(Public Speaking, VIII.)
(Botany, XII.)
(Botany, III.)
(Geology, VI.)
(Economic Science, V.)
(Economic Science, IV.)
(Mathematics, VIB.)
(Literature, II.)
(Public Speaking, IV.)
(Language, II.)
(Language, VI.)
(English, VIII.)
(Agronomy, XIII.)
(History, VI.)
(History, XI.)
Military Science, 1  
Agricultural Economics, 5

Senior Year.

FIRST SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Semester</th>
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<tbody>
<tr>
<td>Farm Management</td>
<td>3</td>
<td>Agronomy, VIII.</td>
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<tr>
<td>Research Work</td>
<td>2</td>
<td>Agronomy, VII, IX, or X.</td>
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**Elective.**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Semester</th>
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<tbody>
<tr>
<td>Advanced Work in Soils</td>
<td>2</td>
<td>Agronomy, VII.</td>
</tr>
<tr>
<td>Farm Blacksmithing and Horseshoeing</td>
<td>2</td>
<td>Agronomy, XV.</td>
</tr>
<tr>
<td>Dairy Bacteriology</td>
<td>3</td>
<td>Dairying, XVII.</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4</td>
<td>Dairying, XIV.</td>
</tr>
<tr>
<td>Buttermaking</td>
<td>3</td>
<td>Dairying, XVII.</td>
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<tr>
<td>Comparative Physiology</td>
<td>2</td>
<td>Veterinary Science, XXIII.</td>
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<tr>
<td>Geology</td>
<td>5</td>
<td>Geology, II.</td>
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<tr>
<td>Political Economy</td>
<td>3</td>
<td>Economic Science, III.</td>
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<td>Analytic Geometry</td>
<td>5</td>
<td>Mathematics, VIII.</td>
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<tr>
<td>History of Political Economy</td>
<td>2</td>
<td>Economic Science, II.</td>
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<tr>
<td>Psychology</td>
<td>5</td>
<td>Psychology, I.</td>
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<td>American Literature</td>
<td>3</td>
<td>Literature, IV.</td>
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<tr>
<td>The Short Story</td>
<td>2</td>
<td>Literature, VI.</td>
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<tr>
<td>Dramatic Art</td>
<td>2 or</td>
<td>Public Speaking, V.</td>
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<tr>
<td>Extempore Speech</td>
<td>2</td>
<td>Public Speaking, X.</td>
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<tr>
<td>Oration</td>
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<td>Public Speaking, IX.</td>
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<tr>
<td>French</td>
<td>4 or</td>
<td>Language, III.</td>
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<tr>
<td>German</td>
<td>4</td>
<td>Language, VII.</td>
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<tr>
<td>Landscape Gardening</td>
<td>2</td>
<td>Horticulture.</td>
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<tr>
<td>History, National Expansion, 1783-1845</td>
<td>3</td>
<td>History, III.</td>
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<td>History, Diplomatic History of United States</td>
<td>2</td>
<td>History, XII.</td>
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<tr>
<td>Military Science</td>
<td>1</td>
<td>Military, VII.</td>
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SECOND SEMESTER.

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
<th>Semester</th>
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<tbody>
<tr>
<td>Thesis Work</td>
<td>5</td>
<td>Agronomy, XVI.</td>
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<tr>
<td>Animal Nutrition</td>
<td>5</td>
<td>Animal Husbandry, IX.</td>
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**Elective.**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Semester</th>
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<tbody>
<tr>
<td>Advanced Work in Soils</td>
<td>2</td>
<td>Agronomy, VII.</td>
</tr>
<tr>
<td>Dairying</td>
<td>3</td>
<td>Dairying, I.</td>
</tr>
</tbody>
</table>
Cheesemaking, 3
Comparative Physiology, 2
Technology of Milk, 1
Advanced Bacteriology, 3
Advanced Entomology, 3 to 5
Geology, 5
Ethics, 3
Calculus, 5
Novel and Romance, 3
The Essay, 2
Advanced Dramatic Art, 2 or Adv. Extempore Speech, 2
History, The Welding of the Nation, 1845-1900
History, The Far Eastern Question, 2
Astronomy, 5
Military Science, 1
Chemistry, 5

(Dairying, XV.)
(Veterinary Science, XXIV.)
(Dairying, XVI.)
(Botany, VIII.)
(Zoology, IX.)
(Geology, IV.)
(Psychology, II.)
(Mathematics, IX.)
(Literature, III.)
(Literature, VII.)
(Public Speaking, VI.)
(Public Speaking, XI.)
(History, IV.)
(History, IX.)
(Physics, VIII.)
(Military, VIII.)
(Agricultural Chemistry, XXXIV.)

AGRONOMY I.

FALL SEMESTER.

Lecture Work.

The Fall Semester is devoted entirely to the study of corn. The lecture work includes an exhaustive study of the best methods of selecting, testing, grading, planting, cultivating, harvesting and storing the crop. The breeding of corn for special purposes receives careful attention. The characteristics and history of the principal varieties grown in the State are studied and their adaptability to different districts noted. Considerable time is devoted to the commercial handling of corn in addition to a study of the cost of production and uses of the crop grown.

Laboratory Work.

The first month is spent in studying corn under field conditions, special attention being given to the study of the influence of cultivation on stand and yield; the per cent. of barren stalks, broken stalks, smutted stalks and suckers in different fields and under different conditions; the per cent. of stand in different fields and its influence on yield; studies in growth and development of corn grown from seed harvested in different
stages of maturity; habit and growth of varieties brought from different parts of this state and from other states; the collecting of samples illustrating desirable and undesirable points in ears and kernels and the study of location and plans for breeding blocks.

The inside laboratory class work in corn includes:

(a) Study of individual ears.
(b) Comparative study of groups of ten ears.
(c) Judging representative types of varieties grown extensively in Iowa.
(d) Study of desirable and undesirable characteristics in seed ears.
(e) Practice in selecting, germinating, and grading corn, and calibrating the planter.
(f) Commercial grading and handling of the crop.
Recitations three hours per week. Laboratories six hours per week.

L. S. Klinck.

AGRONOMY II.

SPRING SEMESTER.

The lectures in this semester will embrace a study of wheat, oats, barley, rye, flax, cow peas, soja beans, grasses, clovers, alfalfa, root crops, fibre crops, tuber crops, sugar crops, and miscellaneous crops, together with discussions on their adaptation to soil and climate, preparation of the seed bed, methods of selection, harvesting the crop and best methods of storing and treating the seeds.

The principles underlying reproduction, germination, plant growth and improvement of crops will be studied at length.

The laboratory work will include score card practice on cereals and forage crops and a study of the weed seeds most commonly found in the commercial grades of these grains.

In the greenhouse laboratory the students will be required to make a careful study of the circumstances influencing vitality in the various farm seeds as shown by germination tests; methods and time of planting; thick and thin seeding; value and importance of careful seed selection; root systems of different
plants in the same and in different soils; different methods of culture and cropping and treatment of farm seeds to arrest loss by fungus diseases and injurious insects.

Recitations three hours per week. Laboratories six hours per week.

L. S. KLINCK.

AGRONOMY III.
Field Engineering.

(a) Plotting the Farm.—This includes methods of laying out the farm, the arrangement of the fields for rotation of crops, mapping and plotting the fields, and system of records kept of the crops of the different fields.

(b) Road Construction.—The location and building of roads leading to different parts of the farm, the construction of country roads such as gravel, dirt, macadam, and oiled roads, and practice in using road machinery.

(c) Farm Location.—The location of the building site, and the arrangement of the farm buildings, pastures, water supply, garden plots, lawns, etc.

(d) Fence Construction.—Consisting of setting and testing of fence posts, designing gates, operating fence building machines, and testing of fence wires.

(e) Drainage.—The study of the road, field and sanitary drainage, the different systems of tile drains, methods of leveling and digging ditches by hand and by machinery, the laying of tile, the inspection and filling of tile ditches, the study of open ditches, methods of construction, location of drainage districts, and the study of drainage laws.

Sophomore year, First Semester. Recitation, three hours; Laboratory, six hours per week. Prof. C. J. Zintheo and H. M. Bainer.

The laboratory work in Agronomy III. and IV. is divided into five parts as follows:

1. Two hours per week throughout the year is devoted to drawing, such as lettering, map making, planning of farm plots and farm buildings. Also sketching parts of farm machinery, reproducing them to scale and making assembled drawings of machines.

2. Field Work.—One-half semester of four hours per week is devoted to field work in engineering consisting of learning
how to use leveling and transit instruments, surveying land, leveling for tile ditches and establishing drainage districts.

3. *Carpentry.*—One-half semester of four hours per week is devoted to wood-work. Practice is had in using carpentry tools and in making neckyookes, whiffletrees, models of farm buildings and such exercises as will teach the student to do the repair work on the farm.

4. *Blacksmithing.*—In the blacksmith shop the student will learn to iron the articles made in the wood shop, they will also learn how to make and temper tools, sharpen plow lathes, and to do the general repair work of the farm. One-half semester of four hours per week is devoted to this work.

5. *Farm Implement Laboratory.*—The laboratory time is devoted to assembling, adjusting and testing the various farm implements, such as binders, mowers, corn binders, huskers and shredders; corn planters and grain drills are calibrated to determine the accuracy of dropping the corn and the uniformity of sowing the grain. Grain and corn graders are tested. A study is made of wagons, buggies, all styles of cultivators, and the construction of different machines compared. One-half semester of four hours per week.

**AGRONOMY IV.**

*Farm Machinery.*

A complete course in the construction of various farm implements will be given including the elementary principles of mechanics. A study of dynamometers, equalizers, methods of computing speeds and size of pulleys and belts. The history and development of the various farm implements will be traced, methods of factory construction discussed and the functions and methods of operation of all kinds of machines on the farm will be carefully investigated.

A comprehensive course in traction engines will be given; the construction of boilers, steam engines, valves and cylinders will be studied and practice given in the firing and cleaning of boilers and the operating of engines, etc. Gasoline engines and their construction will also receive careful study and practice will be had with the different styles of engines. Windmills and their construction will be studied and experiments carried on to
determine the amount of power to be obtained from windmills with different velocities and densities of winds.

AGRONOMY V.—SOILS.

Soil Physics.

This course comprises a study of the origin, formation and classification of soils; soil moisture and methods of conserving it; soil temperature, and conditions influencing it; soil texture as affecting the supply of heat, moisture and plant food; surface tension, capillarity, osmosis, and diffusion as affecting soil conditions; the effect upon the soil and the crop of plowing, harrowing, cultivating, cropping, and rolling; washing of soils and methods of preventing the same; preparation of seed beds, cultivation and drainage as affecting moisture, temperature, root development, and the supply of available plant food.

The work of the class room is designed to give the student an opportunity to study the different methods of handling soils and the effect of these methods upon the moisture, temperature, texture, and productiveness of the soil.

In addition to the work of the class room six hours each week throughout the semester will be devoted to laboratory work. A commodious and well appointed soil laboratory has been equipped on the first floor of Agricultural Hall. The laboratory is fitted for seventy-five students. The desks, hoods and balance room are of the latest design and afford every opportunity for accurate and scientific work. Each student is supplied with a complete outfit of desk apparatus for individual work and has within easy reach, water, gas, steam, and compressed air.

The centrifuge, shaker and other pieces of soil apparatus are run by individual motors.

Nearly three thousand dollars have been expended for new soil apparatus. The very complete line of apparatus and the new laboratory afford unsurpassed facilities for soil work, not only for regular students but also for those who desire to pursue advanced or post graduate courses.

The Department of Soils has two large rooms in the new greenhouse, which are devoted to pot culture work and various lines of soil experimental work. An ample number of plots on
the Station farm are also available for class and experimental work.

Special attention will be given to the mechanical analysis of soils by the centrifuge method employed by the Bureau of Soils, United States Department of Agriculture. The work will also comprise the determination of the specific gravity, apparent specific gravity, volume, weight, porosity, water-holding capacity, and capillary power of various soils; also a study of the effect of mulches on the evaporation of water from the soil and the physical effects upon the soil of different systems of rotations and of continuous cropping. Junior year. First semester. Three recitations and six hours laboratory work per week. Professor Stevenson and Mr. Christie.

AGRONOMY VI.—SOILS.

Soil Fertility.

Maintenance of Fertility; Fertilizers and Rotations.—The influence of commercial fertilizers, barn-yard manure, and green manuring upon the quality and yield of various crops; the effect of different crops upon the fertility of the soil and upon succeeding crops; different systems of rotation and the effect upon the productiveness of the soil of various methods of soil management; also a study of the storing, preserving, and application of barn-yard manure.

This work will be supplemented by a study of manures; fertilizers, and soils; their composition and agricultural value. Pot and field experiments will be conducted to show the influence of fertilizers, applied to the soil in different quantities and at different times, upon the quality and yield of various crops. Leguminous crops as fertilizers and their place in farm rotation. A study will be made of special types of soil in different sections of the State, such as clay, gumbo, loess, and peat soils in Iowa with special reference to the best methods of handling and cropping these soils. Required: Agronomy V; Chemistry XXV. Junior year. Second semester. Three recitations and six hours laboratory work per week. Professor Stevenson, Professor Schaub, and Mr. Christie.
AGRONOMY VII.

Research Work in Soils.

This is a course in advanced work in Soils. This course is required for Agronomy students who do not take Research Work in Farm Crops or Farm Mechanics, and is elective for students in Agronomy, Animal Husbandry, Dairying, and Horticulture, during the second semester of the Junior year and the first and second semesters of the Senior year.

A new soil laboratory for research students has been fully equipped during the past year. This addition to the laboratory equipment of the Soils Department makes it possible to offer advanced students unusual opportunities for individual work.

The student may choose either of the following lines of work which may be pursued for one, two, or three semesters:

(a) Research Work in Soil Physics.—This course is offered for students who desire to pursue advanced work in the study of the physical properties of the soils. The Department of Soils is well equipped with apparatus for the determination, by electrical methods, of the temperature, moisture and soluble salt content of various soils under actual field conditions.

When possible field experiments will be conducted to show the effect upon the soil conditions of different depths of plowing, harrowing, cultivating, rolling, fallowing, and different methods of preparation of seed beds.

A study will be made of the physical properties of the principal types of soils found in the State and of methods of handling them and rendering them more productive. Junior year. Second semester. Senior year. First and second semesters. Arrange time. Required Agronomy V. Professor Stevenson and Mr. Christie.

(b) Research Work in Soil Fertility.—This course is designed for students who desire to continue their investigation of the soil. Problems of special interest regarding the fertility and productiveness of particular types or classes of soils will be studied. The nature and quantity of the elements of fertility in the soils investigated will be determined and pot cultures and pot experiments will be conducted to show the effect, upon the growth and yield of various crops, of fertilizers added to the soil.
This work will be supplemented by assigned readings. The student will study the results published by authorities on these lines of investigations and will also present in written form the results of his own investigations and experiments. Junior year. Second semester. Senior year. First and second semesters. Arrange time. Required Agronomy V. Professor Stevenson and Professor Schaub.

AGRONOMY VIII.

Farm Management.

This consists of a study of the different systems of extensive and mixed farming; the application of business methods to farm operations; comparison and study of methods pursued by our most successful farmers; division of the farm into fields and crop management; circumstances that influence agricultural practices—soil, climate, machinery, land, tenure, et cetera, markets, profits, and losses; executive and commercial problems on large and small farms—management of farm help; amount of fencing, number and character of live stock as affecting the economic management of the farm; relation of farming to other occupations; qualifications and requirements for the farm manager. First semester. Senior year. Professor Holden.

AGRONOMY IX.

Research Work in Farm Crops.

Advantages are offered in this course for the study of special problems relating to cereal, forage, root, and other crops. This course is arranged to permit the students to specialize and pursue independent investigations with those crops in which he is particularly interested. The laboratory work will consist in special experiments conducted by the student in the greenhouses or in the fields. These experiments will include such studies as methods of testing vitality and purity of commercial seeds; a study of the organs of reproduction in the most common farm crops with special regard to their arrangement for close or cross pollination; a study of the effects of different treatments and solutions of different strengths for fungus diseases in grains, and the time and manner of inoculation of different cereals by smut.

These experiments will be planned and executed by the
student. An important consideration in the work will be the training of men to plan and systematically carry out definite lines of experimental work. The laboratory work will be supplemented by a study of previous experiments and the preparation of a bibliography of such work.


AGRONOMY X.

Research Work in Farm Mechanics.

The student may choose any one of the following lines of work:

(1.) **Calibrating Corn Planters.**—This consists of a systematic study of improving the accuracy of planting corn. Considerable improvement has already been made on various corn planters by the department, and this work will be continued in order to still further improve the planters. In connection with the testing of planters will be carried on experiments with corn graders in order to develop machinery that will grade corn into uniform sizes, suitable for the plates of the corn planters.

(2.) **Testing of Grain Drills.**—The various makes of grain drills will be tested to determine the amount of grain of the various kinds sown per acre, and to note how the registers of the different drills compare with the results actually obtained. Tests will also be made to determine the effect of treating the grain with formaldehyde and other liquids, which swell the kernels, and thus vary the amount of seed passing through the feed in a given time.

(3.) **Fence Construction.**—This consists in testing the strength of material of various kinds of fence posts. The strength of cement posts will be compared with that of cedar and other kinds of wooden posts, to note their ability to withstand strains. Various methods of attaching fence wire, setting fence posts and hanging gates will be investigated.

(4.) **Traction Tests.**—The effect of draft on different conditions and grades of roads for different heights of wheels and different widths of tires of farm wagons will be studied and the results compared with friction and roller bearing axels on farm wagons and other vehicles.

(5.) **Farm Telephones.**—This will consist in a study of the
various makes of telephones as used in rural districts, and a comparison of their efficiency. Practice will be had in the construction of rural lines and the effect of correct versus wrong methods of using phones, will be investigated.

(6.) Irrigation.—This will consist in plotting irrigation fields, leveling land for irrigation purposes, constructing irrigation ditches and flumes, and applying water by flooding and by the furrow system. Actual experiments will be carried on with sewage irrigation on the College farm.

(7.) Drainage Experiments.—Drainage experiments will be carried on to note the effect on the amount of moisture in the soil from deep and shallow drainage. Special drainage problems will be solved where difficult cases occur, such as hillside drainage where the water passes over the impervious subsoil. The student will be given a field to drain and will be expected to determine size of the tile to use and the distance apart of the ditches; also make out a contract for the work of putting in the tile, covering, the depth of tile, cost of tile, and of digging and filling the ditches, as well as all points to be done by the drainage engineer.

(8.) Windmill Experiments.—This will consist in determining the amount of available power to be obtained from the wind, during different velocities and densities of the wind. Also to determine the efficiency of different windmills and to keep a careful record of wind velocities during the season by means of the anemometer register. Tests will also be made of various corn and grain grinders, corn shellers, huskers and shredders operated by wind power.

(9.) Binder Studies.—Various grain and corn binders will be studied to compare the efficiency of the knotters in accuracy of tying bundles. The amount of twine used in the tying of a certain size bundle, the amount of twine wasted in making the knot and the effect of tight and loose tension on the amount of twine used; the number of pounds compression necessary to make tight bundles and a general comparison of efficiency of different binders.

Required for all Research Work. Agronomy III and IV. Professor C. J. Zintheo.
AGRONOMY XI.

This course is offered for those who are desirous of fitting themselves more thoroughly to become competent grain judges at institutes and grain expositions. Six hours laboratory per week. Elective. Junior year. First semester. L. S. Klinck.

AGRONOMY XII.

Farm Implement Design.

This course includes the design and construction of implements as now used on the farm or the invention of such new implements as the experience of the student and the men in charge of the Farm Mechanics Department may suggest. The strength of the various kinds of materials entering into farm implements will be studied and tested in the laboratories and experiments will be carried on in the field to determine the efficiency of the work done by machines made by the students. Elective to all agricultural students who have completed Agronomy III and IV. Prof. Zintheo.

AGRONOMY XIII.

Rural Architecture.

(a) This course embraces the planning of farm buildings, farm granaries, silos, machine sheds, living houses; their construction, cost and conveniences; the study of the different stalls, cribs, etc., also testing the strength of building material, cements, etc. Complete plans, specifications, and price lists of material will be made by the students; the ventilation of buildings will be studied, and the arrangement of windows for lighting the buildings will be investigated. During the laboratory period work will be done in the drawing room and carpentry shop and models of various buildings will be made, and practice given in cutting joists, making windows, doors, etc.

(b) Farm Water Supply.—Including the making of plans for and the construction of a system of water supply available to all buildings on the farm and such field plots in which water is required. It will include the study of the construction and the repair of pumps, windmills, water tanks and pipes; practice work will be given in pipe fitting, the bracing of collars, the repair of leaky valves, and plumbing.
Elective to all agricultural students who have completed Agronomy III and IV. Professor Zintheo.

**AGRONOMY XIV.**

**Dairy Engineering.**

This course embraces special work in the management, care and operation of steam and gasoline engines. It includes practical work in setting valves, caulking boiler flues, repairing pumps and injectors, the placing of machinery shafts and belting, pipe fitting, bracing of collars, and repair of leaky valves.

Required of the Dairy students. Sophomore year. First Semester. Recitation one hour, laboratory three hours per week. Also required by the Short Course students in the Dairy course.

**AGRONOMY XV.**

**Farm Blacksmithing and Horse Shoeing.**

This is an advanced course in blacksmithing, elective only to senior agricultural students who have completed Veterinary XVI. in Horse Shoeing. The course aims to prepare the student to teach shop work in rural high schools and other agricultural colleges, and also gives an opportunity for such students who desire more practice in farm blacksmithing and horse shoeing.

Six hours of shop work per week with two hours credit. Fall semester.

**AGRONOMY XVI.**

**Thesis.**

Each student in the Agronomy Department is required to prepare a thesis in the senior year, representing in the work done upon it, the equivalent of a five hour subject for one term.

This thesis shall be upon some subject requiring original work.

**POST GRADUATE WORK IN AGRONOMY.**

**I. FARM CROPS.**

This work is planned to give the graduate student training that shall prepare him for a position with seed firms, for agri-
cultural experimental work, for work along special seed or crop lines in the United States Department of Agriculture, or to still further prepare him to solve the complex problems of the farm.

Close attention will be given to the study of any special farm crop or crops with which the student is desirous of becoming more familiar. These crops will be treated fully both from the practical and from the scientific standpoint. A large part of the student's time will be devoted to original investigations along the line of his special study and every facility will be afforded for successfully carrying out this work. With large experimental fields, well equipped greenhouses and a chemical laboratory for advanced work, the graduate student has splendid opportunities for pursuing any line of investigation work in Farm Crops which he may desire.

**Commercial Judging and Grading of Grains.**

In grain judging and grading the work is entirely along commercial lines. The object of this course is to make the student thoroughly familiar with the commercial grades of grain and prepare him for a position as a grain inspector. If the student is a graduate of an institution where work embraced in the previous Farm Crops courses, or its equivalent, has not been given, an opportunity will be afforded for taking a special course in the judging and grading of Cereals and Forage Crops. Should the student desire to pursue advanced work in the commercial grading of grains, six weeks training under an efficient inspector at an important grain center will be required before finishing the course. L. S. Klinck.

**II. AGRICULTURAL ENGINEERING.**

In order to meet the increasing demand from graduates of Agricultural and Engineering colleges, the Farm Mechanics Department is offering post-graduate work to such students who wish to fit themselves for government positions along irrigation and agricultural engineering lines. Also for those who wish to teach the subject of Farm Mechanics in Agricultural colleges and to act as managers and superintendents of farm properties and as designers and experimenters with manufacturing and implement concerns. For such students who wish to fit themselves
for these positions, there is a great demand and numerous positions are now or will be in the near future open for those who are prepared to accept them.

Post-graduate students may take up any subject for special investigation along the line of Agricultural Engineering that they are interested in, and for which they are fitted by previous training. The following are some of the suggested subjects for special investigation:

(1.) Irrigation.—There are numerous opportunities in the field of irrigation engineering. The principles of irrigation will be studied carefully and practice will be had in designing and constructing flumes and other irrigation appliances. Experiments will be taken up with irrigation machinery such as the various makes of pumps used for the purpose. The motive power for irrigation pumps will also be investigated and a comparison made between windmills, gasoline engines, and steam engines to learn their efficiency and ability to furnish the cheapest power for irrigation purposes. The department is now carrying on experiments with sewage irrigation on the College farm which give the students ample opportunity for practical work.

(2.) Farm Architecture.—There is a wide field of usefulness open for those who wish to specialize in Farm Architecture. The department offers students a chance to investigate the following lines:

I. Designing and constructing farm barns, and other farm buildings including complete plans, specifications and contracts, as well as estimates of cost of material and labor.

II. Plans and descriptions of farm buildings.
   1. Location and sanitary conditions.
   2. Water supply.
   3. Heating.
   4. Ventilation.

Also any other line of investigation of Farm Architecture that may seem feasible.

(3.) Road Construction.—The College has been made the State Highway Commission by an act of the last State Legislature, and the Farm Mechanics Department is well equipped with the latest improved road-making tools. It offers ample opportunity for students who wish to specialize along this line
with the view of becoming highway engineers for which kind of training there is now a great demand.

(4.) **Investigations of Farm Implements.**—A splendid field is open for investigating the construction and efficiency of the various kinds of implements used on the farm; to test their draft under various conditions and to learn just what machines are best suited for certain conditions.

Also to make a comparison between different makes of machines of the same class. The Farm Mechanics Department has an equipment of $20,000.00 worth of the most modern and up-to-date implements on the market which are placed at the disposal of post-graduate students for investigations. The latest instruments and dynamometers are also available to the students to use in their investigations. Several positions are now open with implement manufacturers as expert designers and experimenters of farm implements. College graduates would do well to fit themselves for these positions.

(5.) **Farm Motors.**—A large field for investigation on farm motors. The numerous makes of steam traction engines and gasoline engines used for farm purposes make a fruitful field to learn just what usage these forms of motive powers can be on the farm and to what extent they can be profitably employed in doing farm work displacing horses for such purposes. The department is equipped with various styles of steam traction engines with single, double and compound cylinders. Also various makes of gasoline engines rating from 2 to 20 horse powers. In this field there are openings both with threshing machine firms and gasoline engine manufacturers for young men who have special training along these lines.

(6.) **Drainage.**—For those who wish to fit themselves as drainage engineers the Department of Farm Mechanics offers a splendid field for investigations. A first class equipment of transits and levels is owned by the department as well as water meters and other instruments for measuring the flow of water in streams and tiles. The department is co-operating with the United States Department of Irrigation and Drainage Investigation, both in drainage experiments, irrigation and windmill experiments.

For the latter the department has several different styles and makes of windmills and also an anemometer and anemo-
meter register which records the velocity of the wind at all times. In the field of drainage there are splendid openings as the State of Iowa and other states have just entered on a campaign of redeeming every acre of unprofitable land that is unfit for cultivation on account of the lack of drainage.

While there are numerous positions in the commercial world waiting for men who have completed a post-graduate course in Agricultural Engineering, the most fruitful field is to teach the subject of Farm Mechanics in the agricultural colleges and rural high schools. Numerous institutions are now establishing such departments and the men who possess the proper education as well as the practical training to teach the subject are sought.

III. SOILS.

Study of Soils Fitting for Special Work in United States Bureau of Soils, or Colleges and State Experiment Stations.

The post-graduate work in Soils consists of special lines of investigation in Soil Physics and Soil Fertility. The greatest freedom, consistent with good work, will be accorded the graduate student in the selection of the lines of investigation for post-graduate work in Soils. This work may be taken in the Department of Soils as a continuation of the work begun as an undergraduate of this College or of any line of soil work which has fitted the student for advanced soil studies.

I. Soil Physics.—There is no line of work which offers a richer field for investigation than Soil Physics. Comparatively little is known concerning the fundamental principles which underlie physical soil problems. The equipment of the department is such that students can successfully conduct experiments along the lines relating to soil management. The student’s work in this course will include an exhaustive investigation and study of one or more of the following subjects, or of such other subjects as may meet the approval of the head of the department:

1. Physical Nature of Soil.
2. Mechanical Analysis.
3. Relation of Soil to Water.
5. Relation of Soil to Heat.
7. Relation of Soil to Air.
8. Influence of Methods of Tillage on Physical Conditions.
10. Soil Types—Their Relation to Crop Production.
11. Soil Surveys—Methods and Results.
12. Alkali Lands and Their Treatment.
13. Treatment of Special Types of Soil to Improve Physical Conditions.

II. Soil Fertility.—This course is designed to meet the rapidly increasing demand for graduate work in Soil Fertility. Problems of special interest regarding the maintenance of the fertility of various types of soils will be studied by the student in the laboratory, field and greenhouse. This work will be supplemented by a study of previous experiments. Special attention will be given to the plant food requirements of various soils, as shown by analyses, field plot experiments and pot-culture investigations. The relation of farm manures and rotations to the maintenance of fertility will also constitute one of the principal lines of research. Work is offered in the following subjects:

1. Methods of Maintaining the Productive Capacity of the Soil.
2. Rotations.
3. Composition and use of Manures.
4. Variation in Composition of Soils.
5. Pot-Culture Investigations.
6. The Value of Field Plot Experiments.
7. Companion Crops, Catch Crops, and Clover Crops in Relation to the Maintenance of Fertility.
8. The Plant Food Requirements of Various Crops.
10. The Comparative Value of Important Types of Soils Based upon Composition.
11. The Improvement of Sandy, Peaty, and Loess Soils.

Arrange time. Professor Stevenson.
SHORT COURSE IN CORN AND GRAIN JUDGING,
JANUARY 1 TO 13, 1906.

During the winter vacation a two week's course in corn and grain judging will be given. This course is planned with special reference to meeting the demand for work along these lines by the farmers of the State who are not able to take advantage of the work in the regular College course. A fireproof two-story stock and grain judging pavilion has been erected for this work. Instruction will be given in the methods of selecting, testing, and preparing seed corn for planting.

Instruction will also be given in the methods of cultivation, characteristics and adaptability of different varieties of corn to the various sections of the State.

A comparison of corn cultivators, and of planter tests with both rotary and edge-drop planters, will be made. Samples of all the leading varieties of corn grown in Iowa will be on exhibition and will be used for corn judging purposes.

Those wishing to become corn judges qualified to judge corn at farmers' institutes, fairs, and expositions, will have an opportunity at this corn school to prepare for this work. An examination will be held at the close of the school, and corn and judging certificates will be issued, by the Iowa Corn Growers' Association, to those who prove themselves proficient. The importance of being able to select good seed for next year's crop can scarcely be overestimated.

To partially cover the expense of additional instructors and facilities for judging, a tuition fee of $3.00 will be charged to residents and $5.00 to non-residents, but one fee will cover the instruction in both stock and corn judging. The work during the course will be so arranged that the student's time will be equally divided between corn and stock judging.

DEPARTMENT OF DAIRYING.

G. L. M'KAY, PROFESSOR OF DAIRYING.
C. LABSEN, M. S. A., ASSISTANT PROFESSOR.
F. W. BOUSKA, M. S. A., ASS'T. PROFESSOR, DAIRY BACTERIOLOGIST.

The Dairy Department carries on two kinds of work. (I.) Experimentation, which has for its purpose investigation and discovery of facts in relation to dairying; (II.) instruction and training to fit men for various callings in dairying.
Those who desire to take work in the Dairy Department usually wish to qualify themselves to pursue work in the following occupations:

1. As teachers and investigators of dairying in agricultural colleges and experiment stations, inspectors of creameries and dairy products in municipal, state and government service, superintendents of large creameries, and managers of dairy farms which produce sanitary and modified milk on a large scale.

2. As operators of creameries, cheese factories, central plants, and dairy farms.

3. Some experienced dairy and creamery men come with the intention of devoting only a comparatively short time to special phases of the subject.

The rapid progress and the application of scientific principles in the dairy industry render it imperative for men who are engaged in dairy work to keep in touch with new ideas and principles. In order to meet these demands the Dairy Department has outlined the following different courses:

First, a four-year course with the view of qualifying students for such work as mentioned above under the first heading.

Second, a one year course to satisfy the demands of those who wish to fit themselves for such work as mentioned under the second heading.

Third, a two weeks' course, intended for men who can leave their work for only a short time to acquaint themselves with methods and investigations which they cannot learn in their own factories.

New Dairy Building.

At the last session of the Iowa Legislature, money was appropriated for a new dairy building, a dairy farm and a herd of dairy cows. With these additional equipments the Dairy Department provides for a more thorough and broader training than ever before.

The new building is a three-story building with a basement and attic. Its dimensions are 110x60 feet. It is built of buff pressed brick, trimmed with Bedford stone. On the inside it is wainscoted with enamel brick. It is entirely fire proof. On the ground floor are located the factory butter and cheese rooms, bottling room, testing room, refrigerators, lunch room, toilet and
bath rooms. On the first floor are the offices, research laboratory, farm dairy room, students' testing laboratory, and a lecture room. The rooms on the second floor are devoted mostly to dairy bacteriology. The dairy library and reading room are also on this floor. The building will be heated, ventilated, and the cold storage rooms refrigerated according to the most modern methods.

Dairy Farm.

The dairy farm is located near the College. It comprises 200 acres of choice land. It will be stocked with various types and breeds of milk cows. The milk from this herd will supply the needs of the creamery. Besides this, milk and cream will be handled commercially, being hauled or shipped to the creamery.

The College creamery is in operation the year around. The work is conducted on a practical scale as well as for scientific investigation and instruction. The product made invariably brings the highest quotations and has attained an enviable reputation in the markets of the United States and England.

The facilities for teaching Dairying in a thoroughly practical and scientific manner are unexcelled. The building is exceptionally well equipped for practical work as well as scientific instruction and investigation. It is more than a "Dairy Building" as the term is generally understood. It is a practical working creamery and cheese factory in operation every work day of the year. A portion of the milk is purchased from farmers living in the vicinity of the College and they are paid for it according to its merits, based not only on butter fat determined by the Babcock test, but on inspection of its cleanliness, freedom from all taints, objectionable odors and other general qualities. A bacteriological laboratory offers facilities for instruction and investigation in this important feature of the subject.

The student becomes familiar with everything connected with the management of a commercial creamery and meets every problem that is likely to confront him in his after work. All leading types of separators are used in the dairy building and the most approved machinery is used throughout by the students.

During the latter part of the senior year those students who
have shown themselves capable are permitted to spend a portion of their time in the laboratory in original work, and meritorious work of this kind is reported in the bulletins of the Experiment Station.

The Short Courses in Dairying are established for the benefit of those who are already engaged in the business, either on the farm or in the creamery or factory, and for this reason a very large portion of the time is devoted to practical work in the dairy building.

Students in these courses are taught everything connected with practical work, from weighing the milk brought in by the different patrons and testing the same, to running the engines, scrubbing the floors and shipping the butter. The aim is to teach not only how to do all the work incidental to a business of this kind, but also why,—the reason,—the work should be done in the manner taught. The studies other than dairying proper which appear in the courses outlined are such as are necessary to a correct understanding of the principles involved, and all students entering these courses are required to attend them regularly.

Students in all of the dairy and creamery work are required to provide themselves with white suits, keep them clean and in good order.

DAIRYING.

Academic Year.

FIRST SEMESTER.

Algebra, 5                   (Mathematics, XII.)
English, 5                   (English, I.)
History, Western Europe, 5   (History, I.)
Elementary Speech, 2         (Public Speaking, I.)

SECOND SEMESTER.

Algebra and Geometry, 5      (Mathematics, V. and XIII.)
Elementary Botany, 2         (Botany, I.)
Elementary Rhetoric, 5       (English, II.)
History, Advanced American History, 4 (History, II.)
Gesture and Voice, 1          (Public Speaking, II.)
Freshman Year.

FIRST SEMESTER.

Live Stock and Score Card Practice, 2  (Animal Husbandry, I.)
Market and Home Gardening, 2  (Horticulture, IIH.)
German, 5, or  (Language, V.)
French, 5  (Language, I.)
Corn and Grain Judging, 5  (Agronomy, I.)
History, English, 1  (History, XVII.)
Advanced Rhetoric, 5  (English, III.)
Military, 2  (Military, I.)
Library Work, 4 hours.

SECOND SEMESTER.

Livestock and Score Card Practice, 2  (Animal Husbandry, II.)
Plant Propagation and Small Fruits, 3  (Horticulture, IIH.)
Solid Geometry, 2*  (Mathematics, VIA.)
German, 5, or  (Language, VI.)
French, 5  (Language, II.)
Farm Crops, 5  (Agronomy, II.)
Entomology, 2  (Zoology, I.)
Composition, 1  English, IV.)
Military, 2  (Military, II.)
History, Formation of the Union, 1  (History, XVIII.)

Sophomore Year.

FIRST SEMESTER.

Livestock and Score Card Practice, 4  (Animal Husbandry, III.)
Orcharding, 3  (Horticulture, IIIH.)
Chemistry, 5  (Agricultural Chemistry, XXI.)
Farm Dairying, 3  (Dairying, XII.)
Botany, Ecology, 2  (Botany, II.)
Composition, 1  (English, V.)
Military, 2  (Military, III.)

SECOND SEMESTER.

Live Stock and Score Card Practice, 4  (Animal Husbandry, IV.)
Chemistry, 5  (Agricultural Chemistry, XXIII.)

*Graduates of accredited schools who are deficient in algebra, but have a grade in solid geometry, will take advanced algebra two hours in the Freshman Year in lieu of solid geometry.
Cheese Making, 3
Milk Testing, 3
Composition, 1
Military, 2
Bacteriology, 2
Dairy Engineering, 2

(Dairying, XV.)
(Dairying, XIII.)
(English, VI.)
(Military IV.)
(Botany, VII.)
(Agronomy, XIV.)

Junior Year.

First Semester.

Advanced Butter Making, 4
Principles of Breeding, 2
Chemistry, 4

(Dairying, XIV.)
(Animal Husbandry, VIII.)
(Agricultural Chemistry, XXV.)

Elective.

Live Stock Management, 2
Histology, 2
Comparative Physiology, 1
Physiography, 3
Shop Work, 1
Surveying, 4
Photography, 2
Physical Laboratory, 1 or 2
Advanced Cryptogamic Botany, 3
Economic Botany, 2
Economic Entomology, 5
Geology, 5
Political Economy, 5
Drama, 3
The Drama in Translation, 2
Debating, 1
Advanced Interperlation, 2
French, 5 or
German, 5
History, 16th, 17th and 18th Centuries, 3
History, The Renaissance, 2
Military Science, I

(Animal Husbandry, XI.)
(Veterinary Science, XXXIII.)
(Veterinary Science, XXI.)
(Geology, I.)
(Mechanical Engineering, XXXVIII.)
(Civil Engineering, VIII.)
(Physics, XIV.)
(Physics, XIV.)
(Botany, VI.)
(Botany, X.)
(Zoology, IV.)
(Geology, II.)
(Economic Science, I.)
(Literature, I.)
(Literature, VIII.)
(English, VII.)
(Public Speaking, III.)
(French, I.)
(Languages, V.)
(History, V.)
(History, X.)
(Military, VI.)

Second Semester.

Fancy Cheese Making, 3
Technology of Milk, 1

(Dairying, XXIV.)
(Dairying, XVI.)
Chemistry, 4

(Agricultural Chemistry, XXVI.)

Elective.

Livestock Management, 2
Animal By-Products and Herd Books, 2
Farm Mechanics, 5
Comparative Physiology, 2
Advanced Public Speech, 1
Roads and Pavements, 2
Plane Trigonometry, 3
Vegetable Cytology, 3 or 5
Systematic Botany, 3 or 5
Histology, 4
Mineralogy, 4
Finance, 3
Epic and Lyric Poetry, 5
Expression in Oratory, 2
French, 5 or
German, 5
Debating, 1
History, The French Revolution & 19th Century, 3
History, Constitutional History of England, 2
Military Science, 1
Advanced Work in Soils, 2
Agricultural Economics, 5

Senior Year.

FIRST SEMESTER.

Dairy Bacteriology, 4
Scoring Butter and Cheese, 1
Research Work, 2

Elective.

Comparative Physiology, 2
Advanced Entomology, 3 to 5
Agrostology, 2
Evolution of Plants, 1
Geology, 5
Analytic Geometry, 5

(Veterinary Science, XXIII.)
(Zoology, IX.)
(Botany, XIII.)
(Botany, XIX.)
(Geology, II.)
(Mathematics, VIII.)
Political Economy, 3                                                                 (Economic Science, III.)
History of Political Economy, 2                                                (Economic Science, II.)
Psychology, 5                                                             (Psychology, I.)
American Literature, 3                                                        (Literature, IV.)
The Short Story, 2                                                            (Literature, VI.)
Dramatic Art, 2 or                                                        (Public Speaking, V.)
Extempore Speech, 2                                                        (Public Speaking, X.)
Oration, 1                                                                   (Elocution, IX.)
French, 4 or                                                               (Languages, III.)
German, 4                                                                   (Languages, VII.)
History, National Expansion, 1783-1845, 3                                           (History, III.)
History, The Diplomatic History of the United States, 2              (History, XII.)
Chemistry, 5                                                               (Agricultural Chemistry, XXVII.)
Military Science, 1                                                        (Military, VII.)
Advanced Work in Soils, 2                                                 (Agronomy, VII.)

SECOND SEMESTER.

Factory Management, 4                                               (Dairying, XX.)
Preparation of Ice Cream and Ices, 1                                       (Dairying, XXI.)
Animal Nutrition, 5                                                        (Animal Husbandry, IX.)
Sanitary Science, 2                                                        (Veterinary Science, XLV.)
Thesis, 2                                                                   (Dairying, XXIII.)

Elective.

Comparative Physiology, 2                                                     (Veterinary Science, XXIV.)
Dairying 3,                                                                  (Dairying, I.)
Advanced Entomology, 3 to 5                                               (Zoology, IX.)
Calculus, 5                                                                 (Mathematics, IX.)
Advanced Bacteriology, 3                                                  (Botany, VIII.)
Geology, 5                                                                  (Geology, IV.)
Ethics, 3                                                                   (Psychology, II.)
Novel and Romance, 3                                                        (Literature, III.)
The Essay, 2                                                                (Literature, VII.)
Advanced Dramatic Art, 2 or                                               (Public Speaking, VI.)
Advanced Extempore Speech, 2                                               (Public Speaking, XI.)
History, Welding of the Nation, 1845-1900, 3                                          (History, IV.)
The Far Eastern Question, 2                                               (History, IX.)
Astronomy, 5                                                                (Physics, VIII.)
Chemistry, 5                                                               (Agricultural Chemistry, XXXIV.)
Military Science, 1  (Military, VIII.)
Advanced Work in Soils, 2  (Agronomy, VII.)
Rural Law, 1  (Civics, V.)

Course I.—Dairy Practice.—This consists of five to seven hours of practical work in cheesemaking per day, First Semester of one year course. In the Second Semester of the year course it includes practical work in buttermaking. Professor McKay.

Course II.—Buttermaking.—This course is a one hour study in the Second Semester of the year course. It includes a study of the composition of milk and dairy products, the principles of gravity and centrifugal separation of cream, a consideration of the principles of cream ripening, preparation of starters, churning, and the preparation of butter for the market. This course cannot be substituted for Course XIV. Mr. Larsen.

Course III.—Milk Testing.—1 hour, Second Semester of year course. It includes a thorough study of the Babcock test for dairy products, with special attention for overcoming difficulties arising from varying conditions. The tests (Farrington's and Manns') for determining the acidity of cream and milk, and the use of the lactometer for detecting adulterations, are included. Also composite sampling and testing of individual cows. This course cannot be substituted for Course XIII. Mr. Larsen.

Course V.—Book Keeping.—This course is designed to give the students the best form of bookkeeping for the business of the factory. One hour a week, Second Semester year course.

Course VI.—Dairy Bacteriology.—This course of twenty lectures is for students in the short dairy course. The application of bacteriological knowledge in the care of milk, in butter making, and in cheese making is taught in a simple and practical manner. This course cannot be substituted for Course XVII. in the Four Year Dairy Course. First Semester, one year course. Mr. Bouska.

Course VII.—Breeding and Judging Dairy Stock.—(Animal Husbandry). In this course the judging of dairy stock with the score card and by comparison is made a leading feature, while the lectures relate mostly to the principles, methods and practice of breeding dairy stock and their improvement. It is a two hour study during the Second Semester of the year course. Professor Kennedy.

Course VIII.—Cheesemaking.—This study is given during
the First Semester of the one year course. Sixteen lectures are
given and in addition to this, six lectures on fancy brands of
cheese, including Limburger, Brick, Swiss, Roquefort, Sage,
Stilton, Pineapple and Gouda. Professor McKay.

Course IX.—Scoring Butter and Cheese.—These lectures are
designed to give the student a correct idea of the standard
market requirements for dairy products. Butter and cheese are
examined and scored by the students, and their judgment com­
pared with that of the instructor. It comprises ten lectures
during the First Semester to one year students. Professor
McKay.

Course X.—Feeding Dairy Stock.—(Animal Husbandry).
First Semester, one year course. Special attention is given in
this course to the principles of feeding animals for the most
economical production, with the composition and use of various
feeding materials and the feeding of dairy cows, including the
influence of various feeding stuffs on the quantity, quality and
composition of milk, butter and cheese. Second Semester, one
year course. Mr. ——.

Course XI.—Dairy Chemistry.—(Chemistry). The chemical
composition and methods of analysis of dairy products is con­
sidered in a general manner. The adulterations of butter, cheese
and milk are also taken up in the lectures. It is given in sixteen
lectures in the First Semester of the one year course. Mr. ——.

Course XII.—Farm Dairying.—This is a required study for
all four year agricultural students. First Semester, Sophomore
year. Optional study in course for women. Two class recitations
and one laboratory period per week. The class work takes up
the composition and secretion of milk, separation of milk
by gravity and centrifugal force, the Babcock test for
the determination of fat, preparation of starters, ripening of
cream, and churning and packing butter. As this course has
been planned to give the students a knowledge of dairying in
general, only one laboratory period per week will be involved.
The working of the Babcock test, detecting adulteration of milk,
testing for acidity, and buttermaking as practiced in the best
modern dairies will be taken up, and demonstrated in the labora­
tory. Mr. Larsen.

Course XIII.—Milk Testing.—This includes a thorough
study in the use of the Babcock test for dairy products, with
special attention to overcoming the difficulties resulting from
varying conditions. The tests (Farrington's and Manns') for determining acidity of cream and milk, and the use of the lactometer for detecting adulterations, are included. Also composite sampling and testing of individual cows, and the influences and detection of different preservatives and adulterants. It consists of two recitations per week and one laboratory. Sophomore year, Second Semester. At least one term of Chemistry is required. Mr. Larsen.

Course XIV.—Advanced Buttermaking.—This course consists of three recitations and one laboratory per week. It comprises a detailed and thorough study of the physical and chemical properties of milk and its components. It takes up the secretion and composition of milk, principles of separation of cream by gravity and centrifugal separators, effects of different degrees of acidity of cream upon the quality of butter, and the principles of churning, packing and marketing butter. The laboratory periods are devoted to practical work in the creamery. How to operate the leading types of separators and churns and how to prepare tubs and butter so as to procure the best keeping qualities of it are some of the subjects which will receive special attention in the laboratory. General Bacteriology and one term of Chemistry are pre-requisites. Junior year, First Semester. Mr. Larsen.

Course XV.—Cheesemaking.—This course involves one recitation and two laboratory periods per week. The class work takes up the importance of the quality and composition of milk as it relates to the manufacture of Cheddar cheese. The principles involved in cutting, heating, milling, salting and pressing the curd, curing and marketing. The influence of organized and unorganized ferments in the making and curing of cheese; the ventilation and construction of cheese curing rooms are also taken up. Second Semester, Sophomore year. Professor McKay.

Course XVI.—Technology of Milk.—Second Semester, Junior year, one hour study. The course is intended to give the student a general knowledge of the different ways in which milk and its products are utilized outside of the scope ordinarily considered under dairying. Such subjects as the preparation of condensed, certified, modified and hygienic milk. It also includes the study of the food value of milk and its products, in comparison with other common foods, preparation and utilization of milk sugar and casein. Some Bacteriology and Chemistry are prerequisites. Mr. Larsen.
Course XVII.—Dairy Bacteriology.—Fall Semester, four hours. Two lectures and two laboratories per week are given on this subject. The students taking this course are required to have a knowledge of chemistry and general bacteriology. The lectures take up the function of bacteria and the application of bacteriological principles in dairy processes. The object of the laboratory work is to familiarize the student with a few typical dairy fermentations, and to train him in the use of laboratory methods.—Mr. Bouska.

Course XVIII.—Scoring Butter and Cheese.—First Semester, Senior year, one hour study. The lectures are designed to give students a correct idea of the standard market requirements for dairy products. Butter and cheese are examined and scored by the students, and their judgment compared with that of the instructor. Professor McKay.

Course XIX.—Research Work.—First Semester, Senior year, two hours a week. This course has been planned for the advanced students in dairying. It consists of looking up recent work done on dairy subjects by the experiment stations. Also to read and study the different books on dairying, written by various authorities on assigned topics. General Bacteriology, Dairy XIV and XV are prerequisites. A reading knowledge of French and German is recommended. Mr. Larsen.

Course XX.—Factory Management.—Second Semester, Senior year, a four hour study. This course, together with the knowledge the student already has, is intended to qualify a student to superintend or manage any large factory or dairy establishment. It consists of two lectures per week and work in the creamery equivalent to two laboratory periods per week. The class work will include such subjects as the location and construction of creameries, drainage and ventilation of factories, how to treat the skim milk and other by-products in order to get the best economic results and different methods of creamery refrigerations. It is advisable for the student to put in the laboratory work during vacation or some other time when the work can be done during consecutive days. Course XIV is a prerequisite. Ten lectures are given on this subject to students in one year course, Second Semester. Mr. Larsen.

Course XXI.—Preparation of Ice Cream and Ices.—This course consists of lectures and laboratory work. They are combined in such a way as to give the student the best under-
standing possible concerning the preparation of ice cream, sherbets, and ices, as made on a private and commercial scale. Senior year, Second semester, one hour study. Mr. Larsen.

Course XXII.—Milk Inspection.—Second Semester, two hours. Sixteen lectures and sixteen laboratories are devoted to this study.

In the economical phase of the subject is taught the use of the Babcock test and the lactometer in detecting watered or skimmed milk. Under the sanitary phase come infectious diseases carried by milk, and the detection of preservatives. The legal aspect of such work is also considered.

Course XXIII.—Thesis.—The work on thesis must be original work on some dairy subject. The students should consult the professor in charge concerning their subject before or after the beginning of their senior year. The bacterial and chemical laboratories in connection with the creamery plant offer special facilities to the student for doing original work. Frequently arrangements can be made with the department for co-operation in working out important subjects, and if the work is deemed meritorious it will be published in bulletin form. The thesis work must represent time equivalent to a two hour study during the second semester of the Senior year.

Course XXIV.—Making of Fancy Cheese.—One lecture and two laboratories per week. Second Semester, Junior. This course takes up the making of those varieties commonly found in the American market, namely: Limburger, Brick, Swiss, Roquefort, Sage, Stilton, Pineapple, Gouda, Gorgonzola, and Neuchatel. Professor McKay.

One Year Course in Dairying.

The one year course in dairying is designed to meet the wants of those who wish to acquire an intimate knowledge of practical dairy methods and the underlying principles as well as of the sciences related thereto. This course runs through one college year, beginning in September and ending in June. Students completing this course will be given certificates when evidence is furnished that they have for one year successfully operated a creamery or other dairy establishment. No other certificates will be given for any course in dairying except to students entitled to a diploma for the four years course in
agriculture. The following is the course of study pursued:

**FIRST SEMESTER.**

Dairy Practice, 6 days per week
Cheese Making, 16 lectures
Feeding Dairy Stock, 20 lectures
Dairy Chemistry, 16 lectures
Scoring Butter and Cheese, 10 lectures
Bacteriology of Milk, 20 lectures

**SECOND SEMESTER.**

Dairy Practice in Butter Making, 6 days per week
Buttermaking, 16 lectures
Milk Testing, 16 lectures
Bookeeping, 16 lectures
Breeding and Judging Dairy Stock, 30 lectures
Factory Management, 10 lectures
Dairy Engineering, 2

**Two Weeks Course in Dairying.**

The prominent rank attained by students of the Iowa Dairy School in state and national contests has led to a demand for special instruction. The Short Course will begin January 2, 1906, and continue for two weeks. The subjects that will receive special attention during this time are: (Preparation of commercial and natural starters, ripening of cream, judging and scoring of cream and butter, and how best to treat the hand separator cream). This latter subject was a special feature of our last year's course. Hand separator cream will be shipped in to the College Creamery during this course, and treated in different ways with a view of making the best possible quality of butter from a given quality of cream. No one but experienced butter makers will be admitted to this course. The fees for this course are $12.00, which is intended to cover expenses involved in securing extra instructors, and material for the instruction.
Graduate Course in Dairying.

This department is especially equipped to offer graduate work to advanced students in dairying. In connection with the creamery, which is in operation the whole year, there is in the same building a well equipped laboratory for dairy chemistry, as well as for dairy bacteriology. Opportunities for original investigational work in dairying are offered in the following lines:

Dairy Bacteriology.

For graduate work in Dairy Bacteriology a knowledge of general bacteriology and chemistry is required, and a reading knowledge of German is recommended. Work can be done on the following phases of the subject:

I. Economic.
   1. In Milk and Cream: Methods of Milking, Care of Milk and Preservation of Milk.
   2. In manufacturing Processes.
      (a) Butter making: Cream Ripening and Starters.
      (b) Cheese making: Ripening of Milk, Starters, Quality of different makes of cheese.
      (c) Manufacture of Process Butter and Oleomargarine.
   3. In Derivatives of Milk, i.e., finished products.
      (a) Butter: Pasteurized, Raw Cream, Washed, and Unwashed.
      (b) Cheese: Effect upon Curing and Quality.

II. Sanitary.
   1. Fermentations producing poisonous substances in dairy products.
   2. Transmission of diseases by dairy products.

III. Technical.

Devising and testing of methods in dairy bacteriology.

Dairy Research.

Under this heading investigations relating to the several subjects mentioned below in creamery work are included:

1. Receiving and Sampling Milk and Cream.—The extensive use of hand separators throughout the West and the receiving of hand separator cream, gravity cream and whole milk at one
creamery plant have given rise to several interesting practical questions in connection with receiving and sampling of the above mentioned dairy products. Degree of economy in grading different qualities of cream and milk; shall the cream patrons receive more per pound for fat than the whole milk patrons and if so, how much? Different methods of sampling cream and milk and comparative studies of the degree of efficiency and economy in the use of the different preservatives for composite sample are some of the subjects which may be suggestive to students, under the above heading.

II.—Milk Testing.—This embraces a comparative study of the different tests of dairy products, viz.: Gravimetric, Babcock, Gerber, oil test and the space system. The testing for adulteration of milk is studied from two standpoints: (1) From the standpoint of detecting adulterations made with a view of defrauding buyers and customers, and (2) with a view of detecting adulterations that effect the health of people when added to dairy products. This latter includes the different preservatives.

III.—Separation and Pasteurization of Cream and Milk.—Such subjects as Pasteurization of Different Qualities of Cream and Milk: If Pasteurization is Employed, Shall it be Done Before or After Separation; Degree of Economy in Pasteurization; Different Methods of Pasteurization and Comparative Studies of Different Types of Separators, are some of the most important ones which can be studied under the above heading.

IV.—Cream Ripening.—A Comparative Study of Different Ripening Temperatures; How May Different Qualities of Cream be treated in order to Obtain the Best Ripening Results; How Much and What Kind of Starters shall be used for Different Qualities of Cream, and Quick Ripening vs. Slow Ripening, are some of the phases of cream ripening which can be taken up advantageously.

V.—Churning, Washing, Salting and Working Butter.—In connection with this topic a large number of important subjects for investigation, which bear directly upon the commercial value of butter, could be mentioned. Among them are: Effects of Richness of Cream; Temperature, and Different Amounts of Churning upon Quality and Quantity of Butter; Economic Aspect of Brine Salting Versus Dry Salting under Different Conditions; Amount of Salt to Use for Storage, and for Butter Which is to be used Shortly after Its Manufacture; Effect of Different Qualities
of Water Used for Butter Washing, and Extent and Different Methods of Working.

VI.—Packing and Marketing of Butter.—Subjects which can be included under this heading are: The Most Economical Way of Placing Butter on the Market; A Comparative Study of Different Methods of Treating Tubs for Prevention of Molds and What Are the Losses Sustained from Printing the Butter at Different Degrees of Firmness.

The above mentioned subjects are not comprehensive in their scope. They can be modified or changed to include more or less as the occasion demands. They are intended for suggestions only.

Factory Management.

As a whole this subject is intended to embody the conditions outside of butter making proper which are to be considered in order to obtain the greatest possible degree of economy in the operation of a large dairy or some large factory. Among some of the subjects may be mentioned: Organization of Creameries; Location, Drainage, Ventilation and Construction of Creamery and Dairy Buildings; Mechanical Versus Natural Ice for Refrigeration; Different Methods of Utilizing the Various By-Products in Creameries, and how to avoid the many losses so incidental to creamery management.

Milk Production.

The work along this line is facilitated by reason of having in connection a large herd of cows. Subjects, such as the Greatest Economic Production of Milk with Special Reference to Individuality and Breeds of Cows; The Effect of Different Feeds Upon the Quality of Dairy Products, and the Environmental Conditions Affecting the Quantity and Quality of Milk, are included.

Cheese Making.

In this course is offered advanced work in the manufacture of Cheddar cheese, the chemical and bacteriological laboratories are open for research work to students pursuing work in this course. The Dairy building has rooms and special facilities for the different steps in the manufacture and curing of cheese.
DEPARTMENT OF ANIMAL HUSBANDRY.

WILLARD J. KENNEDY, PROFESSOR.
W. J. RUTHERFORD, ASSOCIATE PROFESSOR.
WAYNE DINSMORE, INSTRUCTOR.
W. W. SMITH, ASSISTANT.
C. W. RUBEL, B. S. A. GRADUATE ASSISTANT.
J. A. CONOVER, ASSISTANT.

JOHN GOSLING, KANSAS CITY, MO., NON-RESIDENT LECTURER.

The department of Animal Husbandry stands for all lines of work which pertains to the judging, selecting, breeding, feeding, development, and care and management of the various breeds and classes of domesticated animals. Because of the importance of the live stock industry to the welfare of the state, and, on account of the unusual quest from students for instruction along this line, nothing within our power has been left undone to make the equipment for instruction purposes complete in every detail.

The herds and flocks were very carefully established at an early date. From time to time valuable additions in keeping with modern ideas have been made until, at the present time, almost every recognized market class of animal and good representatives of all the recognized breeds are available for the purpose of instruction. An equipment of this kind places us in a position to do work along Animal Husbandry lines which cannot be accomplished in those institutions where proper specimens of stock are not furnished. We are firmly convinced that there is but one way to make a young man a proficient judge of live stock, and that is by training his eye. In all of the lecture and laboratory work outlined in our courses the work is demonstrated by the use of living specimens.

The offices and lecture rooms of the department are located on the first floor of Agricultural Hall. The museum, containing a complete assortment of the various kinds of wool, woolen materials, animal by-products, and feed stuffs, is located on the third floor of the same building.

The judging pavilions are located near the barns. In this respect we are most fortunate in having two excellent, commodious judging pavilions. This allows us to divide our classes, which have in the past been unusually large, into many sections, thus affording an excellent opportunity for individual work.
These buildings are well lighted and heated, and are arranged in every way for the convenience and comfort of those who take the work.

An excellent collection of horses representing all the market classes and the breeds of both light and heavy types is maintained for instructional purposes. Among these are good representatives of the Shires, Percherons, Clydesdales, French Coachers, Hackneys, Standard bred, and American Saddle Horses. Some of the horses are imported; while the others have been purchased with much care in their selection, from the best breeders on the continent.

More than two hundred head of cattle, representing all the leading beef, dual purpose, and dairy breeds are maintained on the farm. Complete breeding herds of most of the breeds are kept. A large herd of Galloway cows, kept for cross-breeding purposes, is used in the production of blue grays. An excellent collection of steers, representing the highest type of fat steer, and all the other classes and grades to be found on our leading markets down to the very lowest grades, is always available for class work. This affords our students an excellent opportunity to study the market demands and to know what constitutes each class, also why there is such a wide margin in the prices paid for cattle by the packer.

A dairy farm of 200 acres, located near the College, has been purchased recently. This farm will be well stocked with dairy cattle. It will have a herd of a hundred or more representatives of the Holsteins, Jerseys, Guernseys, Ayrshires, milking Shorthorns, and good grades, with good sires of the different breeds named. This equipment will afford excellent opportunities for classroom work when studying the origin, history, and development of the different breeds of dairy cattle, their characteristics and the conditions under which they have been evolved.

This new equipment will also afford the College excellent opportunities for carrying on investigation work along the lines of breeding, feeding and management of the dairy herd for profit; the adaptability of the different breeds to Iowa conditions; and the relative values of home-grown feed stuffs and by-products in the production of milk and butter fat.

The equipment of the sheep department is especially strong, consisting of over two hundred head, with good representatives of the mutton and wool types and typical specimens of all the
leading breeds. Eight distinct breeds, which have been care­fully selected to represent the type and characteristics of each breed both in regard to their mutton form and wool bearing qualities, are always available for class-room work. In addition to the breeding flocks we always have a choice collection of fat wethers which affords an excellent opportunity for the student to familiarize himself with the highest type of finished mutton sheep.

In the swine department, representatives of six breeds are maintained, including the best American as well as the leading British varieties. As in the other departments, the aim in this has been to keep in touch with the modern ideas of the leading breeders, both in regard to breeding and the type of the animals in these breeds. At all seasons of the year there is more or less feeding of market stock being done on the farm and in connection with the Experiment Station, so that excellent material is always available for instruction purposes regarding the qualities that add to the value of stock for the ordinary market. Having pure bred representatives, it is easy to inform the student in a practical way on the finer points of color, type, and other characteristics that relate to the pure bred classes of stock.

To assist further in this work, the herd books of the different American and foreign registry associations are being constantly added to the library. Through these the student is not only enabled to inform himself in regard to pedigrees, but he is enabled also to study the different scales of points which the breeders have adopted to represent the highest types of the various breeds.

Other features of the equipment are photographs, charts and lantern slides; these are used in the lecture room when it is not possible to illustrate with the living animal. It is the aim of the department to illustrate all lines of instruction with living repre­sentatives. The abundant material available from the herds and flocks is freely drawn upon and used extensively in all lectures and score card practice. By means of score cards prepared by the department, the students are brought in close contact with the animals, and through them are informed on the points of market merit desirable in ordinary stock; while later the use of the official scale of points for the different breeds in a similar way, makes them skillful in judging representatives of the different breeds.
As soon as the student is familiar with the use of the score card, comparative judging is introduced. In comparative judging from four to six animals are used, and each student is required to place all the animals in order of merit, and write down clearly and concisely on a blank folder, prepared especially for this work, full reasons for making his awards. This kind of work teaches the student to compare animals and to balance the weak and the strong points of each in making his final awards. As soon as the student demonstrates his ability to place classes well, herd groups and sweepstake classes are introduced during his Senior year's work. This kind of work is similar to the most difficult judging done at our leading state fairs and international expositions. As soon as the student shows that he possesses the qualifications needed to judge stock in the show ring, he is sent out, in answer to the many requests from the secretaries, to judge various classes of stock at county fairs. This in connection with his college work, results in establishing the lessons learned in the class room.

**Special Courses.**

Students desiring shorter courses of study will be permitted to take up special courses in any line of work offered providing they comply with the full requirements for admission to short course work as outlined elsewhere in this catalog. They must also have credits for all necessary work preparatory to the taking of such courses as are demanded of the regular men in the four year course.

**Winter Course in Stock Judging.**

In response to a widespread demand for special short course instruction in the judging and feeding of animals, a two weeks' course has been established during the winter vacation. This course will begin January 1, 1906, and continue for two weeks. It will be devoted exclusively to score card practice, and judging of horses, cattle, sheep, and hogs, and lectures on feeding the same.

In this work special attention will be given to the selection of animals best suited for feeding purposes. Good specimens of the highest type of fat steer and ideal representatives of all the various breeds will be used for class work. At the conclusion of the cattle work a slaughter test and block demonstration of the
various market types of steers will be conducted under the supervision of John Gosling, Kansas City, Missouri. This course is intended especially for the man on the farm that cannot avail himself of the opportunity to take a complete course.

A special course in corn judging will be given at the same time and the work will be so arranged that all those present may take both lines of work.

To cover in part the expense of securing additional help and stock for demonstration a tuition fee of $3.00 will be charged for admission to this course, but one fee will cover the instruction in both grain and stock judging.

Clay, Robinson & Co. Fellowship Prizes.

Clay, Robinson & Co., Live Stock Commission Merchants, Union Stock Yards, Chicago, offer, annually, $1,000.00 in prizes to be awarded to the Agricultural Colleges making the best exhibit of live stock at the International Live Stock Exposition held at Chicago in December of each year. They stipulate that the money won by the various colleges shall be used for the establishment of fellowship prizes to be awarded to graduate students in the department of Animal Husbandry. These fellowships, amounting to $300.00 per student annually, are granted by the Board of Trustees upon the recommendation of the dean of the Division of Agriculture and the head of the department. A student holding a fellowship may pursue post-graduate work in Animal Husbandry.

Graduate Courses.

We are now in a position to offer post-graduate work along five distinct lines. Students to be eligible to take this work must comply with the College requirements for post-graduate work as stated elsewhere in this catalog.

(a). Animal Nutrition. We have excellent facilities for advanced research work along this line on account of the vast amount of work done on the College farm, along the lines of horse, cattle, sheep, and swine feeding experiments. We have every year a large number of animals in feeding experiments under our direct supervision. Students desiring special research work along this line may do the same under the direction of the head of the Department.

(b). Animal Breeding. A special line of research work has
been outlined for students desiring special work pertaining to underlying principles of animal breeding. Special experiments are being conducted on the farm along new and original lines.

(c). Study of Breeds. Our large collection of pure bred animals representing almost every recognized breed of live stock on the continent affords us excellent opportunities for special work along these lines. We have not only typical specimens, but, in most instances, we have complete breeding herds, thus there is an excellent opportunity to study the adaptability of each breed to Iowa conditions.

(d). Stock Judging. We have unusual facilities for thorough work along this line. All of the various market types of animals are available, also good representatives of all the pure breeds. Animals are carefully examined on foot, then slaughtered for a block test and the exact percentages of the various cuts with their values are ascertained.

(e). Practical Management of Stock. This course will include an exhaustive study and investigation of the methods in vogue on the best managed stock farms and breeding establishments in the United States, Canada, Great Britain, and other countries, and is intended especially for those students who are preparing to manage stock farms.

Positions Open to Men Trained Along Animal Husbandry Lines.

The demand for competent young men, thoroughly trained along the lines of practical and scientific animal husbandry work, by far exceeds the supply. We are constantly in receipt of inquiries for men combining college training with practical experience and natural ability. There appears to be no limit to this demand at a compensation not exceeded in any other calling. Our course is so arranged that our students have an excellent opportunity to combine practical and scientific knowledge. A few of the many lines of work open to graduates of this department are: College and Experiment Station work, Agricultural journalism, Managers of stock farms, Salesmen with commission merchants, Buyers for the packing houses at the many stock yard centers, Salesmen of animal feed stuffs manufactured by the packing houses, Glucose companies, Linseed and Cotton seed oil companies, etc., etc. At the present time we have not nearly enough good men to fill the positions open to graduates.
COURSE IN ANIMAL HUSBANDRY.

Academic Year.

FIRST SEMESTER.

Algebra, 5  (Mathematics, XII.)
English, 5  (English, I.)
History, Western Europe, 5  (History, I.)
Elementary Speech, 2  (Public Speaking, I.)

SECOND SEMESTER.

Advanced Algebra and Plane Geometry, 5  (Mathematics, XIII and V.)
Elementary Botany, 2  (Botany, I.)
Elementary Rhetoric, 5  (English, II.)
History, Advanced American, 4  (History, II.)
Gesture and Voice, 1  (Public Speaking, II.)

Freshman Year.

FIRST SEMESTER.

Live Stock and Score Card Practice, 2  (Animal Husbandry, I.)
Market and Home Gardening, 2  (Horticulture, I.)
German, 5, or  (Language, V.)
French, 5  (Language, I.)
Corn and Grain Judging, 5  (Agronomy, I.)
History, English History, 1  (History, XVII.)
Advanced Rhetoric, 5  (English, III.)
Military, 2  (Military, I.)
Library Work, 4 hours

SECOND SEMESTER.

Live Stock and Score Card Practice, 2  (Animal Husbandry, II.)
Plant Propagation and Small Fruits, 3  (Horticulture, II.)
Solid Geometry, 2*  (Mathematics, VIA.)
German, 5 or  (Language, VI.)
French, 5  (Language, II.)
Farm Crops, 5  (Agronomy, II.)

*Graduates of accredited schools who are deficient in algebra but have a grade in solid geometry; will take advanced algebra two hours in the Freshman Year in lieu of solid geometry.
Sophomore Year.

FIRST SEMESTER.

Live Stock and Score Card Practice, 4  (Animal Husbandry, III.)
Farm Mechanics, 5  (Agronomy, III.)
Vertebrate Zoology, 4  (Zoology, III.)
Chemistry, 5  (Agricultural Chemistry, XXI.)
Composition, 1  (English, V.)
Orcharding, 3  (Horticulture, III.)
Military, 2  (Military, III.)

SECOND SEMESTER.

Live Stock and Score Card Practice, 4  (Animal Husbandry, IV
Farm Mechanics, 5  (Agronomy, IV.
Invertebrate Zoology, 4  (Zoology, III.)
Chemistry, 5  (Agricultural Chemistry, XXIII.)
Composition, 1  (English, VI.)
Military, 2  (Military, IV.)

Junior Year.

FIRST SEMESTER.

Live Stock Management, 2  (Animal Husbandry, XI.)
Principles of Breeding, 2  (Animal Husbandry, VIII.)
Chemistry, 4  (Agricultural Chemistry, XXV.)
Farm Dairying, 2  (Dairying, XII.)
Embryology, 3  (Zoology, V.)
Soils, 5  (Agronomy, V.)

Elective.

Histology, 2  (Veterinary Science, XXXIII.)
Comparative Physiology, 1  (Veterinary Science, XXI.)
Physiography, 3  (Geology, I.)
Surveying, 4  (Civil Engineering, VIII.)
Photographs, 2  (Physics, IX.)
Physical Laboratory, 1 or 2  (Physics, XIV.)
Cryptogamic Botany, 4  (Botany, IV.)
Economic Botany, 2  (Botany, X.)
Economic Entomology, 5  (Zoology, IV.)
Geology, 5  (Geology, II.)
Political Economy, 5  (Economic Science, I.)
Drama, 3  (Literature, I.)
History, Europe in the 16th, 17th, 18th Centuries, 3  (History, V.)
History, The Renaissance, 2  (History, X.)
The Drama Translation, 2  (Literature, VIII.)
Debating, 1  (English, VII.)
Advanced Interpretation, 2  (Public Speaking, III.)
French, 5 or  (Language, III.)
German, 5  (Languages, VII.)
Military Science, 1  (Military, VII)

SECOND SEMESTER.

Live Stock Management, 2  (Animal Husbandry, XII.)
Animal Parasites, 2  (Zoology, VIII.)
Soils, 5  (Agronomy, VI.)
Chemistry, 4  (Agricultural Chemistry, XXVI.)

Elective.

Agricultural Economics, 5  (Economics, VIII.)
Plant Breeding, 3  (Horticulture, IV.)
Forestry, 3  (Horticulture, XIV.)
Comparative Physiology, 1  (Veterinary, XXII.)
Bacteriology, 2  (Botany, VII.)
Adv. Public Speech, 1  (Public Speaking, VIII.)
Roads and Pavements, 2  (Civil Engineering, XIII.)
Plane Trigonometry, 3  (Mathematics, VIII.)
Vegetable Cytology, 3 or 5  (Botany, XII.)
Systematic Botany, 3 or 5  (Botany, XV.)
Histology, 4  (Botany, III.)
Mineralogy, 4  (Geology, VI.)
Finance, 3  (Economic Science, V.)
Money and Banking, 2  (Economic Science, IV.)
Epic and Lyric Poetry, 5  (Literature, II.)
Expression in Oratory, 2  (Public Speaking, IV.)
French, 5 or  (Language, IV.)
German, 5  (Language, VIII.)
Debating, 1 (English, VIII.)
History, French Revolution and the XIXth Century, 3 (History, VI.)
History, Constitutional History of England, 2, (History, XLI.)
Advanced Work in Soils, 2 (Agronomy, VII.)
Military Science, 1 (Military, VI.)

Senior Year.

FIRST SEMESTER.

Advanced Live Stock and Score Card Practice, 2 (Animal Husbandry, VI.)
Anatomy of Domestic Animals, 2 (Veterinary Science, XVII.)
Obstetrics, 1 (Veterinary Science, XIX.)
Sanitary Science, 2 (Veterinary Science, XLIV.)
Farm Management, 5 (Agronomy, VIII.)

Elective.

Dairy Bacteriology, 3 (Dairying, XVII.)
Butter Making, 3 (Dairying, XIV.)
Comparative Physiology, 2 (Veterinary Science, XXIII.)
Vegetable Pathology, 2 or 5 (Botany, V.)
Advanced Entomology, 3 to 5 (Botany, XIII.)
Agrostology, 2 (Agricultural Chemistry, XXVII.)
Chemistry, 4 (Botany, XIX.)
Evolution of Plants, 1 (Botany, IX.)
Geology, 5 (Geology, II.)
Analytic Geometry, 5 (Mathematics, VIII.)
History Political Economy, 2 (Economic Science, II.)
Political Economy, 3 (Economic Science, III.)
Psychology, 5 (Psychology, I.)
American Literature, 3 (Literature, IV.)
The Short Story, 2 (Literature, VI.)
Dramatic Art, 2 or (Public Speaking, V.)
Extemporaneous Speech, 2 (Public Speaking, X.)
Oration, 1 (Elocution, IX.)
French, 4 or (Language, III.)
German, 4 (Language, VII.)
History, National Expansion, 1783-1845, 3 (History, III.)
History, Diplomatic History of the United States, 2 (History, XII.)
Landscape Gardening, 2  (Horticulture, VIII.)
Military Science, 1  (Military, VII.)
Chemistry, 5  (Agricultural Chemistry, XXVII.)
Advanced Work in Soils, 2  (Agronomy, VII.)

SECOND SEMESTER.

Herd Books and Animal By-Products, 2  (Animal Husbandry, VII.)
Horse Shoeing, 2  (Veterinary Science, XVI.)
Conformation and Soundness, 2  (Veterinary Science, XVII.)
Animal Nutrition, 5  (Animal Husbandry, IX.)
Evolution of Animals, 1  (Zoology, VI.)

Elective.

Chemistry, 4  (Agricultural Chemistry, XXXIV.)
Dairying, 3  (Dairying, I.)
Cheese Making, 3  (Dairying, XV.)
Technology of Milk, 1  (Dairying, XVI.)
Rural Law, 1  (Civics, V.)
Advanced Forestry, 3  (Horticulture, XV.)
Advanced Entomology, 3 to 5  (Zoology, IX.)
Comparative Physiology, 2  (Veterinary Science, XXIV.)
Calculus, 5  (Mathematics, IX.)
Advanced Bacteriology, 3  (Botany, VIII.)
Vegetable Physiology, 2 or 5  (Botany, XI.)
Geology, 5  (Geology, IV.)
Ethics, 3  (Psychology, II.)
Novel and Romance, 3  (Literature, III.)
The Essay, 2  (Literature, VII.)
Advanced Dramatic Art, 2 or 3  (Public Speaking, VI.)
Advanced Extempore Speech, 2  (Public Speaking, XI.)
History, The Welding of the Nation, 1845-1900, 3  (History, IV.)
The Far Eastern Question, 2  (History, IX.)
Astronomy, 5  (Physics, VIII.)

Industrial Development of the United States.
Chemistry, 5  (Agricultural Chemistry, XXXIV.)
Advanced Work in Soils, 2  (Agronomy, VII.)
Military Science, 1  (Military, VIII.)

The following courses of study are given in Animal Husbandry:
Course I.—Market Types — Cattle and Sheep. — First Sem-
estern. Freshman year. This course covers the judging of the different market classes of cattle (beef and dual purpose), and sheep (mutton and wool.) Judging two 2-hour periods per week. Prof. Rutherford, Mr. Dinsmore, Mr. Smith, and Mr. Rubel.

**Course II.—Market Types—Dairy Cattle—Horses and Swine.**—Second Semester. Freshman year. This course covers the judging of the different market classes of dairy cattle; of horses (light and heavy); and swine (bacon and fat.) Judging two 2-hour periods per week. Prof. Rutherford, Mr. Dinsmore, Mr. Smith, and Mr. Rubel.

**Course III.—Breed Types — Cattle and Sheep.**—First Semester. Sophomore year. This course covers the judging of representatives of the different breeds according to their official standards; also a study of their origin, history and characteristics and adaptability to different conditions of climate and soil. Lectures two 1-hour periods per week. Judging two 2-hour periods per week. Professor Rutherford, and Mr. Dinsmore.

**Course IV.—Breed Types—Dairy Cattle—Horses and Swine.**—Second Semester. Sophomore year. This course covers the judging of representatives of the different breeds according to their official standards; also a study of their origin, history and characteristics, and adaptability to different conditions of climate and soil. Lectures two 1-hour periods per week. Judging two 2-hour periods per week. Only students who have a credit in Course I., or a credit showing that they have covered the same work in some other agricultural college, are eligible to Courses III and IV. Professor Rutherford, and Mr. Dinsmore.

**Course VI.—Advanced Livestock Judging.**—First Semester, Senior year. This course covers horses, cattle, sheep and swine. Special attention is paid to the judging of groups of animals, similar to county and state fair work. Judging two 2-hour periods per week. Only special or regularly enrolled students in Animal Husbandry who have credits in Courses I., II., III., and IV. are eligible to Animal Husbandry VI. Professors Kennedy and Rutherford.

**Course VII.—Animal By-Products and Herd Book Study.**—Second Semester. Senior year. The first sixteen weeks are devoted to the study of herd books, with a view to becoming acquainted with the pedigrees and the leading strains and families of the different breeds of livestock. The remaining four
weeks will be given to the study of the animal by-products of the packing houses. Two 1-hour periods per week. Students must have credit in Course VIII. in order to classify in Course VII. Professor Rutherford.

Course VIII. — Principles of Breeding. — First Semester, Junior year. This course embraces a study of the principles of breeding, including selection, heredity, atavism, variation, fecundity, with the presentation of the methods of breeding, in-and-in breeding, cross breeding, etc., and a historical study of their results. In addition, the several features relating to the higher breeding of pure bred stock are made the subject of study and investigation. Two 1-hour periods per week. Students must have credits in Courses III. and IV. in order to classify in Course VIII. Professors Kennedy and Rutherford.

Course IX.—Animal Nutrition.—Second Semester. Senior year. This course includes anatomy and physiology of the digestive system, the purpose of nutrition, the theory and practical economy of rations for growth, fattening, milk or maintenance; sanitation of feeds, and hygiene of the farm. Five 1-hour periods per week. Students must have Agricultural Chemistry, Courses 21, 23, 25 and 26, and 72 hours Comparative Physiology, 80 hours Organic Chemistry, and 50 hours Physiologic Chemistry. Professor Kennedy and Mr. Smith.

Course X.—Thesis and Investigation Work.—Senior year. Upon lines to be arranged with the head of the department, according to the nature of the subject. Professors Kennedy and Rutherford.

Course XI.—Livestock Management.—First Semester. Junior year. The housing, feeding, care and management of beef and dairy cattle. One-hour lecture and one 2-hour laboratory per week. Mr. Dinsfore.

Course XII.—Livestock Management.—Second Semester. Junior year. The housing, feeding, care and management of horses, hogs, and sheep. Mr. Dinsmore.
The Department of Horticulture has offices, classroom and library on the second floor of Agricultural Hall, a laboratory building 35 x 50 feet, two stories high with a nine foot basement, and greenhouses of the modern construction, containing over 5,000 square feet under glass.

The main floor of the laboratory is divided into two rooms and will accommodate fifty students. One of the rooms is especially fitted for the study of fruits, and opening from it are two refrigerators for the storing of specimens. The second floor contains photographic and dark rooms for the department, and the horticultural museum equipped with a full collection of horticultural implements and machinery. The museum also contains a large collection of fruit models and horticultural herbarium that is accessible to advanced students.

The greenhouses give every opportunity for the student to become familiar with the management of plants under glass, and the collection has been made with a view of representing species of the greatest educational value.

The department has a large library which is kept in the offices in Agricultural Hall and in addition to the complete files of horticultural publications of the country, possesses the private library of Charles Downing, the author of "Fruits and Fruit Trees of America," which contains many rare horticultural works, as well as his original notes and manuscript.

The land devoted to horticultural purposes comprises about forty acres. In this area are orchards of varying ages, from fifteen years down to those set within the last two years. The varieties of fruits on trial, number more than one thousand and include the hardiest types of native and foreign kinds. The student is thus afforded unusual facilities for observation and study. Adjacent to the orchards and small fruit plantations, are the nursery grounds where the operations of the nurseryman in the various methods of stratification, budding and grafting are illustrated in a practical manner. A considerable area is devoted each year to the growing of vegetables, and variety tests of the leading types are made in connection with the Experiment
Station work, thus affording ample opportunity for field study in the methods of culture practiced by the amateur and market gardener.

Within the past six years there has been a wonderful development throughout the country in the science of Forestry. Private lumber firms, railroads, and the United States government are constantly calling for young men trained in Forestry to carry on lumbering operations in a way that will insure future supplies, to study the question of the production of timber for ties, poles and posts, the preservation of timber, and for the more scientific work of the government in studying the general forest conditions of the country. To fill these various demands, a few colleges and universities, including this one, have established courses of instruction which will prepare young men for the above mentioned positions.

Iowa is largely a prairie state, yet there are excellent opportunities at this College for the study of planted groves, and of the native timber growing along near-by rivers and streams. It is the question of the formation and care of the farm wood lot which will produce on short rotations, the necessary fuel and posts for the farm that will be of prime importance in the development of forestry in the state, hence, a great deal of attention will be paid to the problems connected with farm forestry.

On the College grounds there are some ten acres of forest plantations in which there are to be found a large number of deciduous and evergreen trees which are known to be well adapted for planting in this and the surrounding prairie states. Several acres have been set apart for the establishment of exhibition plots of trees adapted to Iowa conditions. Portions of these plots will be planted in the spring of 1905. There are excellent examples of windbreaks and shelterbelt planting, both of native and foreign trees upon or near the campus which afford splendid opportunity for the study of the comparative value of the native and foreign kinds.

A collection of specimens of several hundred different species of woods, native to this country and tropical America, are available for study in the museum of the department and these are used for illustrating the lectures upon timber, its uses and identification. This collection has recently been enlarged by donations from the Philippine Islands and other possessions.
The library has recently added a large number of the best books on Forestry both from this country and abroad, and on the reading table of the department are to be found all of the best magazines and papers bearing upon the subjects of Forestry, Lumbering, and Game.

The graduate who completes this course will find himself well equipped in the technique and applied principles of Horticulture and Forestry. Graduates who desire to pursue postgraduate work, will find themselves well prepared to do so, either at this or other institutions of like character.

Particular stress is laid upon laboratory instruction and the facilities and equipment are exceptionally good for this phase of the work.

Text books are used as a basis for the work in most of the courses, supplemented by lectures.

**COURSES IN HORTICULTURE.**

**Academic Year.**

**FIRST SEMESTER.**

Algebra, 5  
English, 5  
History, Western Europe, 5  
Elementary Speech, 2

**SECOND SEMESTER.**

Advanced Algebra and Plane Geometry, 5  
Elementary Botany, 2  
Elementary Rhetoric, 5  
History, Advanced American, 4  
Gesture and Voice, 1

**Freshman Year.**

**FIRST SEMESTER.**

Live Stock and Score Card Practice, 2  
Home and Market gardening, 2  
German, 5 or  
French 5,  
Corn and Grain Judging, 5  
Advanced Rhetoric, 5  
History, English, 1  
Military, 2  
Library Work, 4 hours.

(Mathematics, XII.)  
(English, I.)  
(History, I.)  
(Public Speaking, I.)  
(Mathematics XIII. and V.)  
(Botany, I.)  
(English, II.)  
(History, II.)  
(Public Speaking, II.)  
(Animal Husbandry, I.)  
(Horticulture, I.)  
(Language, V.)  
(Language, I.)  
(Agronomy, I.)  
(English, III.)  
(History, XVII.)  
(Military, II.)
SECOND SEMESTER.

Live Stock and Score Card Practice, 2   Animal Husbandry, II.)
Plant Propagation, 3   (Horticulture, II.)
Solid Geometry, 2*   (Mathematics, VI. a.)
German, 5, or   (Language, VI.)
French, 5   (Language, II.)
Field Crops, 5   (Agronomy, II.)
Entomology, 2   (Zoology, I.)
Composition, 1   (English, IV.)
Military, 2   (Military, II.)
History, Formation of the Union, 1   (History, XVIII.)

Sophomore Year.

FIRST SEMESTER.

Orcharding, 3   (Horticulture, III.)
Farm Crops, 5   (Agronomy, III.)
Chemistry, 5   (Agricultural Chemistry, XXI.)
Botany, Ecology, 2   (Botany, II.)
Meteorology, 3   (Geology, I.)
Farm Dairying, 2   (Dairying, XII.)
Composition, 1   (English, V.)
Military, 2   (Military, III.)

SECOND SEMESTER.

Histology, 4   (Botany, III.)
Vegetable Cytology, 3 or 5, or   (Botany, XII.)
Systematic Botany, 3 or 5   (Botany, XV.)
Chemistry, 5   (Agricultural Chemistry, XXV.)
Forestry, 3   (Horticulture, XIV.)
Composition, 1   (English, V.)
Military, 2   (Military, VI.)

Junior Year.

FIRST SEMESTER.

Pomology, 2   (Horticulture, V.)
Economic Entomology, 5   (Zoology, IV.)
Chemistry, 4   (Agricultural Chemistry, XXV.)
Soils, 5   (Agronomy, V.)

*Graduates of accredited schools who are deficient in algebra, but have a grade in solid geometry, will take advanced algebra two hours in the Freshman Year in lieu of solid geometry.
Elective.

Histology, 2  (Veterinary Science, XXXIII.)
Physiology, 1  (Veterinary Science, XXI.)
Analytical Geometry, 5  (Mathematics, VIII.)
Photography, 2  (Physics, IX.)
Physical Laboratory, 1 or 2  (Physics, XIV.)
Cryptogamic Botany, 4  (Botany, IV.)
Geology, 5  (Geology, II.)
Political Economy, 5  (Economic Science, I.)
Drama, 3  (Literature, I.)
The Drama in Translation, 2  (Literature, VIII.)
Debating, 1  (English, VII.)
Advanced Interpretation, 2  (Public Speaking, III.)
German, 5, or  (Language, VII.)
French, 5  (Language, III.)
Military Science, 1  (Military, VI.)
Europe in the 16th, 17th and 18th Centuries, 3  (History, V.)
The Renaissance, 2  (History, X.)

SECOND SEMESTER.

Forestry, 3  (Agriculture Chemistry, XXVI.)
Bacteriology, 2  (Agronomy, VI.)
Plant Breeding, 3  (Botany, VII.)
Greenhouse Management, 3  (Botany, IV.)
Soils, 5  (Horticulture, XV.)

Elective.

Comparative Physiology, 1  (Veterinary Science, XXII.)
Chemistry, 4  (Agronomy, XI.)
Improvement of Farm Crops, 2  (Public Speaking, VIII.)
Advanced Public Speech, 1  (Botany, XII.)
Vegetable Cytology, 3 or 5  (Botany, III.)
Histology, 4  (Geology, VI.)
Mineralogy, 4  (Mathematics, VII.)
Plane Trigonometry, 3  (Economic Science, V.)
Finance, 3  (Economic Science, IV.)
Money and Banking, 2  (Literature, II.)
Epic and Lyric Poetry, 5  (Public Speaking, IV.)
Expression in Oratory, 2  (Language, IV.)
French, 5, or
German, 5
Debating, 1
Rural Architecture, 4
History, French Revolution and XIXth Century, 3
History, Constitutional History of England, 2
Military Science, 1
Soils, 2
Botany, Economic, 2
Agricultural Economics, 5

Senior Year.

FIRST SEMESTER.

Landscape Gardening, 2
Research Work, 2
Advanced Entomology, 3 to 5
Vegetable Pathology, 3 to 5

Elective.

Dairy Bacteriology, 3
Buttermaking, 3
Comparative Physiology, 2
Farm Management, 5
Agrostology, 2
Geology, 5
Analytic Geometry, 5
Political Economy, 3
History of Political Economy, 2
Psychology, 5
American Literature, 3
The Short Story, 2
Evolution of Plants,
Advanced Crypt. Botany, 3
Dramatic Art, 2, or
Extempore Speech, 2
Oration, 1
Chemistry, 5
Military Science, 1
History, National Expansion, 1783-1845, 3
History, Diplomatic History of the United States, 2
Soils, 2

(Language, VIII.)
(English, VIII.)
(Agronomy, XIII.)
(History, VI.)
(History, XI.)
(Military, VI.)
(Agronomy, VII.)
(Botany, X)
(Economics VIII.)
(Horticulture, VIII.)
(Horticulture, IX.)
(Zoology, IX.)
(Botany, V.)
(Dairying, XVII.)
(Dairying, XIV.)
(Veterinary Science, XXIII.)
(Agronomy, VIII.)
(Botany, XIII.)
(Geology, II.)
(Mathematics, VIII.)
(Economic Science, III.)
(Economic Science, II.)
(Psychology, I.)
(Literature, IV.)
(Literature, VI.)
(Botany, XIX.)
(Botany, VI.)
(Public Speaking, V.)
(Public Speaking, X.)
(Elocution, IX.)
(Agricultural Chemistry, XXVII.)
(Military, VII.)
(History, III.)
(History, XII.)
(Agronomy, VII.)
SECOND SEMESTER.

Literature of Horticulture, 2  
Vegetable Physiology, 2  
Forestry, 3  
Thesis, 2

(Horticulture, X.)  
(Botany, XI.)  
(Horticulture, XVI.)  
(Horticulture, XIII.)

Elective.

Animal Nutrition, 5  
Comparative Physiology, 2  
Technology of Milk, 1  
Advanced Entomology, 3 to 5  
Calculus, 5  
Advanced Bacteriology, 3  
Ethics, 3  
Novel and Romance, 3  
The Essay, 2  
Advanced Dramatic Art, 2  
Geology, 5  
Advanced Extempore Speech, 2  
Chemistry, 5  
Military Science, 1  
Rural Law, 1  
Soils, 2  
History, The Welding of the Nation, 1845-1900, 3

(Animal Husbandry, IX.)  
(Veterinary, XXIV.)  
(Dairying, XVI.)  
(Zoology, IX.)  
(Mathematics, IX.)  
(Botany, VIII.)  
(Psychology, II.)  
(Literature, III.)  
(Literature, VII.)  
(Public Speaking, VI.)  
(Public Speaking, XI.)  
(Agricultural Chemistry, XXXIV.)  
(Military, VIII.)  
(Civics, V.)  
(Agronomy, VII.)

COURSES IN HORTICULTURE.

FIRST SEMESTER STUDIES.

Course I.—Home and Market Gardening.—This course is a study of the small fruits and vegetables. It takes up the principles of culture, methods of harvesting and marketing, and the practical details of home and market gardening. Two recitations per week. Required of all Agricultural students in the First Semester of the Freshman year. Mr. Merritt.

Course III.—Orcharding.—Under this subject is studied the principles and practices of orcharding. The establishment and maintenance of home orchards and commercial plantations, is considered. The work is designed primarily for the Agricultural student who expects to engage in general farming hence a large
portion of the time is devoted to the home orchard and its problems. In the laboratory, the leading types of orchard fruits are studied. Each student is furnished fresh specimens of the important varieties for description and score card work. This is followed by a discussion regarding its adaptability to the various sections of the state, its season, hardiness and other characteristics. Two recitations and one laboratory. Required of all Agricultural students in the First Semester of the Sophomore year. Professor Erwin and Mr. Merritt.

Course V.—Pomology.—This is a course in systematic Pomology and is devoted to the study of orchard fruits, their origin, history and synonyms. Special attention is given to the important commercial types. Course III. is a pre-requisite to this work. Required of Horticultural students in the First Semester of the Junior year. One laboratory and one recitation per week. Professor Beach.

Course VIII.—Landscape Gardening.—This course embraces the principles of Landscape Gardening, the planting and decoration of home grounds, parks, etc. A systematic study is also made of the materials most suitable for planting in Iowa. On the College campus and in the Horticultural Department grounds, is to be found a large collection of ornamental trees and shrubs which afford excellent laboratory material for this work. First Semester of the Senior year. Required in the Horticultural course, and elective to other Agricultural students. Two hours per week. Professor Erwin.

Course IX.—Research.—This course affords an opportunity for students to carry on a special line of investigation which is mapped out and carried on independently by the student under the supervision of the head of the department. Required of Horticultural students in the First Semester of the Senior year. Two hours per week. Professor Beach.

Course XI.—Amateur Floriculture.—This course embraces a study of the propagation and general management of house plants, outdoor flower beds and ornamental shrubs. A systematic study of annuals, herbaceous perennials, bulbs, climbers, and house plants is also included in the course. This course requires no pre-requisite work in Horticulture and is an elective in the General and Domestic Science and required in Domestic Science in the First Semester of the Junior year. Two hours per week. Professor Erwin.
SECOND SEMESTER STUDIES.

Course II. — Plant Propagation. — The course embraces a study of the principles of plant growth as affected by moisture, temperature, and food supply. Propagation of plants by seedage, cuttage, layerage, and graftage is studied. Laboratory work is given in the various methods of propagation, both in greenhouse and nursery. Required of all Agricultural students in the Second Semester of the Freshman year. Two recitations and one laboratory period per week. Professor Erwin and Mr. Merritt.

Course IV. — Plant Breeding. — Perhaps no subject in the field of Agriculture is attracting more attention today than that of plant improvement. Plant Breeding is governed by certain fundamental principles. In this course, study is first made of the underlying principles governing the amelioration and breeding of plants and second, the direct application of these principles to the field of Horticulture. The methods of Knight, Van Mons, Mendel and other prominent plant breeders are studied. A systematic survey is also made of what has already been accomplished in this work in the field of Horticulture. Required of Horticultural students in the Second Semester of the Junior year, and elective for other students in Agriculture. Three hours per week. Professor Beach.

Course VII. — Greenhouse Management. — A study of the construction and heating of greenhouses, a systematic study of the more important greenhouse plants and methods of culture; also the forcing of vegetables in both greenhouses and hot beds. Laboratory work embraces the practical details of propagation and care of plants in greenhouses. Required of Horticultural students in the Second Semester of the Junior year. Two recitations and one laboratory per week. Mr. Merritt.

Course X. — Literature of Horticulture. — This course is designed to familiarize the student with the ancient and modern workers in the field of Horticulture. It embraces the study of the lives and accomplishments of the past workers in the field of American Horticulture and also the leading ones of the old world. Required of Horticultural students and elective to others. Second Semester. Senior year. Two hours per week. Professor Erwin.

Course XIII. — Thesis. — A subject shall be chosen under the
direction of the head of the department, which requires original work of investigation. After the subject has been thoroughly studied, a complete write up of the results is made. All required courses in Horticulture except those given in the Second Semester Senior are pre-requisites of this course. A subject for investigation may be chosen for Course IX and the work continued in Course XIII. Required of Horticultural students in the Second Semester of the Senior year. Two hours per week. Professor Beach.

COURSES IN FORESTRY.

Course XIV.—Elementary Forestry.—In this course short studies are made of the life history of a tree, influences of forests upon climate and the erosive action of streams, distribution of trees in the United States, and tree planting in Iowa, with special attention given to the formation, growth, and care of windbreaks and farm woodlots. The structure and uses of our common timber and methods of artificial preservation are dealt with briefly. Text book, Elementary Forestry, by Greene. This course is required of all students in Horticulture and Agronomy. Three hours per week, second Semester, Sophomore. Professor Baker.

Course XV.—Silviculture.—During the Second Semester of the Junior year, the work begun in Course XIV. will be continued. Special attention will be given to the distribution and character of our native forests, factors of tree growth and various phases of tree planting, such as collection and storage of seed, choice of species to plant, and methods of planting in reference to Iowa conditions, the protection of growing timber from the usual enemies of trees. The study of forest measurements will be given some attention, especially methods of determination of contents of single trees and forests as a whole, with the rate of growth of trees, etc. Field work will be given in connection with the lectures in which summer and winter characters of the trees will be studied. Required of all Horticulture students and elective to others. Three hours per week. Professor Baker.

Course XVI.—Forest Management and Policy.—This work will cover the various phases of forest management, such as the different methods of reproduction, thinning, and final cutting
of the forest, valuation of forest crops, and practical studies of
the Iowa farm woodlot. Methods of identification of our common
commercial timbers with their principal uses will also be taken
up. Under the head of forest policy, brief studies will be made
of the attitudes of nations toward forests, ownership of forests,
relation of forests to water supply, and history of forestry in the
United States, with notes upon the Government Bureau of
Forestry and its work. Required of all Horticulture students
and elective for others who have completed Courses XIV. and
XV. Three hours per week. Second Semester, Senior year. Profes-
sor Baker.

Course XVII.—Wood Technology.—This course will be an
elective for students in the Civil and Mechanical Engineering
and other departments, and will be a study of the common
timbers found upon the market. The work will consist of the
studies of the gross structure of woods and methods of identifi-
cation of timber which the student can use outside of the labor-
atory; also the uses of common timbers and minor forest
products, and the decay of timber with methods of preservation.
Two hours of field work will be given in which the summer and
winter characteristics of the common trees will be studied.
Three hours per week during Second Semester, Senior year.
Professor Baker.

GRADUATE WORK.

The department of Horticulture and Forestry offers graduate
work along the following lines.

Horticulture.

(a.) Pomology.—The orchards of the department, which
contain over two hundred and fifty varieties of apples, one
hundred and fifty varieties of plums, and fifty varieties of
cherries, furnish abundant material for the specialist who desires
to make a comparative study of varieties. In addition to this,
the department possesses the private library of Charles Downing
and his unpublished manuscript notes and descriptions; also
several hundred catalogue descriptions of fruit that have been
made in the last few years in the department.

(b) Plant Breeding.—For many years systematic plant
breeding has been carried on by the department. The results
of this work can be seen in all stages from the young plants
just starting to grow to those that have been fruiting or flower-
ing for many years. The department each year carries on
extensive work in plant breeding in connection with the
State Horticultural Society which offers exceptional opportunity
for study and field experience by the specialist. The department
is equipped with incubators, microscopes and other apparatus
for laboratory investigations.

Forestry.

The last census returns show that Iowa has less than 12%
of wooded area. This condition explains why we are so essen-
tially a prairie state and as such, there are very many new and
unsolved problems in tree planting and the reproduction and
care of the areas of native timber. Examples of what are typical
conditions throughout the State are found on or near the cam-
pus, hence we feel that there is splendid opportunity for research
and graduate work along the lines outlined below. The depart-
ment has in its museum, several hundred different kinds of
native and foreign woods and this collection has recently been
greatly enlarged by specimens from the Philippine Islands and
surrounding states of this country. An herbarium of forestry
specimens is being built up which will aid the student much in
identification of our native trees.

(a.) Problem of Tree Planting.—Some ten acres of planted
groves on the campus, of both deciduous and broad leaved
specimens, and numerous groves and windbreaks in the imme-
diate region, present excellent opportunities for studies in the
adaptation of a large number of native and introduced species
to our various soil and climatic conditions. Also, methods of
collection, storage, and germination of the seed of these trees
with the treatment of the seedlings in the nursery, the rate of
growth as seedlings and as mature trees. There is a wide field
for the study of the formation and care of windbrakes and
farm woodlots, their value for the production of fuel, posts and
lumber and the influence of their protection on orchards, or-
dinary field crops and ornamental tress and shrubs.

(b.) Studies of the Native Timber Growth.—The scattered
and open growth of native timber along Squaw Creek and
Skunk River provides for numerous lines of interesting study
such as the problem of the reproduction and care of these areas
of native timber and the determination of their value to farmers
and stockmen for protection against erosion, severe winds, and for commercial purposes such as the production of fuel, posts and lumber. There is need of a more complete study of methods of protection of both native and planted timber against over-grazing and trampling by stock as well as from fires, and insects and fungi which usually follow the fires.

(c.) Prevention of Erosion and Reclamation of Flood Damaged Lands by Tree Planting.—This line of investigation will cover a thorough study of various trees that are best adapted for the holding of stream banks against the erosive action of floods, and high water. Methods of planting and the care of these trees and practical studies of various methods of reclamation by planting, of lands whose value has been destroyed by high waters and floods.

(d.) Studies in the Artificial Preservation of Timber.—Within the year, a series of experiments has been undertaken in co-operation with the United States Bureau of Forestry in the investigation of several methods of the artificial preservation of various soft-wooded fence posts such as willow, cottonwood, soft maple and box elder. The first work in these experiments will be the use of a shallow open tank for the impregnation of these fence posts with tar oil and as the work will be under way for a year, there will be opportunity for original investigation along these lines.

**SCIENCE AND AGRICULTURE.**

The field of Agriculture is undergoing such rapid changes and there is such wide and varied demand for men combining agricultural and scientific training that it has been deemed advisable to add a course rather less technical than the four preceding courses that relate directly to these special lines of agriculture. This course is designed to meet the demands of country agricultural high schools and other institutions, public and private, established for the purpose of giving instruction in the general sciences, and elementary instruction in agriculture. The introduction of agriculture into the rural schools has received a marked impetus during the past few years. There will doubtless arise a large demand for strong, broadly educated, well trained teachers for this and other kinds of agricultural instruction in public and preparatory schools.
COURSE IN SCIENCE AND AGRICULTURE.

Academic Year.

FIRST SEMESTER.

Algebra, 5
English, 5
History, Western Europe, 5
Elementary Speech, 2

(SECOND SEMESTER.

Advanced Algebra and Plane Geometry, 5
Elementary Botany, 2
Elementary Rhetoric, 5
History, Advanced American, 4
Gesture and Voice, 1

Freshman Year.

FIRST SEMESTER.

Live Stock and Score Card Practice, 2
Home and Market Gardening, 2
German, 5, or
French, 5
Advanced Rhetoric, 5
History, English History, 1
Military, 2
Library Work, 4 hours.

(SECOND SEMESTER.

Live Stock and Score Card Practice, 2
Plant Propagation, 3
Solid Geometry, and Trigonometry, 5
German, 5, or
French, 5
Composition, 1
Entomology, 2
History, Formation of the Union, 1
Military, 2
Sophomore Year.

FIRST SEMESTER.

Orcharding, 3  
Botany, Ecology, 2  
Chemistry, 5  
Meteorology, 3  
Farm Dairying, 2  
Farm Mechanics, 5  
Composition, 1  
Military, 2

(Horticulture, III.)  
(Botany, II.)  
(Agricultural Chemistry, XXI.)  
(Geology, I.)  
(Dairying, XII.)  
(Agronomy, III.)  
(English, V.)  
(Military, III.)

SECOND SEMESTER.

Histology, 4  
Systematic Botany, 3 to 5  
Forestry, 3  
Chemistry, 5  
Composition, 1  
Military, 2

(Botany, III.)  
(Botany, XV.)  
(Horticulture, VI.)  
(Agricultural Chemistry, XXIII.)  
(English, VI.)  
(Military, IV.)

Junior Year.

FIRST SEMESTER.

Chemistry, 4  
Soils, 5  
(Agricultural Chemistry, XXV.)  
(Agronomy, V.)

Elective.

Principles of Breeding, 2  
Advanced Pomology, 2  
Economic Entomology, 5  
Vertebrate Zoology, 4 or 5  
Live Stock Management, 2  
Histology, 2  
Physiology, 1  
Shop Work, 1  
Analytical Geometry, 5  
Surveying, 4  
Photography, 2  
Physical Laboratory, 1 or 2  
Cryptogamic Botany, 4  
Geology, 5

(Animal Husbandry, VIII.)  
(Horticulture, V.)  
(Zoology, IV.)  
(Zoology, II.)  
(Animal Husbandry, XI.)  
(Veterinary Science, XXXII.)  
(Veterinary Science, XXI.)  
(Mechanical Engineering, XXXVIII.)  
(Mathematics, VIII.)  
(Civil Engineering, VIII.)  
(Physics, IX.)  
(Physics, XIV.)  
(Botany, IV.)  
(Geology, II.)
Political Economy, 5
Drama, 3
The Drama in Translation, 2
Debating, 1
Advanced Interpretation, 2
German, 5, or
French, 5
History, The 16th, 17th and 18th Centuries, 3
History, The Renaissance, 2
Military Science, 1

SECOND SEMESTER.

Forestry, 3
Bacteriology, 2
Soils, 5

Elective.

Economic Botany, 2
Vegetable Cytology, 3 to 5
Invertebrate Zoology, 4 or 5
Live Stock Management, 2
Embryology, 3 to 5
Greenhouse Management, 4
Chemistry, 4
Physiology, 1
Advanced Public Speech, 1
Roads and Pavements, 2
Calculus, 5
Farm Mechanics, 5
Systematic Botany, 3 to 5
Mineralogy, 4
Finance, 3
Money and Banking, 2
Epic and Lyric Poetry, 5
Expression in Oratory, 2
French, 5, or
German, 5
Debating, 1
History, The French Revolution and to XIXth Century, 3
Senior Year.

FIRST SEMESTER.

Landscape Gardening, 2
Vegetable Pathology, 3 to 5

Elective.

Advanced Entomology, 3 or 5
Research Work, 2
Chemistry, 4
Dairy Bacteriology, 3
Butter Making, 3
Comparative Physiology, 2
Farm Management, 5
Agrostology, 2
Geology, 5
Political Economy, 3
History of Political Economy, 2
Psychology, 5
American Literature, 3
The Short Story, 2
Dramatic Art, 2, or
Extempore Speech, 2
Oration, 1
Advanced Cryptogamic Botany, 3
History, National Expansion, 1783-1845, 3
History, Diplomatic History of the United States, 2
Evolution of Plants, 1
Military Science, 1

SECOND SEMESTER.

Evolution of Cultivated Plants, 2
Vegetable Physiology, 2

Elective.

Chemistry, 4
Evolution of Animals, 1
The aim of the work in Agricultural Chemistry is twofold; namely, to give the student a fundamental knowledge of chemistry, and then to apply this knowledge to the chemical problems of agriculture.

A sufficient amount of time during the first year and a half of study is applied to the acquiring of chemical principles and relations, yet at the same time the application of these facts is considered and constitutes a portion of the work. In other words the study of the science of chemistry accompanies its application to agricultural questions. The later work of the courses is principally devoted to applied chemistry.

The courses of study open to the undergraduate student are briefly described as follows:

Course XXI.—Elementary Experimental Chemistry.—This is the introductory work for the students in the agricultural courses
and is intended to give knowledge of matter by actual handling and experience with it. The recitations are upon the laboratory work for the purpose of obtaining a first-hand knowledge of chemical changes. The student learns how, and the necessity for taking notes of useful data, how to interpret these facts and apply them to common chemical changes that are going on in nature. The course includes a study of the so-called non-metallic elements that are present in the air and soils, etc. There are three recitations and two afternoons of laboratory practice per week. First Semester, Sophomore year.

Course XXIII.—This course is a continuation of Course XXI, dealing with the metallic elements and their relation to those studied in the preceding Semester. In this course the student becomes acquainted with the basic elements in the soil and their relation to non-metallic compounds, i.e., the acids and their place in the formation of salts. He learns how to separate and recognize these elements, their compounds, preparatory to determining them quantitatively. Three recitations and two afternoons of laboratory work are required each week. Second Semester, Sophomore year.

Course XXV. — Organic Chemistry. — This course follows regularly Courses XXI. and XXIII. and deals with substances produced by animal and plant life. The laboratory study brings the student in touch with the properties and methods of preparing organic food material. The sugars, starches and proteids, the simpler food material will be studied and at the same time the fundamentals of organic chemistry will be required. The work is divided into two recitations and two laboratory periods per week, during the First Semester, Junior year.

Course XXVI.—Chemistry Applied to Agriculture.—This work will be introduced in the laboratory study by quantitative analysis of inorganic substances followed by analyses of soils, fertilizers and other inorganic substances related to agricultural processes. The recitation work, two hours per week, will follow the laboratory practice and be accompanied by text book and lecture study.

Course XXVII.—Chemistry Applied to Agriculture.—This course will consider in an elementary manner the organic phase of Agricultural Chemistry and will deal with the chemical changes in foods during digestion and assimilation, and the changes that occur in the plant and animal body. Some time
will be devoted to dairy products and especially to the methods of analyzing such substances for adulteration. Laboratory practice will occupy two afternoons per week.

Course XXVIII.—Dairy Chemistry.—Lectures and laboratory practice. This course is for students in the one year course in dairying, and will be arranged to fit the needs and the preparation of such students, but it will be an elementary character throughout. ·First Semester.

Course XXIX.—Continuation of Course XXVIII. Second Semester.

Course XXXIV.—This is a continuation of Course XXVII. It is expected that the student electing this work will take up some special line of investigation as a result of the work done in the courses that have preceded it. The requisite courses are XXI, XXIII, XXV, XXVI, XXVII. For example, the student may desire to investigate somewhat fully the kind and character of organic matter in fertile soils; the effect of the composition of food on the composition of milk, as a whole or as to any of its constituents; changes in the composition of cheese during ripening, etc. This course is intended to take the student into the subject as far as can be profitably done by the undergraduate.

The time devoted to the subject is not less than three hours nor more than five hours per week in the second semester of the senior year. The work is largely done in the laboratory but is supplemented by consulting authorities and conferences with the instructor.

Graduate Work in Agricultural Chemistry.

Advanced work in agricultural chemistry leading to the master's degree in scientific agriculture may be selected either as a major or minor study. This work may be taken in the chemical department as a continuation of the work begun as an undergraduate of this college or any other college of equal rank. Or the student may elect to do this work with the chemical section of the experiment station thus coming in touch with the research work and investigations being carried on there. The following courses of graduate work are offered:

Course I.—Chemistry of Soils.—This course embraces a study in soil chemistry and its relation to plant life, including the chemical composition, its relation to fertility, the determination of available plant food, fertilizers and other substances which
are effective in the production of crops, also the study of rain and drainage waters, the loss of plant food due to improper drainage and other conditions.

Course II.—Chemistry of Dairying.—This work will cover a general survey of the field of chemistry applied to dairy problems such as the composition and chemical changes of butter, milk and cheese, and also other oils and fats used as food products and for adulteration.

Course III.—Chemistry of Feeds.—This course includes a careful study of the chemistry of plants and field crops, such as the chemical composition of corn, wheat and oats, methods of modifying and improving the chemical composition by selection and plant breeding, chemical study of growing plants during the various stages of development, etc., the effects of various elements in the soil on the composition and quality and the yield or productiveness of the grain and forage crops. The study of the chemical composition and nutriments of the various refuse and by-products used for stock feeding.

Course IV.—Chemistry of Horticulture.—This course includes a careful study of the chemical composition of fruits including the influence of various elements present in the soil on the composition, quality and productiveness of the orchard, vineyard or garden; also the influence of climatic conditions upon the composition and quality of fruits, and the influence of selection and breeding.

Courses in Botany.

L. H. PAMMEL, PROFESSOR; R. E. BUCHANAN AND E. D. VOGEI, ASSISTANTS.

Many of the contagious diseases of animals depend upon a knowledge of bacteriology. A knowledge of the products of the farm, such as grasses, clovers, and potato, from a botanical standpoint is important. It is not necessary here to enumerate the various lines of botany and its relation to agriculture, suffice it to say that the subject is so important that botany occupies a very prominent place. The department is well equipped to carry on the various phases of the work. The courses in botany are grouped under the following heads:

Course I.—Elementary Botany.—This embraces a study of the morphology of flowering plants. The work covered is essentially found in Leavitt’s Lessons or Bergen’s Botany. Credit will not
be given in this work in the college unless there is evidence of having pursued laboratory work in the high school.

Course II.—Ecology.—In this course special attention is given to the relation of plants and their environment, much time being devoted to the pollination of flowers, especially of our economic plants, and the dissemination of the plants, especially how our weeds are scattered. Two hours. First Semester. Sophomore year.

Course III.—Histology.—In this course the student studies the minute structure of plants. In the lectures a discussion of the cell, its parts and constituents, how cells multiply, tissue and tissue systems. These subjects are studied in the light of modern investigations. Three lectures and one laboratory. Four hours. Second semester. Sophomore year.

Course IV.—Cryptogamic Botany.—The first semester of the Junior year is devoted to the study of cryptogams from a systematic standpoint. Special attention is given to "rusts," "smuts," and "mildews." The morphology and life history of the different groups of cryptograms are considered. Lectures and laboratory, with frequent excursions. Four hours. First semester. Junior

Course V.—Vegetable Pathology.—In this course plant diseases of the farm, garden and horticultural crops are taken up. In this course, lectures on the more injurious of the fungus diseases of cultivated plants are considered in a more extended way than is possible in Course IV. The theory of immunity and prevention of diseases, rotation of crops and fungicides are considered. In this course the diseases are treated from the standpoint of the host plant. First semester. Senior year. Two or five hours.


Course VI.—Advanced Course in Cryptogamic Botany.—An advanced course in cryptogamic botany is given, especially with reference to the injurious fungi such as rusts, smuts, molds and mildews. Three hours.

Course VII.—Bacteriology.—Bacteriology bears an important relation to many different agricultural problems. In Course VII special attention is given to the technique of the subject, the making of media and the growing of ordinary saprophytic bacteria with special lectures on the diseases of animals and the
classification of bacteria. Second Semester, Junior year. Two hours.

Course VIII.—Advanced Bacteriology.—This is an elective study, special attention being given to the study of the more intimate relations of bacteria to agriculture, such as bacteria of the soil and water. Second Semester, Senior year. Three hours.

Course X.—Economic Botany.—In this course special attention is given to our cultivated plants, and especially to those used as food, such as cereals, clovers, etc. Lectures and laboratory work. Two hours.

Course XI.—Vegetable Physiology.—A course of lectures with demonstrations on the functions of plants, nutrition, growth, movements and reproduction of higher plants. Lectures and laboratory. Second Semester, Senior year. Two hours.

Course XII.—Vegetable Cytology, and Micro-technique.—A study of the cell, and its division in lower and higher plants. The use of reagents and staining, methods of sectioning and mounting. Recitation and laboratory work. Second Semester, Senior year. Three hours.

Course XIII.—Agrostology.—This course is an elective one. It is intended to give the student a general idea of some of the more important grasses, not only with reference to their botanical position, but also with reference to their economic uses, especially meadow and pasture grasses; the cereal food products, grasses in medicine, grasses as soil binders, and grasses for lawn and lawn making. Lecture and laboratory work. First Semester, Senior year. Two hours per week.

Course XIV.—Seeds and Seed Testing.—A short course embodying the principles of seed testing is given. The principal agricultural weed seeds and their detection in commercial seeds, as well as the structural characters of the more important commercial seeds are studied. The germinative energy of various seed and such other features as are important in connection with seed testing are considered. First Semester, Senior year. Two hours.

Course XV.—General Systematic Phanerogams.—This course takes up a systematic study of Phanerogams. In the lectures, the sequence given in Engler's Syllabus is used, special attention being given to the horticultural, dendrological and agricultural plants. In the laboratory the student becomes familiar with the
more important of the plants taken up. Each plant is written up from the following view points: History, description, ecology, and economic value. Second semester. Junior year. Three or five hours.

Course XIX.—Evolution of Plants.—A course of lectures dealing with evolution as applied to plants, theories of evolution, heredity, mutation, Mendel's laws, present and past distribution. Senior year, First Semester. One hour.

Agricultural Economics.

Course VIII.—Within the whole range of economics there is no richer field of opportunity than this; it is almost entirely unworked, and the materials for study are abundant. There is hardly a more complex industry than farming and none in which economic principles can be better illustrated. On the other hand there is no industry where the economic student can more easily find an occasion for the application of economic principles to concrete problems. In view of these facts the course will begin with a study of the principles of economics, which will, of necessity, occupy a considerable part of the time for a semester. But illustrations and examples from agriculture will be used throughout. Following this a study of the history of agriculture will be made, giving particular attention to the United States. This in turn is to be followed by a study of the problems of agriculture, such as: Rent, Leasing, Land Ownership, Farm Credit, Farm Labor, Tariffs In Relation to Agriculture, Taxation of Land, Relation of the State to Agriculture, State Aid and Control in Irrigation and in Forestry.

It will not be possible to do more than make a good beginning in so extended a field in one semester, but it is hoped that the way will be open to offer something further in the near future.

Courses of this kind are being introduced in many of our leading colleges and universities and an earnest student will find abundant opportunity to turn his efforts to use in this field. Five hours. Second semester. Elective for juniors in agricultural courses. Dr. Hibbard.

Comparative Anatomy.

Prepared for students in Animal Husbandry (Veterinary Science, 55), and comprises lectures from models and prepared
specimens, recitations and practical work in dissection. This course is given during the First Semester, Senior year. Dr. McNeall.

The Agricultural Club.

A Students' Agricultural Club holds weekly meetings in Agricultural Hall for the consideration of current topics in agriculture. A students' reading room is also maintained there, and all the leading agricultural journals are kept on file for the use of agricultural students. The College Library contains an extensive list of agricultural and scientific publications to which students are referred for original research and study.

There are seven societies that hold their weekly meetings on Saturday evenings and serve to supplement the literary work of the College. All students are urged to join in the work of the Agricultural Club and advised to join one of the literary societies and to avail themselves of these other adjunct means of instruction. The faculty of clear and concise thinking and speaking is of incalculable value to the agricultural student.

Remunerative and Instructive Labor.

The Agricultural courses afford opportunity to do considerable work in the fields and about the barns and grounds. The compensation for services of this kind ranges from 8 to 15 cents per hour, according to the merit of the work. Students are thus able to earn from one-fourth to one-half their expenses and at the same time materially strengthen the practical side of their education. A number of the strongest and most capable students have been aided in finding employment during vacations with successful stockmen on good farms and in various other positions in line with their chosen lines of work. Some young men have preferred to take a year of practical work in this way during their course, and it has invariably proved of marked benefit and enabled them to command more desirable and remunerative positions at the completion of their college work. Too much emphasis cannot be placed on a thorough understanding of the practical application of correct principles in agriculture.

Special Courses.

Students desiring shorter courses of study will be permitted to take up special courses in accordance with the general
regulations governing such work and subject to the approval of the Dean of the Division of Agriculture and the President of the College.

Such courses may cover a period of one term, one year or two years, but special students are advised to take not less than one year's work in any chosen branch and in all cases where practicable or possible to do so, students are urged to complete the four years' course. The results will fully justify the time and expense required and modern agriculture demands thorough training, special fitness, and a high order of ability. No degrees are granted for less than four years' work.

Graduate Courses.

Special facilities are offered for Graduate work in the following lines as described under the head of graduate work in the several departments:

1. Agronomy, major or minor in
   (a) Farm Crops.
   (b) Farm Mechanics.
   (c) Soils.
   (d) Farm Management.

2. Dairying.
   (a) Dairy Bacteriology.
   (b) Dairy Research.
   (c) Factory Management.
   (d) Cheese Making.
   (e) Milk Production.

   (a) Animal Nutrition.
   (b) Animal Breeding.
   (c) Study of Breeds.
   (d) Stock Judging.
   (e) Practical Management of Stock.

4. Horticulture, major or minor in
   (a) Pomology.
   (b) Plant Breeding.
   (c) Greenhouse Work.
   (d) Forestry.

5. Agricultural Chemistry, major or minor in
   (a) Chemistry of Soils.
   (b) Chemistry of Dairying.
   (c) Chemistry of Fields.
   (d) Chemistry of Horticulture.
The four years' course leads to the degree of B. S. A., Bachelor of Scientific Agriculture. Graduate Students are eligible for the degree of M. S. A., Master of Scientific Agriculture. This degree is granted only to students who have completed a four year course in this or some similar college and completed a two year graduate course in scientific and practical agriculture, one year of which must be resident work at this College. The work required for a post graduate degree is largely in the nature of personal research and investigation under the direction of professors in charge of the studies chosen.

Credits For Practical Work.

Agricultural students who, by previous agreement with the head of the department, do practical work on farms, horticultural or feeding or breeding establishments, beet sugar factories or forestry reservations, of recognized standing, during their course of study will be allowed credits on the following basis: Students who take practical work of the kind described under the direction of the proprietor and render competent and faithful service, will, on their return to College and the presentation of a concise written report or resume of their observations and experience, be entitled to the following credits in the four year courses in Agriculture:

For three months, five hours of elective work in the Junior or Senior year; for six months, eight hours; and for one year, ten hours; no more than five hours of which shall be credited in any one term of the College course.

Positions.

The demand for competent young men thoroughly trained in practical and scientific agriculture and dairying exceeds the supply. We are in constant receipt of inquiries for men combining college training with practical experience, good sense and native ability. There appears to be no limit to the demand for the right kind of men and the compensation for such service is not exceeded in any other calling. In view of this demand for well trained men in the field of agriculture, students are urged to take a full four years' course, supplemented with extensive practical work and observation. To this end, a number of our best students have taken a term or a year out during their course on some of the
best farms of this and other states; and many have secured employment during vacations in large dairy and horticultural establishments where the most valuable practical experience can be acquired. The importance of this feature of preparation cannot be overestimated and it is urged and recommended even where young men are entirely familiar with ordinary agricultural work. It enables the student to derive more benefit from his course in college and fits him for a better and more lucrative position after graduation.

**Department of Agriculture Scholarship.**

The State Department of Agriculture offers a scholarship prize of $200.00, open to young men of the state not enrolled as a regular or special student in any agricultural college, without barring students of the special short courses in January. This scholarship is to be awarded for the best work in judging live stock and corn annually at the state fair in accordance with the rules and conditions prescribed by the state department of agriculture governing this contest.
EXPERIMENT STATION
EXPERIMENT STATION STAFF

A. B. STORMS, M. A., D. D.,
President.

C. F. CURTISS, B. Sc., M. S. A.,
Director.

W. J. KENNEDY, B. S. A.,
Animal Husbandry and Vice Director.

SPENCER A. BEACH, B. S. A.,
Horticulturist.

L. G. MICHAEL, B. Sc.,
Chemist.

L. H. PAMMEL, B. Ag., M. Sc., Ph. D.,
Botanist.

H. E. SUMMERS, B. S.,
Entomologist.

G. L. McKAY,
Dairying.

P. G. HOLDEN, M. Sc., B. Pd.,
Agronomist.

W. H. STEVENSON, A. B.,
Soils.

C. J. ZINTHEO, B. Sc.,
Farm Mechanics.

W. J. RUTHERFORD, B. S. A.,
Assistant in Animal Husbandry.

A. T. ERWIN, M. Sc.,
Assistant Horticulturist.

E. E. LITTLE, B. S. A., M. S. A.,
Assistant in Horticulture

--------------------------------------------------
Assistant in Agronomy.

F. W. BOUSKA, B. S. A.,
Dairy Bacteriology.

C. LARSEN, B. S. A.,
Assistant in Dairying.

I. O. SCHAUB, B. Sc.,
Assistant in Soils.

WILL H. OGILVIE,
Bulletin Editor.
The investigations of the Experiment Station have an intimate relation to the college work of instruction, as the problems occupying the attention of the Station are those that have a material bearing on the profit of the farm, and they are also those that are timely, and in need of accurate investigation. Whether relating to the field, the feed lot, or the laboratory, the aim is to investigate those questions which will have a practical relation to successful agriculture. Originality is made a feature of the work so far as it is consistent with useful results, and in all instances the sole object is to throw light on the truth relating to the various principles and practices of the farm. The field work strongly supports the instruction of the College in regard to the varieties of grains and the method of cultivation, thus enabling the student to become acquainted with the latest ideas relating to these. Thorough tests are made of the different varieties of fodders, grasses and grains. In addition to this, complete trials, embodying various crops and systems of culture, are carried on extensively each year, with the hope of giving direction to the farm management that is best for Iowa.

The investigations with animals embrace a study of the value of different feeds for different features of animal production. The system of feeding, the preparation of different feeds are also made the subjects of investigation as far as it is thought they may be made a part of the methods of the Iowa farmer. Included with these, there have been a large number of trials
with the different types of animals suitable for the requirements of the market. The object sought in this department of the Station work has been to indicate the manner in which the Iowa farmer through the employment of animals can realize the most from his farm products and add to the fertility of the farm. The Experiment Station has reached out in this way to a remarkable degree, bringing sheep from Mexico, Colorado and Scotland, cattle from Texas and Great Britain, horses from Wyoming, Montana and Europe, in its endeavor to thoroughly study this very important feature of the farmer's work. The data from these experiments is always accessible to the student and he has the opportunity of daily observing the development of it at every stage.

The dairy industry is already indebted to the Experiment Station for doing much towards establishing it on a surer foundation of accurate knowledge. The Station has always kept in closest touch with those engaged in the various lines of the dairy industry. Some of the problems which practical men are constantly meeting and asking aid in solving, are at all times objects of experiment by the Dairy Section. The students have the advantage of seeing these experiments carried out, and in some cases assist in the work themselves. In this way they learn not only what are the chief problems to be solved but become informed on the methods employed in different lines of investigation. The experimental work that has been so far conducted, relates mainly to the various problems of butter-making while lately features of cheesemaking have been made subjects of special study. The records of these are abundantly used in class work, together with the results from the later investigations in the newer field of bacteriology.

The Horticultural Department in its connection with the Experiment Station affords the student admirable opportunities for checking the theory of the class room against the practice of the field. The connection of the Department of Horticulture with the State Horticultural Society is such that problems touching the commercial side of fruit growing receive the closest attention. The field equipment of the Department is excellent, so that experiments in spraying for the prevention of fungous pests and injurious insects may be carried on under the eye of the student; this is true also of other phases of orchard routine, such as fertilizing, pruning and thinning. The experimental
nursery work carried on is of decided educational value. In plant breeding, extensive experiments have been inaugurated and are still in progress. The Station work thus equips the student with the practice and technique necessary to a thorough horticultural training.
DIVISION OF VETERINARY SCIENCE
FACULTY

ALBERT BOYNTON STORMS, A. M., D. D.,
President.

JOHN H. MCNEIL, V. M. D.,
Dean of the Faculty and Professor of Theory and Practice of Medicine and the Principles and Practice of Surgery.

WALTER A. STUHR, D. V. M.,
Associate Professor of Histology, Pathology and Therapeutics.

FRED R. AHLERS, D. V. M.,
Assistant Professor of Anatomy and Obstetrics.

LESLIE M. HURT, D. V. M.,
Assistant Professor of Physiology and Sanitary Science.

WILBERT EUGENE HARRIMAN, B. Sc., M. D.,
Professor of Ophthalmology.

M. STALKER, M. Sc., V. S.,
Lecturer

CHARLES F. CURTISS, B. Sc., M. S. A.,
Dean of Division of Agriculture.

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Professor of Animal Husbandry.

WILLIAM JOHN RUTHERFORD, B. S. A.,
Assistant Professor of Animal Husbandry.

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Assistant Professor of Animal Husbandry.

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ALFRED ALLEN BENNETT, M. Sc.,
Professor of Chemistry.

GENERAL JAMES RUSH LINCOLN,
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GEORGE JUDISCH,
Lecturer on Pharmacy.

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Lecturer on Veterinary Jurisprudence.

WAYNE DINSMORE, B. S. A.,
Instructor in Animal Husbandry,

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ESTELLE DENNIS FOGEL, B. A., B. Sc.,
Assistant in Bacteriology.

ANNOUNCEMENT.

The Division of Veterinary Science, as before announced, has recently extended its prescribed course of study to four years, of nine months each, instead of three years of eight months, as it has been heretofore. This change, at first, was looked upon by some with reserve, inasmuch as it represented the initiative in veterinary education in this country.

Doubt no longer exists concerning the wisdom of this step in the advance, and the benefits to be derived from an extended course of study are already being appreciated.

That the new course has met with general approval can be seen from the increased attendance in face of advanced entrance requirements and increased length of the course of study. The former curriculum has been entirely revised and enlarged, and in addition has been enriched by a well graded course in stock judging and animal nutrition from the department of animal husbandry. This latter department is endowed with unexcelled facilities for the teaching of this branch of the science of agriculture.

Specially equipped laboratories afford excellent opportunity for the study of anatomy, pharmacy, bacteriology, histology, pathology, and the related sciences.
Students may avail themselves of the advantages offered by a very extensive library where access may be had at all times to such journals, magazines, experiment station bulletins, and other literature as they may desire for reference in their study. The Veterinary Department occupies the third floor of Agricultural Hall where offices, lecture rooms and museum are located. The Veterinary Hospital is a three story brick building, conveniently located, and well equipped for conducting clinical as well as general hospital work. The College being located in a rich stock growing section of the country, is supplied with an abundance of clinical material for daily demonstration at the hospital.

Field Open to Qualified Veterinarians.

The student having completed the course of instruction outlined in this curriculum becomes a veterinarian in the broadest sense and competent to enter a wide field of usefulness by any of the avenues enumerated.

A.—General Practice.—In view of the fact that the National live stock valuation is estimated at $3,200,000,000, it becomes obvious that the graduate possessing fitness and aptitude for this kind of work will meet with a ready demand and substantial compensation for his services.

B.—Bureau of Animal Industry.—Veterinarians are in demand for inspection work in the Bureau of Animal Industry, United States Department of Agriculture, at salaries ranging from $1,200.00 to $2,500.00.

C.—Army.—The Veterinarians in the United States Army now have a position similar to that of a commissioned officer. The salary is $1,500.00 per year with a ten per cent increase for each five years’ service up to twenty years with the same allowances as a second lieutenant of cavalry.

These positions are most desirable and with our insular possessions give opportunities for wide experience in professional work.

D.—Animal Husbandry.—Qualified veterinarians are called upon to act as counsel to the breeder and as guardians to the vast live stock industry of the nation.

E.—Municipal and State Veterinarians.

F.—Veterinarians to stock farms and corporation stables.

G.—Veterinarians to Experiment Stations and Instructors in Veterinary Colleges.
Requirements For Admission.

Candidates having a college degree, a teachers' first grade certificate, diploma from an accredited high school or those who have passed successfully the matriculate examination of a recognized college will be admitted without examination.

Other candidates for admission will be required, 1: To write legibly and correctly an essay of not less than two hundred words; 2: To pass a satisfactory examination in Arithmetic and in United States History, and to present other evidence of sufficient ability to follow with profit the instruction offered in the Veterinary course.

Graduates from recognized schools of Veterinary Science, Agriculture, Medicine, Dentistry or Pharmacy will be given credit for work pertaining to the course, upon the presentation to the faculty of satisfactory standing or upon passing an entrance examination.

Registration and Classification.

Students are registered and classified by the Dean of the Veterinary Faculty.

A student's relation with the College may be continued at any time during his course, at the discretion of the Faculty.

All students must enter in September of each year, except for advanced standings.

Length of Semesters and Year.

The year is divided into two Semesters, one of 16 weeks and one of 20 weeks; making a school year of nine months.

The hospital and dissecting room are open during vacation, thus affording the student an opportunity to devote additional time to this work.

Examinations and Degree.

Examinations are held at the close of each term upon the work passed over during that Semester. At the end of each year the final examinations are held. Students must have passed examinations in all pre-requisite work of a given Semester or year before they can proceed with the work of the succeeding Semester or year. These examinations are controlled by the faculty rules. At the close of the course after passing a satis-
factory examination, the student receives the degree of Doctor of Veterinary Medicine (D. V. M.).

Candidates for graduation must be twenty-one years of age, of good character and must have passed examinations in all the required subjects in the course.

Membership in the American Veterinary Medical Association.

Graduates of this school are eligible to membership in the American Veterinary Medical Association.

Veterinary Medical Society.

The Veterinary Medical Society of the Iowa State College was organized by the students for the purpose of investigating and discussing subjects relating to Veterinary Science. All matriculate students of the four classes are members and the diploma of the society is conferred upon graduates.

Equipment.

The Veterinary Hospital and the daily free clinics furnish an abundance of material for practical work. Situated in an extensive stock growing district, the College is especially favored in this respect, not only horses, but all species of animals, being brought to the hospital for treatment. Senior students are assigned cases for diagnosis and treatment under the supervision of the clinical professor, thus having an opportunity to apply the theoretical knowledge obtained in the class room. During the course opportunity is offered to witness all the different operations performed in veterinary surgery, together with the methods of treating the different internal diseases. Junior students are detailed in alphabetical order to assist the pharmacist in the compounding of prescriptions, in this way becoming familiar with the various forms in which medicines are administered. A detailed description of the various branches taught in the course is given on the succeeding pages.

The department occupies quarters in Agricultural Hall. In this building are offices for the veterinary members of the Faculty, two large lecture rooms for the use of the department, a laboratory and a museum.

The Veterinary Hospital is a substantial brick building three stories high, fitted with commodious, well lighted single and box
stalls, operating room, office and pharmacy, resident surgeon’s room, dissecting room, an elevator for the accommodation of the patients unable to use the runway to second floor, and is furnished with all the surgical instruments of modern construction, operating table and other important conveniences for hospital work. A number of fine grass paddocks directly adjacent to the hospital are used for such patients as are likely to be benefitted by out door exercise and a grass diet in the season.

A laboratory constituting part of the Experiment Station has recently been equipped. This laboratory is intended for the purpose of bacteriological and pathological investigation of the diseases of domestic animals. It is supplied with the most modern biological apparatus, such as high power microscopes, incubators, hot air and steam sterilizers, microtomes, stains, gas, water and electric light, and in fact all first class facilities for scientific investigation. Specimens are received frequently for examination. Students of the Veterinary Division may avail themselves of these facilities under the direction of the veterinarian in charge.

Aside from the facilities which belong especially to the Veterinary Division the equipment for instruction in Animal Husbandry is very complete.

The work in botany, chemistry, zoology and other related studies is adequately provided for in the special buildings for the accommodation of these several departments of college work.

Library.

The entire College library of about 16,000 volumes containing a good variety of veterinary and medical books and journals is open to the veterinary students.

COURSES OF STUDY.

Comparative Anatomy of the Domestic Animals.

DR. AHLERS.

This subject is studied through the entire Freshman and Sophomore years and embraces Descriptive and Practical Anatomy.

Descriptive Anatomy is taught by a series of lectures, including the study of the bones, articulations, muscles, circula-
tory apparatus, the nervous system, the respiratory system, the organs of digestion, the urino-genital apparatus and the organs of special sense. The lectures are supplemented by demonstrations from mounted skeletons, prepared specimens, charts and an Auzoux elastic model.

Practical Anatomy comprises a comprehensive and thorough course in dissection, which extends through the Freshman and Sophomore years. During each year the student is required to make two complete dissections of the horse and such parts of other animals as may be deemed necessary. Freshman students devote their time in the dissecting room to the study of the bones, articulations and muscles. Sophomore students make special dissection of the nervous system, circulatory apparatus, lymphatic glands, organs of special sense and the organs contained in the abdominal and thoracic cavities. The dissection is carried out in a systematic manner under the personal supervision and direction of the Professor of Anatomy. Each student is required to properly dissect and pass an examination on the part assigned before passing to the dissection and study of another part.

The subject is taught in four courses, as follows:

Course I.—First Semester, Freshman year, three lectures each week.

Course II.—Second Semester, Freshman year, three lectures each week.

Course III.—First Semester, Sophomore year, three lectures each week.

Course IV.—Second Semester, Sophomore year, three lectures each week.

Histology.

DR. STUHR.

Histology proper is preceded by a short course in Microscopy. This is designed to give the student a working knowledge of the microscope and microscopical methods, thus fitting him to study, to best advantage, the minute structure of tissues and organs.

Instruction in Histology is conducted by recitations from a standard text, supplemented by a laboratory course.

Course XXXIII.—Treats of the cell as a unit of structure,
and function, and the tissues, their classification and characteristics. First Semester, Freshman year, one recitation and one laboratory per week.

Course XXXIV.—Treats of the above tissues in their relation to the structure of organs. Second Semester, Freshman year, one recitation and one laboratory per week.

**Physiology.**

**DR. HURT.**

Physiology is taught by the comparative method, the vital phenomena of the domesticated animals being compared with those of the human being and the common features pointed out. Special attention is given to the variations occurring in the functions and extends throughout the Freshman and Sophomore years.

Course XXI.—Higher forms of animal life are nothing more than mere association of the simpler organism, the modification of whose protoplasm leads to such specialization of function as characterizes the different tissues of the body.

It becomes necessary therefore to acquire some knowledge of the simplest expressions of these complex functions as manifested in the simpler organization. Thus general physiology deals with the animal cell, the unit of organization, its origin, modification of form and structure, chemical constitution and the various physical and chemical laws which influence its nutrition, growth, reproduction and development.

General physiology is taught throughout the Freshman year by a course of lectures one hour per week.

Course XXII.—This is a continuation of Course XXI throughout the Second Semester of the Freshman year.

Course XXIII.—The study of special physiology is begun in the First Semester of the Sophomore year and continued throughout the year. It deals more particularly with the special functions of the various organs and tissues of the body.

It is taught by two recitations per week.

Course XXIV.—The subject of physiology is continued in the Second Semester of the Sophomore year.

F. Smith's Manual of Veterinary Physiology is used as a text in these courses.
Pharmacy.

MR. JUDISCH.

This subject is taken up in the First Semester of the Freshman year and continued throughout the year. It consists of lectures and laboratory work.

Course XXV.—All the official drugs and preparations are considered. Special attention is paid to practical pharmaceutical problems and manipulations. Each student is required to prepare at least one of each class of the official preparations. This course is given in the First Semester of the Freshman year and consists of one lecture and one laboratory exercise each week.

Course XXVI.—In the Second Semester of the Freshman year one lecture and one laboratory exercise each week are devoted to the principles and practical work of the compounding of prescriptions.

Materia Medica.

This subject is taught throughout the Freshman year and is divided into two courses:

Course XXVII.—As an introduction to the study of Materia Medica the student is first taught to familiarize himself with the definition and uses of such terms as he will encounter in his subsequent study of the subject.

The classification of drugs presented is that in accordance with their most dominant action and includes all such agents as are employed in the practice of Veterinary Therapeutics. Each drug is studied in detail, attention being called to the following characters: Official name, common name, origin, mode of preparation, description of properties, adulterations, incompatibles, names of therapeutic action and preparations in the official U. S. Pharmacopoeia.

Samples of the various drugs and their preparations are exhibited as they are discussed in order that the student may become more firmly impressed with their leading characters. This course is taught by lectures one hour per week throughout the First Semester of the Freshman year.

Course XXVIII.—This is a continuation of Course XXVII and is carried throughout the Second Semester of the Freshman year.
Therapeutics.

DR. STUHR.

This subject is presented by a course of lectures of one hour per week extending throughout the Sophomore and Junior years.

Course XXIX.—This is begun in the First Semester of the Sophomore year. The same classification of drugs is followed throughout these courses as was presented in Materia Medica. This work is simply carried on from that point where the study of Materia Medica ceases.

The work of this Semester is largely composed of such preliminary considerations as lead up to the subsequent study of therapeutics proper; thus the work is confined to the study of the modes of action of drugs, the physiological laws which govern the same, the absorption, elimination and methods of administration, dosage, idiosyncrasy, etc.

This work is supplemented by a course of lectures on prescription writing.

Course XXX.—The study of Therapeutics proper begins in the Second Semester of the Sophomore year.

Each therapeutic agent is considered in detail and the following features brought out: The physiological and therapeutic actions, indications and contra-indications, toxicology and treatment, modes of administration and dose.

Course XXXI.—This is a continuation of Course XXX throughout the First Semester of the Junior year.

Course XXXII.—The subject is completed in the Second Semester of the Junior year. Lectures dealing with general therapeutic measures are presented during the latter part of this Semester.

The entire course is supplemented by reading from standard works on the subject.

Winslow's "Veterinary Materia Medica and Therapeutics," is used as a reference.

Structural Botany.

PROFESSOR PAMMEL.

Course IX.—This course begins in the First Semester of the Freshman year. The work consists of recitations and lectures. The student is expected to become familiar with the morphology
of flowering plants and the terms used in descriptive botany. In studying the identification and selection of drugs it is necessary to have a thorough botanical knowledge of general structural botany as well as vegetable histology. Vegetable drugs do not always consist of the entire plant, but frequently of parts only. In this course the general structure of the plant, from the root to reproductive organs, is taken up and considered. In the laboratory the student takes up the histology of plants, especially from the standpoint of pharmacognosy, with a brief survey of the more important plants from a systematic standpoint.

There are two recitations and one laboratory of 54 hours. First semester. Freshman year.

Chemistry.

PROFESSOR BENNETT.

Laboratory study is the basis of the work done during the first year of the Veterinary Course to become acquainted with Inorganic Chemistry and the general principles of Qualitative Analysis. Special attention is given to those compounds that are important in Veterinary Medicine. Attention is also given to inorganic poisons and the general effects of these poisons on the animal body.

During the First Semester of the Sophomore year the students in Veterinary Medicine are given a course in Organic Chemistry in which they become acquainted with the various hydro-carbons, carbo-hydrates, and nitrogenous compounds, special attention being directed to those substances used in pharmaceutical preparations.

During the Second Semester of the Sophomore year the student studies elementary Physiological Chemistry and a sufficient amount of the general principles of Quantitative Analysis to enable him to make complete analyses of urine.

The laboratory provides each student with a separate table which is furnished with water, gas, and all the needed apparatus and re-agents. The cost of this work to the student is the cost of the material and apparatus consumed or destroyed in the prosecution of the study.

Poisonous Plants.

PROFESSOR PAMMEL.

Course XVI.—The veterinarian is frequently called upon to investigate cases of poisoning caused by wild plants. He should
therefore be familiar with the plants responsible for poisoning live stock. In this course the subject is treated from the historical standpoint, with a brief reference to the history of toxicology; autointoxication; poisoning from ptomaines, toxins and the agents responsible for such poisoning; poisoning by fungi, like toadstools, ergot, etc. The life history of these fungi and the poisons they produce are considered in detail. The rusts and smuts, as possible causes of disease are also considered. The higher plants are then taken up in a systematic order, calling attention to the poisonous plants in the various orders and means for recognizing these plants.

One lecture and one laboratory, of 48 hours. Second Semester, Freshman year.

Entomology.

PROFESSOR SUMMERS.

This course (Zoology I), given during the Second Semester of the Freshman year, is designed as an introduction to Zoological methods, especially to those of Systematic Zoology. The student also gets practice in the determination of insects, which is of special use later in his study of the parasites of domestic animals. Some training is had in the use of the microscope. The lectures deal chiefly with the physiology and life history of the different orders of insects. Incidentally the general principles involved in dealing with injurious insects, including parasites, are discussed.

Pathology.

DR. STUHR.

The course in Pathology extends through the Sophomore and Junior years, and must be preceded by Normal Histology. The work is divided into General Pathology, which treats of the causes of disease, its spread and generalization, the protecting and healing forces, the disturbances of circulation, retrograde disturbances of nutrition, and infiltration, hypertrophy and regeneration, inflammation and tumors; and Special Pathology, which treats of the etiology and morbid anatomy of diseases caused by streptococci, baccilli, higher fungi, protozoa, animal parasites, and those infectious diseases, the specific cause of which is not yet determined.
In the laboratory the student in General Pathology is taught the methods of preparation and preservation of gross specimens, the preparation of sections for Microscopic study, and the general technique of laboratory diagnosis. He is then given preparations for the study of the various pathological phenomena as they are considered in the class room.

Course XXXV.—General Pathology.—First Semester, Sophomore year. Two recitations and one laboratory per week.

Course XXXVI.—General Pathology.—Second Semester, Sophomore year. Two recitations and one laboratory per week.

Course XXXVII.—Special Pathology.—First Semester, Junior year. Two recitations per week.

Course XXXVIII.—Special Pathology.—Second Semester, Junior year. Two recitations per week.

Bacteriology.

PROFESSOR PAMMEL.

Course VII.—This subject is taken up in the first semester of the Sophomore year and is conducted by laboratory work and lectures covering approximately the following ground.


What are bacteria? Structure, growth, nutrition and reproduction.


History of anthrax, symptomatic anthrax, malignant oedema,
tetanus, glanders, tuberculosis, swine plague, hog cholera, typhoid fever, diphtheria. The germs of pus, erysipelas, yellow fever, cholera nostras, caries of teeth, etc., are discussed. The characteristic growth and the morphological characters of the germs are given. The formation of ptomaines, toxins, and enzymes and their relation to disease.

Muir and Ritchie's "Manual of Bacteriology" is used as a text book.

Recitations once per week. One laboratory 48 hours. First Semester, Sophomore year.

**Physical Diagnosis.**

**Course LIV.**—This course is designed to be introductory to the study of Veterinary Medicine. Since a correct diagnosis is the basis of all medicine, it is essential that the student be taught to recognize the various disturbances of function and the pathological conditions they indicate.

The arts and methods of diagnosis are first considered, then general examination, special examination of the different apparatuses of the animal body and finally specific examinations, including experimental inoculations as a means of diagnosis, are studied.

One lecture per week. First Semester, Sophomore year.

**Vertebrate Zoology.**

**PROFESSOR SUMMERS.**

This course (Zoology II), given during the First Semester of the Sophomore year, consists mainly of a laboratory study of the anatomy, including histology, of a typical vertebrate. This serves as an introduction to the methods of gross dissection, and gives practice in the use of the microscope. The study of a series of other forms of vertebrates follows, leading to a knowledge of general vertebrate structure. The laboratory work is supplemented by lectures on the general morphology and classification of vertebrates.

**Animal Parasites.**

**PROFESSOR SUMMERS.**

In the Second Semester of the Sophomore year is given a course (Zoology, VIII), or lectures upon the zoo-parasites of domestic animals. Detailed descriptions are given of the life
histories of the most important species attacking animals in the United States, special emphasis being laid upon such portions of their economy as may render them open to treatment by preventive or remedial measures.

**Animal Husbandry.**

The following courses of study are given in Animal Husbandry:

**Course I.—Market Types—Cattle and Sheep—First Semester, Sophomore year.** This course covers the judging of the different market classes of cattle (beef and dual purpose), and sheep (mutton and wool). Judging two 2-hour periods per week. Dr. Gay, Mr. Dinsmore, Mr. Smith, and Mr. Rubel.

**Course II.—Market Types—Dairy Cattle—Horses and Swine.**—Second Semester, Sophomore year. This course covers the judging of the different market classes of dairy cattle; of horses (light and heavy); and swine (bacon and fat). Judging two 2-hour periods per week. Dr. Gay, Mr. Dinsmore, Mr. Smith, and Mr. Rubel.

**Course III.—Breed Types—Cattle and Sheep.**—First Semester, Junior year. This course covers the judging of representatives of the different breeds according to their official standards; also a study of their origin, history and characteristics and adaptability to different conditions of climate and soil. Lectures two 1-hour periods per week. Judging two 2-hour periods per week. Professor Rutherford, Dr. Gay, and Mr. Dinsmore.

**Course IV.—Breed Types—Dairy Cattle—Horses and Swine.**—Second Semester, Junior year. This course covers the judging of representatives of the different breeds according to their official standards; also a study of their origin, history and characteristics, and adaptability to different conditions of climate and soil. Lectures two 1-hour periods per week. Judging two 2-hour periods per week. Only students who have credits in Courses I and II, or credits showing that they have covered the same work in some other agricultural college, are eligible to Courses III and IV respectively. Professor Rutherford, Dr. Gay, and Mr. Dinsmore.

**Course VIII.—Principles of Breeding.**—First Semester, Junior year. This course embraces a study of the principles of breeding, including selection, heredity, atavism, variation, fecundity,
with the presentation of the methods of breeding, in-and-in breeding of pure bred stock are made the subject of study and investigation. Two 1-hour periods per week. Professor Kennedy.

**Course IX.---Animal Nutrition.---**Second Semester, Senior year. This course includes anatomy and physiology of the digestive system, the purpose of nutrition, the theory and practical economy of rations for growth, fattening, milk or maintenance; sanitation of feeds, and hygiene of the farm. Five 1-hour periods per week. Professor Kennedy and Mr. Smith.

**Course XI.---Live Stock Management.---**First Semester, Junior year. The housing, feeding, care and management of beef and dairy cattle. 1-hour lecture and one 2-hour laboratory per week. Professor Rutherford and Mr. Dinsmore.

**Course XII.---Livestock Management.---**Second Semester, Junior year. The housing, feeding, care and management of horses, hogs, and sheep. Professor Rutherford and Mr. Dinsmore.

**Theory and Practice of Veterinary Medicine.**

**DR. MCNEIL.**

The study of medicine is begun the First Semester of the Junior year and is continued throughout the course.

**Course XL.---**First Semester, Junior year, three lectures per week.

**Course XLI.---**Second Semester, Junior year, three lectures per week.

**Course XLII.---**First Semester, Senior year, three lectures per week.

**Course XLIII.---**Second Semester, Senior year, three lectures per week.

Instruction consists chiefly of lectures supplemented by practice in the daily clinics. Courses XL, XLI, XLII cover the work on congestion, inflammation and fever, diseases of the respiratory system, circulatory system, blood and lymph; digestive apparatus, nervous system, genito-urinary system, diseases of the eye, skin, and the non-infectious constitutional diseases.

**Course XVIII.** is devoted to the study of the history, etiology, symptoms, lesions, differential diagnosis and treatment of the infectious animal diseases and diseases caused by animal parasites. Assuming the student to have had the prescribed work in
bacteriology it is deemed advisable to review the morphology and the cultural characteristics of the specific organisms in connection with the symptoms and lesions which they produce.

Thus the importance of a bacteriological examination as a means of positive diagnosis is emphasized.

**OPHTHALMOLOGY.**

**DR. HARRIMAN.**

Course XLIX.—The Course in Ophthalmology is given in the Second Semester of the Senior Year. It consists of one lecture per week supplemented by demonstrations upon models and cases.

It is the aim of this course to familiarize the student with methods of examination and diagnosis in particular, as well as general principles and special forms of treatment.

**PRINCIPLES AND PRACTICE OF SURGERY.**

**DR. MCNEIL.**

This subject is taught to Junior and Senior students in four courses, as follows:

**Course X.**—First Semester, Junior year, three lectures each week.

**Course XI.**—Second Semester, Junior year, three lectures each week.

**Course XII.**—First Semester, Senior year, three lectures each week.

**Course XIII.**—Second Semester, Senior year, three lectures each week.

General Surgery embraces the following subjects: Surgical bacteriology, the pathology and treatment of inflammation, diseases of the bones, nerves, articulations, muscles, tendons, tendon sheaths and bursae; methods of amputation and exarticulation; suturing and the general treatment of wounds; methods of anaesthesia; intra-venous and sub-cutaneous injections; castration; methods of restraint in securing animals, and the methods of actual cautery.

Special Surgery includes the surgical diseases of the head, neck, thorax, abdomen, urino-genital organs, fore-limb, hind-limb, vertebrae, pelvis, and the surgical diseases of the stomach and bowels.
EMBRYOLOGY.
PROFESSOR SUMMERS.

The foundation of this course (Zoology V.), consists of laboratory work on the chick and to a small extent on the frog. The lectures deal with the general principles of development, including the structure of the germ cells, maturation and fertilization, and the modifications of cleavage and gastrulation found in the different classes of vertebrates. The peculiarities of the development of mammals are also discussed.

HORSESHOEING.

Course XVI.—This course is devoted to the study of the anatomy and physiology of the foot; the relation between the form of the foot and direction of the limb; variation in the flight of the foot; style of going; the shoeing of normal and irregular feet; winter shoeing; hoof nature; correction of defects in gait and the methods of shoeing hoofs defective in form or diseased. Instruction is by two lectures per week the Second Semester, Junior year.

MILK INSPECTION.

Dairying XVIII.—This course embraces a thorough study of the composition of milk and its products and their variations. The Babcock test for finding the amount of butter-fat; the use of the lactometer for finding the specific gravity and calculating the milk solids are made leading features of the course. The detection of the most common adulterations and preservatives in milk is also taken up.

The course consists of one laboratory period and one recitation per week. It is given in the Second Semester of the Junior year. Mr. Bouska.

SURGICAL ANATOMY.

Course V.—This work is discussed during the first semester of the Senior year, being a continuation of the Course in Anatomy, but studied with special reference to its relation to surgery and not as an abstract science.

The student is taught to apply the systematic anatomy studied during the first two years.

The course embraces surface anatomy, the outline of organs,
location of joints, significance of bony projections and muscular swells, position, relations and means of recognizing various arteries and nerves, relation of tissues in organs to each other, including a general review of all practical anatomy.

**PRACTICAL OPERATIVE SURGERY.**

In the Course in Operative Surgery the student is required to perform all the operations that are found necessary in veterinary practice. Five hours each week are devoted to this work. The subject is covered in two courses, as follows:

**Course XIV.**—First Semester, Senior year.

**Course XV.**—Second Semester, Senior year.

**SANITARY SCIENCE.**

**DB. HURT.**

These courses are designed to train the student in all that pertains to preventive medicine.

**Course XLIV.**—Consists of the consideration of health and disease; the etiology of disease, predisposing and exciting; means and manner of propagation and transmission of infectious diseases; general hygiene and stable sanitation, including ventilation, drainage, selection of site and materials for construction. Two lectures per week, First Semester, Senior year.

**Course XLV.**—A consideration of practical methods of disinfection with a discussion of disinfecting agents, physical and chemical; methods of dipping and dips; principles of serum therapy, vaccination and quarantine. During the latter part of this course the sanitary police of the individual infectious and parasitic animal diseases are discussed. Two lectures per week. Second Semester, Senior year.

**MEAT INSPECTION.**

This comparatively new branch of veterinary work is given the attention which its present importance deserves. The subject is approached from the American point of view, and the students are taught how to perform the work with that rapidity and thoroughness required by the United States Bureau of Animal Industry. The instruction which the student receives in the courses in anatomy, physiology, pathology, bacteriology,
animal parasites and veterinary medicine makes it possible to cover this subject in the one course described below:

Course XXXIX.—Two lectures are given each week in the First Semester of the Senior year, embracing the following topics: The physical characters of normal flesh and organs; the methods of slaughter; the principles of refrigeration and preservation; the effect of accidental and pathological conditions on the preservation and edibility of meats.

The putrefaction of meats and the consequences of the ingestion of such meats by man; the effects upon the meat of various constitutional and infectious diseases; the transmissibility of disease to man the effects of cooking on transmissibility; the meat inspection laws of the United States.

CONFORMATION AND SOUNDNESS.

Course XVIII.—This course is taught by lectures and practical demonstrations upon the living animal. The student studies the conformation of the horse with special reference to the defects which exist and predispose to pathological changes causing unsoundness.

Comparisons are made between normal and diseased parts and a systematic classification arranged to conform to the regions and parts involved.

OBSTETRICS.

Course XIX.—This course is devoted to physiological obstetrics; ovulation, oestrum, fecundation, sterility, gestation, the hygiene of pregnant animals; and parturition. One hour per week, First Semester, Senior year.

This work is preceded by Zoology V.

Course XX.—This course is devoted to pathological obstetrics; the diseases and accidents of pregnancy; dystokia; obstetrical operations; the sequelæ of parturition; and diseases of the young animal. One lecture per week, Second Semester, Senior year.

HIPPOLOGY.

GENERAL LINCOLN.

Course XLVII.—It is as essential for the veterinarian to maintain the health and strength of the horse as to care for and treat the sick and disabled animal.
This course studies the horse as a machine; and the bridle, saddle and harness as aids in the use of his powers, as well as the management of the horse in the stable and in the field so as to best maintain his usefulness.

The following topics are studied: The framework of the horse from a mechanical standpoint; bits and bitting; saddling; draft and harness. The care of animals in garrison and in the field, including watering, feeding and grooming.

This subject is taught by one lecture per week the Second Semester of the Senior year.

JURISPRUDENCE.

MR. LEE.

Course XLVIII.—The work in this course consists of a study of the rights and duties of the veterinary practitioner; the rights and duties of the owner or value of domestic animals; contracts and sales as applied to dealings in live stock; the subject of expert testimony. One lecture is given each week in the Second Semester of the Senior year.

CLINICS.

DRS. MCNEIL, AHLERS AND HURT.

The practical work afforded by the clinics is considered a highly essential part of the instruction given to the student. A student's didactic instruction will do him but little good if at the same time he is not required to put his knowledge into practice. Also, a student shows his fitness for membership in the profession chiefly by the degree of aptness which he exhibits in his practical work. The clinical training which he gets here gives him an opportunity to acquire the aptitude which is requisite for his professional work. Free clinics are held at the hospital every day from 1 to 3 o'clock p. m. The cases brought to the hospital for treatment are assigned to the senior students in alphabetical order and the students are required to prepare a full report of their examination, diagnosis, and proposed treatment and hand it to the clinician when he comes to examine the case. These reports are then graded by the clinician according to their merits. The hospital cases are assigned to the senior students who are required to treat them and keep a careful
report of the case under the direction and supervision of the clinical instructors. The junior students are required to assist the seniors in their clinical and hospital work. The Semester grades of the students are made up from their attendance, and character of their clinical and hospital work. The clinical professor upon examination of a case or performance of an operation or administration of internal treatment gives to the students a clinical lecture upon the various aspects of the case before them. In this exhaustive way each case is made to yield the utmost good to the student. Animals of all species are brought in considerable numbers to the hospital from the surrounding excellent stock-growing territory and in this way the students come into intimate contact with a great variety of diseases, and acquire a familiarity with their treatment such as will enable them to give good service to their clients immediately upon their entrance into practice.

**Freshman Year.**

**FIRST SEMESTER.**

Comparative Anatomy, 3  
Dissection, 6  
Comparative Physiology, 1  
Histology, 2  
(One laboratory period.)  
Materia Medica, 1  
Pharmacy, 2  
(One laboratory period.)  
Structural Botany, 3  
(One laboratory period.)  
Inorganic Chemistry, 3  
(One laboratory period.)  
Military Drill, 2

**SECOND SEMESTER.**

Comparative Anatomy, 3  
Dissection, 6  
Comparative Physiology, 1  
Histology, 2  
(One laboratory period.)  
Materia Medica, 1
Pharmacy, 2  
(One laboratory period.)

Poisonous Plants and Fungi, 2  
(One laboratory period.)

Entomology, 2  
(One laboratory period.)

Inorganic Chemistry, 3  
(One laboratory period.)

Military Drill, 2

(Sophomore Year.)

FIRST SEMESTER.

Comparative Anatomy, 3  
(Veterinary, III.)

Dissection, 6  
(Veterinary, VIII.)

Comparative Physiology, 2  
(Veterinary, XXIII.)

Live Stock and Score Card Practice, 2  
(Animal Husbandry, I.)  
(Two 2-hour periods.)

Therapeutics, 1  
(Veterinary, XXIX.)

General Pathology, 3  
(Veterinary, XXXV.)  
(One laboratory period.)

Bacteriology, 2  
(Botany, VII.)  
(One laboratory period.)

Zoology, 4  
(Zoology, II.)  
(One laboratory period.)

Physical Diagnosis, 1  
(Veterinary, LIV.)

Organic Chemistry, 2  
(Chemistry, X.)

Military Drill, 2  
(Military, III.)

SECOND SEMESTER.

Comparative Anatomy, 3  
(Veterinary, IV.)

Dissection, 6  
(Veterinary, IX.)

Comparative Physiology, 2  
(Veterinary, XXIV.)

Live Stock and Score Card Practice, 2  
(Animal Husbandry, II.)  
(Two 2-hour periods.)

Therapeutics, 1  
(Veterinary, XXX.)

General Pathology, 3  
(Veterinary, XXXVI.)  
(One laboratory period.)

Animal Parasites, 2  
(Zoology, VIII.)

Physiological Chemistry, 3  
(Chemistry, XIII.)  
(One laboratory period.)
Military Drill, 2  

Military, IV.)

Junior Year.

FIRST SEMESTER.

Theory and Practice of Medicine, 3  
Principles and Practice of Surgery, 3  
Live Stock and Score Card Practice, 4  
(Animal Husbandry, III.)
(Two lectures and two judging periods.)

Principles of Breeding, 2  
Live Stock Management, 1  
(Animal Husbandry, VIII.)
(Animal Husbandry, XI.)

Therapeutics, 1  
Special Pathology, 2  
Embryology, 3  
(Veterinary, XXXI.)
(Veterinary, XXXVII.)
(Zoology, V.)
(One laboratory period.)

Clins, 6  
(Veterinary, L.)

SECOND SEMESTER.

Theory and Practice of Medicine, 3  
Principles and Practice of Surgery, 3  
Live Stock and Score Card Practice, 4  
(Animal Husbandry, IV.)
(Two lectures and two judging periods.)

Live Stock Management, 1  
(Animal Husbandry, XII.)
(One laboratory period.)

Therapeutics, 1  
Special Pathology, 2  
Milk Inspection, 2  
(Veterinary, XXXII.)
(Veterinary, XXXVIII.)
(Dairying, XVIII.)
(One laboratory period.)

Horse Shoeing, 2  
(Veterinary, XVI.)
Clinics, 6  
(Veterinary, LI.)

Senior Year.

FIRST SEMESTER.

Theory and Practice of Medicine, 3  
Principles and Practice of Surgery, 3  
Operative Surgery, 5  
Surgical Anatomy, 1  
Ophthalmology, 1  
Sanitary Science, 2  
(Veterinary, XLII.)
(Veterinary, XII.)
(Veterinary, XIV.)
(Veterinary, V.)
(Veterinary, XLIX.)
(Veterinary, XLIV.)
Obstetrics, 1
Hippology, 1
Meat Inspection, 2
Jurisprudence, 1
Clinics, 6

(SECOND SEMESTER)

Theory and Practice of Medicine, 3
Principles and practice of Surgery, 3
Operative Surgery, 5
Sanitary Science, 2
Animal Nutrition, 5
Obstetrics, 1
Hippology, 1
Conformation and Soundness, 2
Clinics, 6

(TEXT AND REFERENCE BOOKS)

Dictionary.—Dorland and Gould.


Histology.—Szymanowicz-MacCallum.

Materia Medica.—"United States Dispensatory."

Pharmacy.—"Remington's Practice of Pharmacy."

Chemistry.—Bennett's "General Chemistry and Qualitative Analysis," Remsen's "Organic Chemistry," Bunge's "Physiological Chemistry."

Botany.—Atkinson's "Elementary Botany."

Therapeutics.—Winslow's "Veterinary Materia Medica and Therapeutics," "Arzneimittellehre für Tierärzte" by Fröhner.

General Pathology.—Zeigler, Stengel. "Allgemeine Pathologie für Tierärzte" by Kitt.

Special Pathology.—Moore. Hayes' Translation of "Infective Diseases of Animals," by Friedberger and Frohner.

Zoology.—Comstock and Kellogg's "Elements of Insect Anatomy," for beginners; none for advanced work.

Bacteriology.—Muir and Ritchie's "Manual of Bacteriology."
Animal Husbandry.—Craig's "Judging Live Stock."

Surgery.—Dollar's. Volume I., Operative Technique.

Williams' Surgical Operations.

Medicine.—Law's "Veterinary Medicine," Hayes' Translation of "Infective Diseases of Animals" by Friedberger and Fröhner.

Animal Husbandry.—Shaw's "Animal Breeding."


Milk Inspection.—Farrington and Woll.


Conformation and Soundness.—Goubaux and Barrier's "Exterior of the Horse," translated by Harger; "Hayes' "Points of the Horse."
DIVISION OF ENGINEERING
OFFICERS OF INSTRUCTION

ALBERT BOYNTON STORMS, A. M., D. D.,
President.

ANSON MARSTON, C. E.,
Dean and Professor of Civil Engineering.

GEORGE WELTON BISSELL, M. E.,
Vice-Dean and Professor of Mechanical Engineering.

LOUIS BEVIER SPINNEY, B. M. E., M. Sc.,
Professor of Electrical Engineering.

SAMUEL WALKER BEYER, B. Sc., Ph. D.,
Professor of Mining Engineering.

WARREN H. MEEKER, M. E.,
Associate Professor of Mechanical Engineering.

L. E. ASHBAUGH, B. S. in E., Ph. B.,
Associate Professor of Civil Engineering.

FREDERICK ALLEN FISH, M. E. in E. E.,
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WILBUR M. WILSON, M. M. E.,
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JOHN HENRY LAWTON,
Assistant in Drawing.

DAILY M. CURL,
Assistant in Forge and Foundry.

FRANK HASKIN RICKER,
WALTER E. REULING,
Student Assistants in Machine Shop.

HORACE LYMAN BLACKMAN,
Student Assistant in Drawing.

M. J. REINHART, L. L. HIDINGER,
Student Assistants in Drawing.

W. H. GROVER, B. Sc. in E. E.
Superintendent of Heat, Light and Power.

EDGAR WILLIAM STANTON, M. Sc.
Professor of Mathematics and Economic Science.

GENERAL JAMES RUSH LINCOLN,
Professor of Military Science.

ALFRED ALLEN BENNETT, M. Sc.
Professor of Chemistry.

MISS LIZZIE M. ALLIS, B. A., M. A.,
Professor of French and German.

ALVIN B. NOBLE, B. Ph.,
Professor of Rhetoric.
ADRIAN M. NEWENS, B. O.,
Professor of Public Speaking.

ORANGE HOWARD CESSNA, A. M., D. D.,
Professor of History.

RICHARD C. BARRETT, M. A.,
Professor of Civics.

MISS MARIA M. ROBERTS, B. L.,
Associate Professor of Mathematics.

MISS LOLA PLACEWAY, B. Sc.,
Assistant Professor of Chemistry.

MISS ELIZABETH MACLEAN, M. D.,
Assistant Professor of English.

BENJAMIN H. HIBBARD, B. Ag., Ph. D.,
Assistant Professor in Economic Science.

ERNEST ALANSON PATTENGILL, B. S.,
Instructor in Mathematics.

E. B. TUTTLE, B. S. in E. E.,
Instructor in Physics.

MISS JULIA COLPITTS, M. A.,
Instructor in Mathematics.

MISS HELEN G. REED,
Instructor in English.

MISS GRACE I. NORTON, B. A.,
Instructor in German.

F. WENNER, B. S.,
Instructor in Physics.

MISS ANNIE W. FLEMMING, B. Sc.,
Instructor in Mathematics.

MISS MAE MILLER, B. Sc.,
Instructor in History.

WARD MURRAY JONES, B. C. E.,
Instructor in Mathematics.

MISS FLORENCE ANN LUCAS,
Instructor in French.

MISS EFFIE ALENE WHITE, A. B.,
Instructor in English.

MISS ROSE ABEL, A. B.,
Instructor in English.
JOHN F. TRAVIS, A. M.,
Instructor in Mathematics.

MISS BLANCHE ISABEL THOBURN, A. B.,
Instructor in English.

MISS ELIZABETH MOORE, Ph. M.,
Instructor in English.

MISS LISLE M'CULLOM, B. A.,
Instructor in German.

MISS DORA GILBERT TOMPKINS, A. M.,
Instructor in English.

MISS MARGARET B. STANTON, B. Sc.,
Instructor in Mathematics.

MISS ETHEL CESSNA, B. Sc.,
Instructor in History.

MISS EFFIE MAE MCKIM, B. Sc.,
Instructor in Chemistry.

WILLIAM ALFRED BEVAN, B. Sc.,
Instructor in Chemistry.

MISS VINA ELETHE CLARK,
Librarian.

MISS OLIVE STEVENS, B. L.,
Assistant Librarian

NON-RESIDENT LECTURERS.

JUDGE J. C. DAVIS.
"Relations of the Railways as Common Carriers to the State and Federal Governments."

J. L. BURGESS,
General Travelling Auditor, C. & N. W. R'y.
"Railway Accounting."

L. R. CLAUSEN,
Signal Engineer, C. M. & St. P. R'y.
"Signal Engineering."

ROBERT QUAYLE,
Superintendent of Motive Power, C. & N. W. R'y.
"Motive Power."

W. H. WHALEN,
Division Superintendent, C. & N. W. R'y.
"Relations of the Railways to the Producers."
The work of the Division of Engineering of the College is
apportioned among four departments, viz.:
The Department of Mechanical Engineering.
The Department of Civil Engineering.
The Department of Electrical Engineering.
The Department of Mining Engineering.

Through these departments the College offers systematic
courses in Mechanical Engineering, Civil Engineering, Electrical
Engineering and Mining Engineering, each leading to its appro-
priate degree.

These several courses are planned with a view to fitting those
pursuing them to enter professional engineering work and to
advance therein more rapidly than would be possible without the
preparation furnished by a College course. Experience shows
that the graduates from technical schools generally excel in their
chosen lines and it is worthy of note in this connection that rail-
roads, manufacturers and other corporations, as well as munici-
palities and government departments, are demanding that those who seek promotion in their technical departments shall have secured a technical training such as can now be obtained in the engineering schools of the country.

It is very manifest, because of the lack of time in the course, the multiplicity of general subjects which must be emphasized and the lack of uniformity of details in the profession due to the local and personal differences which exist in the conduct of engineering work of all kinds, that no college course in engineering can give to a student the training and experience in all the details of his profession. Moreover it seldom happens that a student in college knows definitely what specific branch of his chosen profession he will follow and it would be folly for him to spend his time on details which he may never use. A thorough education in the branches of pure and applied science which are related to professional work is essential. Having this the engineer readily acquires familiarity with the details of his work. Without it no amount of experience with details alone can give an engineer high rank in his profession.

Therefore it is believed that a college course in engineering should be in the first place a training of the mind of the student toward ability to think logically, to observe accurately and by the application of the former acquirement to the latter to reach correct inferences; in the second place such a course should acquaint the student with approved methods of draughting and computing with the use and limits of the instruments employed in the every day work of his profession and should give him an opportunity for experimental work bearing upon engineering problems; in the third place such a course should provide that the student acquire the art of expressing himself, publicly and privately, in good English and should furnish him with some knowledge of the history of his own and preceding times, thus equipping him to be an ornament to his profession, and an enlightened member of society.

In accordance with the views above expressed the engineering courses of this college include a variety of studies. These may be conveniently grouped as culture studies, training or disciplinary studies, professional studies, and practical work.

CULTURE STUDIES.

Two years' work in modern languages, (French or German) three years' work in English, culminating in seminar work, two
years' work in history required and one year elective, economic science and civics are found in all courses.

The French or German serves the double purpose of giving access to foreign technical literature and of aiding the work in English. History, economic science and civics cultivate interest in mankind at large and are thus broadening to the student.

If possible the amount of time devoted to culture studies would be increased, because it is believed that the engineering graduate profits by the time spent in general study almost as much as by that devoted to the professional studies.

**TRAINING STUDIES.**

Mathematics and physics constitute the backbone of engineering and of the engineer because by their study are secured habits of logical thinking and a knowledge of the fundamental principles of matter—the laws of nature.

**Mathematics.**—The study of Mathematics begins in the Academic course and extends through the Sophomore year.

Advanced Algebra, Plane and Solid Geometry, Plane Trigonometry, Analytical Geometry and Calculus are included in this course.

**Applied Mathematics,** e. g., analytical mechanics and hydraulics, are studied in the Junior and Senior years.

**Physics.**—The course in Physics is begun in the Sophomore Year. The ground of mechanics, heat, light, and sound is very thoroughly covered. In the Junior Year the subject of electricity and magnetism is introduced and the engineering student begins elementary laboratory work in physical measurements.

Students in mechanical engineering and electrical engineering continue work in physics in the Senior Year.

**Chemistry.**—Chemistry is also a training study, especially in laboratory work, where habits of observing and recording facts are thoroughly instilled. The study also serves as a preparation for the study of the materials of engineering and other professional studies. With the increase in the application of both chemistry and engineering to the arts, as in electrolytic treatment of ores, the refining of metals, the manufacture of cement and in many other industrial operations, the subject of chemistry has an important place in the training of engineers.

The study of chemistry is pursued in the first and second semesters of the Sophomore year of this course.
The text book work extends through the year and parallel thereto is a course in laboratory work, wherein the student becomes familiar with the general laboratory methods for a qualitative analysis.

PROFESSIONAL STUDIES AND PRACTICAL WORK.

Considerable time in the Junior and Senior Years is given by all engineering students to work having practical bearing on their profession; the object being to correlate, in some measure, theory and practice.

Draughting, shop work and field work are begun upon entrance and continued in proper proportions throughout the several courses. By their means students are frequently able to obtain valuable practical experience during their vacations and are thereby, in turn, benefited by being able to see the usefulness of their college work more clearly than before.

By such vacation work the student is placed in a measure, in the position of the so called practical engineer, who, if he be honest with himself, wishes for the advantages of a technical education.

In the professional studies the student, through his teachers, text books, and actual practice gets into touch with the problems which the engineers of the day are trying to solve, and thus learns to appreciate the difficulties which confront them.

The professional and practical studies culminate in the graduation thesis in which the student is expected to show energy, determination, resourcefulness and discrimination in the solving of a problem whose solution will add something to the store of engineering knowledge.

A certain amount of undergraduate work and a large amount of graduate work as well as the research work carried on by the individual members of the engineering faculty is devoted to the various industrial interests of the state.

Advanced students are given an opportunity to assist in all research or commercial work which is being conducted by the engineering departments.

BUILDINGS AND EQUIPMENT.

The buildings occupied exclusively by the Division of Engineering are the Engineering Hall, the Engineering Laboratory, the Power Station, the Forge Shop and Foundry, the Pattern Shop
the Locomotive Laboratory, and the Ceramic Laboratory.

Engineering Hall.—This building, completed for occupancy at the opening of the spring term, 1903, is a fire proof building, four stories in height, having a frontage of 208 feet, a depth of 70 feet, with a semicircular wing at back, three stories in height. The architecture is classic in treatment. The exterior is Bedford stone with plate glass windows. The interior is finished in pressed brick, with enameled brick in corridors and lavatories. The building is heated and ventilated by the hot blast system with automatic regulation, is electric lighted and equipped with modern plumbing.

On the first floor are located the dynamo laboratory, workshop and special laboratories of the department of electrical engineering, the cement laboratories of the department of civil engineering, the metallurgical laboratory of the department of mining engineering, and research rooms of the department of mechanical engineering. Also public lavatories for men and women. The corridor of this floor is furnished with 400 lockers for students.

On the second and third floors are respectively the offices of the departments of Mechanical Engineering and Electrical Engineering, and of the departments of Civil Engineering and Mining Engineering. On the second floor is the general assembly room, seating 400, two lecture rooms of the department of Mechanical Engineering, two laboratories for electrical engineering and instrument and cabinet rooms of the department of Electrical Engineering.

On the third floor are class, draughting and seminar rooms of the department of Civil Engineering, class and seminar rooms and museum of the department of Mining Engineering, a general engineering museum and a faculty room.

On the fourth floor are two draughting rooms and office of the department of Mechanical Engineering, draughting and instrument rooms of the department of Civil Engineering and photographic and blue-print rooms for the joint use of all departments.

The heating and ventilating apparatus is located in the basement, steam therefore being supplied through a tunnel communicating with the Power House.

The interior finish is light antique oak and the furniture is golden oak. Ample blackboards, convenient and comfortable furniture and furnishings are provided for the needs of the several departments.
Engineering Laboratory.—This building, formerly the principal engineering building and headquarters of the several departments, is now used for machine shop and engineering laboratory purposes. The arrangement and equipment of this building are described at length in connection with the mechanical and civil engineering departments.

Power Station.—This is a one story brick building, 36x120, devoted to the lighting and pumping plants of the College, and to the heating plant for the engineering buildings. All of the equipment is used for purposes of instruction, as far as this does not interfere with its other uses. The building contains an engine and dynamo room, a boiler room and a pump room.

Forge Shop and Foundry.—This is a one story brick building 38x78 feet, containing the equipment for instruction in forge shop and foundry practice. The roof trusses are of steel and calculated to carry traveling cranes for transferring heavy castings and forgings.

Pattern Shop.—This is a one story brick building, 38x120 feet, devoted to the work of instruction in bench work, wood turning and pattern work. A fire proof room is provided for the storage of patterns.

Locomotive Laboratory.—For the temporary protection of the locomotives donated to the Department of Mechanical Engineering by the Chicago & Northwestern railway and by the estate of S. H. Mallory, a corrugated iron structure has been provided.

Ceramic Laboratory.—A small brick building is being fitted up with brick and tile making machinery, and a small kiln is being built, to enable the brick and pottery clays of the state to be tested, to determine their values for manufacturing purposes, and the methods of manufacture to which they are adapted.

COURSES OF STUDY.

The following general courses are given by the Dean and the Vice Dean and are included in the course of study of each of the four engineering departments:

Engineering I.—History of Engineering.—This is a course of lectures in the second semester of the Senior Year of all engineering courses. The early development of engineering, as traced from history and from the remains of ancient works, will be discussed and the development of engineering in later periods
and its growth into a separate profession followed. Especial study will be given to the effect on civilization and general history and economic problems of the several inventions and other improvements which have marked the development of engineering. The lives of the more famous engineers will be discussed, and also the development of the general technical principles of engineering. Dean Marston.

Engineering II.—Specifications and Contracts.—One lecture or recitation per week, first semester, Senior Year in all engineering courses. Text-book, Engineering Contracts and Specifications, Johnson. Vice Dean Bissell.

DEPARTMENT OF MECHANICAL ENGINEERING.

G. W. BISSELL, PROFESSOR.

W. H. MEEKER, ASSOCIATE PROFESSOR.

H. W. DOW AND W. M. WILSON, ASSISTANT PROFESSORS.


F. H. RICKER, W. E. REULING, F. H. BLACKMAN, AND A. H. HOFFMAN,

STUDENT ASSISTANTS.

The headquarters of this department are in Engineering Hall. The principal offices are on the second floor. On the same floor are a lecture room and a combination class and drawing room. On the first floor are two rooms devoted to research work in mechanical engineering. On the fourth floor are two drafting rooms accommodating 200 students at one time, fitted with combination drawing tables, instrument cabinets and boards, whereby 600 students can be assigned to mechanical drawing and designing in the department. In conjunction with these rooms is a commodious office for the instructing staff in drawing. In addition the department has a common interest in and use of a photographic room, a blue print room on the fourth floor, the engineering museum, and faculty room on the third floor and the assembly room on the second floor.

The draughting and class and lecture rooms are equipped with ample blackboard space and the offices are fitted with the most convenient furniture for efficient and comfortable administration of the interests of the department.

In addition to the above space in the new Engineering Hall,
the department occupies the Engineering Laboratory, the Power House, the Forge and Foundry, the Pattern Shop and the Locomotive Laboratory.

In the Engineering Laboratory the basement is used as a hydraulic laboratory conjointly with the Department of Civil Engineering, the first floor is used as a machine shop, the second and third floors as an engineering laboratory.

SHOP WORK.

Students in mechanical engineering pursue the full course in shop work, which consists of eight hours per week for three and one-half years. Partial courses are given to the students in the mining and electrical engineering courses.

The system of instruction in the several shops begins with graded exercises calculated to familiarize the student with tools and with the materials used. The exercises are supplanted as soon as possible by work on machines or parts thereof which are to be put into actual use. By this arrangement greater interest is maintained in the work than would be possible with a strict adherence to the exercise system. The object of the shop work is not to teach trades, but to acquaint the student with the tools, materials and difficulties of shop practice and to establish in the mind principles which will aid him in designing and construction work in the other studies of his course and in his professional career.

The machine shops are equipped with a twenty-four by twenty-four inch planer, a milling machine, a universal grinding machine, a shaper, a drill press, two emery grinders, a polishing wheel, a power hack saw, a cutting off machine, eight engine lathes of capacities from ten to twenty inch swing and three to ten feet between centers, and three speed and drilling lathes together with the usual assortment of small tools in the tool room. Power is furnished to this shop by an electric motor.

The pattern shop is a brick building, one story high with spacious attic for storage of lumber. The building is one hundred and twenty feet long by forty feet wide. A tool room twelve by twenty feet is screened off in the center. A fire proof room is provided for patterns. The equipment of the pattern shop consists of a universal buzz saw, a mortising machine, planer, buzz planer, band saw, jig saw, grindstone, fifteen turning lathes, benches for thirty students, twenty-four complete sets of small
tools and a number of special tools. Power for this building is furnished by a twenty horse power electric motor.

The forge and foundry equipment are housed under one roof in a brick building eighty by forty feet. A steel truss roof structure of substantial construction provides support for an overhead traveling crane, which serves the whole floor for handling heavy ladles, castings and forgings. Twelve forges, an oil burning annealing and tempering furnace, donated by the Rockwell Engineering Co., with blower and exhaust fan, drill press, vises, anvils, grindstone and small tools, such as sledges, fullers and swages, constitute the equipment for forge work.

A cupola and blower for melting cast iron, a brass furnace, a core oven, core benches, twelve sets of moulder's tools, crucibles and a large assortment of flasks are used for foundry work. An electric motor supplies power for the forge and foundry.

Students are advised to work in outside shops during their vacations. Experience obtained in this way may be credited in the shop work required in the regular course.

DRAWING.

The drawing room work begins with free hand drawing and drawing, and linear perspective, and is followed successively by machine sketching, mechanical, kinematic drawing and designing. The latter division occupies the last two years of the course.

The object sought by the drawing room course is to enable the student to make, as quickly as possible, neat and accurate working drawings, to design, in general and in detail, machines or parts thereof, and to apply throughout his knowledge of shop methods and his theoretical information acquired in the laboratory and class room.

The two large drawing rooms on the fourth floor of Engineering Hall and a part of the combination drawing and class room on the second floor of the same building are equipped with fifty combination drawing tables, each accommodating four students at once. The drawing boards are placed in frames adjustable as to height and angle and equipped with parallel rulers. Each unit has twelve drawers which are assigned to students for their drawing instruments and supplies.

Extra drawing boards are supplied so that each place can be used by more than one student at different periods.

An extensive collection of blue-prints, photographs, drawings
and trade catalogues, as well as machines and parts thereof, constitute an important part of the working equipment in this branch of the work.

EXPERIMENTAL ENGINEERING.

Experimental work begins with the Junior Year and extends to the end of the course. The instruction in this work is thorough, its scope being indicated by the following list of experiments:

- Tensile, tranverse and compression tests of materials, properties and lubricants, measurements of power by absorption and transmission dynamometers, steam gauge and indicator spring calibration, flue gas analysis, indicator practice, variation of engine speed, fan-blower tests, calorimetry, including throttling and separating calorimeters, weir and water meter calibration, efficiency tests of steam engines, boilers, injectors, and steam heating, electric lighting, refrigerating, power and pumping plants, and thermal analysis of the steam engine, coal calorimetry, besides a number of special experiments in the line of investigation. Tests on power plants outside of the College are made as frequently as possible. The engineering laboratory work usually culminates in the thesis, which is an exhaustive investigation of a limited subject. From four to five hundred hours of actual time are spent on thesis by students in the engineering courses.

The power house contains the complete electric light and power and pumping plants of the College, all of which is available for experimental work, and constitutes a part of the engineering laboratory equipment of the engineering departments of the College. In the power house are a 100-H. P. Scotch boiler, a 51-H. P. Babcock & Wilcox boiler, and a 264-H. P. Cahall horizontal water tube boiler, a 75-H. P. Straight Line engine, a 50-H. P. Ball engine, a 40-H. P. Buckeye engine, and a 35-H. P. Ideal engine, with five dynamos alternating and direct current from 15 to 60 kilowatt capacity. In addition to the above the engineering laboratory equipment of the department consists of a 25-H. P. Harris Corliss engine with Alden absorption brake, a twelve horsepower Otto gasoline engine, a five horsepower Lennox gasoline engine, a Wheeler condenser, three Worthington and three other water meters, two Venturi meters, a Pelton water motor, a Holly duplex pump, a Morris Machine Works centrifugal pump, injectors, weir and weighing tanks, gas meters, a Crosby steam guage tester, fan blowers for experimental work, Westinghouse
and New York air pumps, a 100,000 pound Riehle testing machine with Gray autographic device, a 50,000 pound Olsen testing machine, an Olsen torsion testing machine, a Thurston oil tester, a complete De La Vergne refrigerating machine, gas and air analysis apparatus, anemometer, two Thompson, two Crosby and one Richards indicators, dynamometers, a Prony brake, Parr coal calorimeter, platform scales and other apparatus essential and accessory to experimental engineering.

A Hydraulic Laboratory has been fitted up in the basement of Old Engineering Hall. Water is supplied by about 700 feet of 8 inch and 10 inch cast iron pipe from the College elevated tank, of 163,000 gallons capacity. The available head is about 150 feet. Arrangements are made for measuring the loss of head from friction in the supply pipe and in its special castings. In the laboratory a tank in provided 90 feet long by 6 feet wide and 4 feet deep, which is used as a measuring and discharging tank for various pieces of apparatus, and which can also be used for experiments on the resistance of models to propulsion. The water is removed from this tank by two sewers; one 6 inches and the other 15 inches in diameter. These are arranged to be used for experiments on the laws of flow in sewer pipes. The laboratory is also provided with pipes of different sizes so arranged that measurements of the friction losses in these pipes and in their fittings can be made. Additional apparatus in the nature of hydraulic motors, pumps of various types, and apparatus for experiments with orifices is being provided.

Locomotive. The Chicago and Northwestern railway has presented to the department an eight-wheel passenger locomotive and tender complete with attachments. The locomotive will be mounted for experimental work and will be a valuable addition to the laboratory equipment.

The principal dimensions of the locomotive are as follows:

Cylinder, 16x24 inches.
Drivers, diameter, 63 inches.
Driving wheel base, 7 feet, 3 inches.
Total engine wheel base, 21 feet, 3 inches.
Total engine and tender wheel base, 42 feet, 3 inches.
Total weight of engine, 70,000 pounds.
Weight on drivers 40,000 pounds.

The estate of S. H. Mallory of Chariton, Iowa, has presented a narrow gauge locomotive, of the first in service on the moun-
tain roads of Colorado. The valve mechanism is of the Wael-
schert type and the drivers and leading wheels are on a truck
with the cylinders entirely separate from the boilers.

The engine is a very interesting machine and will be a nu-
cleus for a museum of railway mechanical engineering.

CLASS ROOM WORK.

In the class room the work is carried on by means of recita-
tion and lectures, a text book and recitations being used wherever
practicable; it is necessary, however, to present much material
not found in text books, and in such cases recourse is had to the
lecture system. Free use is made of the projection lantern and
models.

INSPECTION TRIPS.

Once each year or oftener visits of inspection are made by
the Senior class to power and manufacturing plants in Chicago
and other large centers. These prove of great value to all.

NON-RESIDENT LECTURES.

Lectures by men in active engineering work are introduced
from time to time and serve to add interest to the College work
by bringing students and teachers in contact with the outside
fields of engineering application.

THESIS.

So far as possible the graduating thesis is directed along
lines which will produce results directly useful to the industrial
interests of the State of Iowa, but this object is not furthered to
the detriment of the student's interest to whom the thesis must
be first of all an opportunity to think for himself and to apply
principles previously inculcated in the regular course of his
studies.

FEES.

All students taking shop work or engineering laboratory are
required to pay a fee to defray the cost of materials, power, and
breakage. The amount is specified in the description of the
courses of study.
MECHANICAL ENGINEERING AT AMES AND THROUGHOUT THE STATE.

It is the desire of the department to be of all possible service to owners and operators of power stations for heat, light and power, of machine shops and of manufacturing plants in any line.

To this end correspondence is invited relating to problems on mechanical engineering lines and whenever inquiries by letter or in person indicate a need for investigation demanding the technical skill and equipment of the department the same will be undertaken if possible and the results furnished to all interested.

COURSES OF STUDY.

The following courses of study are given by the Department of Mechanical Engineering:


Course IV.—Steam Engine.—Three lectures or recitations per week, second semester, Junior Year. Theory and practical application thereof to the steam engine and other heat engines. Professor Dow. Text-book, Thermodynamics of Heat Engines, Reeve. Course XII., Physics III. and IV. and Mathematics are prerequisites.

Course V.—Machine Design.—Three lectures per week, first semester, Junior Year. Elements of machine design. Professor Bissell. Simultaneous work in Courses I, XII and XXIV required. See also Course XXVIII.

Course VI.—Hydraulics.—Four recitations per week, first semester, Senior Year. Professors Meeker and Wilson. Text-book, same as for Course I. Courses I and II are prerequisites.
Course VII.—Steam Engine Design.—Three lectures per week, first semester, Senior year. A study of the principles involved in proportioning the cylinder dimensions of simple, compound and triple expansion engines and in the designing of fly-wheels, governors, valve-gears, engine shafts, etc. Professor Dow. Courses I, II, III and IV are prerequisites.

Course VIII.—Railway Mechanical Engineering.—Two lectures or recitations per week, first semester, Senior Year. Professor Bissell. Courses I, II, III, IV, XIII, and XXV are prerequisites.

Course IX.—Constructive Engineering.—Three lectures per week, second semester, Senior Year. Principles of design and construction of heating, refrigerating, power, lighting and pumping plants in general and detail. Professor Bissell. Courses I, II, IV and XII are prerequisites.

Course X.—Thesis.—The equivalent of one hour per week, first semester, Senior Year, and

Course XI.—Thesis.—The equivalent of five hours per week, second semester, Senior Year, devoted to special work on an assigned topic. Professor Bissell. The thesis can be undertaken only by those students in the Department of Mechanical Engineering who have completed the prescribed course in Mechanical Engineering to the end of the Junior Year. The expenses of the thesis are adjusted by special arrangement in each case.

Course XII.—Engineering Laboratory.—One half day, first semester, Junior Year, and

Course XIII.—Engineering Laboratory.—One half day per week, second semester, Junior Year. Properties of materials, calibration of instruments, valve setting, indicator practice and efficiency tests of simple machines. Professor Meeker and Mr. Cleghorn. Text-book, Experimental Engineering. Carpenter Physics II and IV and Chemistry III and VI are prerequisites. Fee, $3.00 for each course, XII and XIII.

Course XIV.—Engineering Laboratory.—Two half days per week, first semester, Senior Year, and

Course XV.—Engineering Laboratory.—Two half days per week, second semester, Senior Year. Efficiency test of stationary, and locomotive steam engines, gasoline and hot-air engines, boilers, refrigerating machinery and complete plants. Professor Bissell. Courses IV, XII and XIII are prerequisites. Fee, $5.00 for each course, XIV and XV.
Course XVI.—Seminar.—One hour per week, first semester, and
Course XVII.—Seminar.—One hour per week, second semester, Junior and Senior Years for students in Mechanical Engineering. Written papers on assigned topics with discussions thereof. Professors Bissell, Meeker and Dow.

Course XVIII.—Steam Engineering.—One lecture per week, with examinations at intervals, on the elementary principles of construction and operation of steam engines, boilers and accessory apparatus. Professor Bissell. Required of Freshmen in Mechanical Engineering, second semester. Elective to Academic students in engineering.

Course XIX (A)—Free-Hand Drawing.—Four hours per week, second semester, Academic Year for students in Science Course. Use of pencil and pen in sketching from flat copies and from objects. Mr. Lawton.

Course XIX.—Four hours per week, second semester, Academic year. Use of pencil and pen in sketching linear perspective, for engineering students.

Course XX.—Machine Sketching.—Three hours per week, second semester, Freshman Year. Machine sketching and mechanical drawing of and from machine parts. Mr. Allen and Mr. Lawton. Course XIX or its equivalent is a prerequisite.

Course XXI.—Mechanical Drawing.—Six hours per week, first semester, Freshman Year. The use of drawing instruments and practice in lettering. Mr. Allen and Mr. Lawton.

Course XXII.—Mechanical Drawing.—Six hours per week, first semester, Sophomore Year. Working drawings, tracings and blue prints of complete machines and their details. Mr. Allen. Courses XX and XXI are prerequisites.

Course XXIII.—Kinematic Drawing.—One lecture and five hours drafting per week, second semester, Sophomore Year. The relative motion of machine parts, including belting, gearing, cams and linkages. Mr. Allen. Course XXII is a prerequisite.

Course XXIV.—Designing.—Six hours per week, first semester, Junior Year, and
Course XXV.—Designing.—Three hours per week, second semester, Junior Year. Design of Steam Boilers. Text-book, Steam Boilers, Peabody and Miller. Also a study of the form, strength and proportions of the frames and moving parts of cranes and other machines, with detail drawings of same. Pro-
Professor Dow. Text-book, Hand-book of Information, Cambria Steel Co. Courses XXII and XXIII are prerequisites and concurrent work in Courses I and II is required.

Course XXVI.—Designing.—Six hours per week, first semester, Senior Year. Each student works out the design of a standard type of steam engine with especial attention to the design of the fly-wheel and governor for efficient speed regulation and obtains practice in laying out heating and ventilating plants. Professor Dow. Text-book, Mechanical Engineers’ Pocket Book, Kent. Courses I, II, III, IV, XXIV and XXV are prerequisites and simultaneous work in Course VII is required.

Course XXVII.—Designing.—Six hours per week, second semester, Senior Year. The design of complete machines of different types, including punching machinery, machine tools, special and automatic machinery. Attention is given to methods of construction as influenced by cost and other conditions. Practice in laying out power plants is given in connection with Course IX. Professor Dow. Courses I, II, III, IV and XXIV are prerequisites.

Course XXVIII.—Mechanical Engineering.—Two lectures per week, second semester, Junior Year. Mechanical Engineering practice, shop construction, management and cost keeping. Professor Bissell. Courses V, XXIV and XXIX to XXXIII are prerequisites.

Course XXIX.—Shop Work.—Eight hours per week for one semester. Bench work and wood turning. Mr. Potter and Mr. Spangler. Fee, $5.00.

Course XXX.—Shop Work.—Eight hours per week for one semester. Forge work, forging and welding iron and steel dressing and tempering tools. Mr. Knesche and Mr. Curl. Fee, $5.00.

Course XXXI.—Shop Work.—Eight hours per week for one semester. Pattern work, making patterns and core boxes for iron and brass castings, with allowances for draft, shrinkage and finish. Mr. Potter and Mr. Spangler. Courses XXIX and XXXII are prerequisites. Fee, $5.00.

Course XXXII.—Shop Work.—Eight hours per week, one semester. Foundry work, moulding and casting in iron and brass, green and dry sand, cores, mixtures and alloys. Mr. Knesche and Mr. Curl. Fee, $5.00.

Course XXXIII.—Shop Work.—Eight hours per week for one semester,
Course XXXIV.—Shop Work.—Eight hours per week for one semester,

Course XXXV.—Shop Work.—Eight hours per week for one semester. Machine shop. Use of hand and machine tools for working iron, steel and brass, finishing and assembling of machines and parts thereof. Mr. Hummel. Courses XXIX, XXX, XXXI, and XXXII are prerequisites. Fee, $5.00 for each course, XXXIII, XXXIV and XXXV.

COURSE IN MECHANICAL ENGINEERING.

*ACADEMIC COURSE.

FIRST SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Algebra, 5</td>
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<tr>
<td>English, 5</td>
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<tr>
<td>History, 4</td>
<td>4</td>
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<tr>
<td>Civics, 2</td>
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</table>

(English, I.)

(History, XV.)

(Civics, I.)

SECOND SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Algebra, 5</td>
<td>5</td>
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<tr>
<td>Elementary Rhetoric, 5</td>
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<tr>
<td>French, 5, or</td>
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<tr>
<td>German, $</td>
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<td>History, 2</td>
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(Mathematics, II or III.)

(English, II.)

(Languages, I.)

(Languages, V.)

(History, XVI.)

THIRD SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Plane and Solid Geometry, 5</td>
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<tr>
<td>English Literature, 5</td>
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<tr>
<td>French, 5, or</td>
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<tr>
<td>German, 5</td>
<td></td>
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<tr>
<td>Drawing, 2</td>
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<tr>
<td>**Steam Engineering, 1</td>
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(Mathematics, V and VIa.)

(Literature, IX.)

(Languages, II.)

(Languages, VI.)

(Mechanical Engineering, XIX.)

(Mechanical Engineering, XVIII.)

Freshman Year.

FIRST SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Advanced Algebra, 5</td>
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</table>

(Mathematics, IV.)

*Students who at entrance present satisfactory credits for part of the Academic work, or who by examinations pass part of it satisfactorily, will be classified in the remaining studies to the best advantage. Frequently such students can take 10 hours of mathematics in preparing for the Freshman work. Opportunity will be offered during the four weeks winter vacations whereby students somewhat deficient in mathematics, English or modern language can make up some work in those lines under private tutors.

**Elective upon consultation with Professor of Mechanical Engineering.
DIVISION OF ENGINEERING 201

French, 5, or (Languages, III.)
German, 5 (Languages, VII.)
Advanced Rhetoric, 5 (English, III.)
Shop-Work, 2 (Mechanical Engineering, XXIX., XXX. or XXXII.)
Mechanical Drawing, 2 (Mechanical Engineering, XXI.)
History, English History, 1 (History, XVII.)
Military Drill, 2 (Military, I.)
Library Work, 4 hours (Library, I.)

SECOND SEMESTER.

Solid Geometry and Plane Trigonometry, 5 (Mathematics, VI.)
French, 5, or (Languages, IV.)
German, 5 (Languages, VIII.)
Composition, 1 (English, IV.)
Descriptive Geometry, 4 (Civil Engineering, IV.)
Machine Sketching, 1 (Mechanical Engineering, XX.)
Shop-Work, 2 (Mechanical Engineering, XXIX., XXX. or XXXII.)
Steam Engineering, 1 (Mechanical Engineering, XVIII.)
History, Formation of the Union, 1 (History, XVIII.)
Military Drill, 2 (Military, II.)

Sophomore Year.

FIRST SEMESTER.

Analytical Geometry, 5 (Mathematics, VIII.)
Physics, 5 (Physics, III.)
Chemistry, 5 (Chemistry, III.)
Shop-Work, 2 (Mechanical Engineering, XXX, XXXI, or XXXII.)
Mechanical Drawing, 2 (Mechanical Engineering, XXII.)
Composition, 1 (English, V.)
Military Drill, 2 (Military, III.)

SECOND SEMESTER.

Calculus, 5 (Mathematics, IX.)
Physics, 5 (Physics, IV.)
Chemistry, 5 (Chemistry, VI.)
Shop-Work, 2 (Mechanical Engineering, XXX, XXXI, or XXXII.)
Mechanical Drawing, 2 (Mechanical Engineering, XXIII.)
Composition, 1 (English, VI.)
Military Drill, 2 (Military, IV.)
## Junior Year.

### First Semester.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Analytical Mechanics</td>
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<tr>
<td>Political Economy</td>
<td>5</td>
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<tr>
<td>Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>Machine Design</td>
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<tr>
<td>Physical Laboratory</td>
<td>1</td>
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<tr>
<td>Engineering Laboratory</td>
<td>1</td>
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<tr>
<td>Designing</td>
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<tr>
<td>Shop-Work</td>
<td>2</td>
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<tr>
<td>Seminar</td>
<td>1</td>
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<tr>
<td><strong>Debating</strong></td>
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<tr>
<td><strong>History, XIXth Century</strong></td>
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### Second Semester.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Analytical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Materials of Construction</td>
<td>3</td>
</tr>
<tr>
<td>Dynamo Electric Machinery</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Physical Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Designing</td>
<td>1</td>
</tr>
<tr>
<td>Steam Engine</td>
<td>3</td>
</tr>
<tr>
<td>Shop-Work</td>
<td>2</td>
</tr>
<tr>
<td>Seminar</td>
<td>1</td>
</tr>
<tr>
<td><strong>Debating</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>History, XIXth Century</strong></td>
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## Senior Year.

### First Semester.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Steam Engine Design</td>
<td>3</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>4</td>
</tr>
<tr>
<td><em>Railway Mechanical Engineering</em></td>
<td>2</td>
</tr>
<tr>
<td>Designing</td>
<td>2</td>
</tr>
<tr>
<td>Engineering Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Shop-Work</td>
<td>2</td>
</tr>
<tr>
<td>Physical Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Specifications and Contracts</td>
<td>1</td>
</tr>
<tr>
<td>Seminar</td>
<td>1</td>
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<tr>
<td>Thesis</td>
<td>1</td>
</tr>
<tr>
<td><strong>History, XIXth Century</strong></td>
<td>2</td>
</tr>
</tbody>
</table>

*Elective for year 1906. Interchange with M E. XXVIII for callendar year 1905.

**Elective on consultation with the Professor of Mechanical Engineering.
SECOND SEMESTER.

History of Engineering, 1
Constructive Engineering, 3
Hydraulic Engineering, 3
Electrical Engineering, 2
Designing, 2
Engineering Laboratory, 2
Seminar, 1
Thesis, 5
*Wood Technology, 3

(Engineering, I.)
(Mechanical Engineering, IX.)
(Civil Engineering, XXII.)
(Electrical Engineering, XXXII.)
(Mechanical Engineering, XXVII.)
(Mechanical Engineering, XV.)
(Mechanical Engineering, XVII.)
(Mechanical Engineering, XI.)
(Forestry; IV.)

DEPARTMENT OF CIVIL ENGINEERING.

A. MARSTON, PROFESSOR.
L. E. ASHBAUGH, ASSOCIATE PROFESSOR.
F. C. FRENCH, ASSISTANT PROFESSOR.
T. H. MCDONALD, ASSISTANT IN CHARGE OF ROAD INVESTIGATIONS.
J. E. STEWART, INSTRUCTOR.
C. JOHNSON, ASSISTANT.
M. J. REINHART, L. L. HIDINGER, STUDENT ASSISTANTS.

The Department of Civil Engineering has its headquarters in new Engineering Hall. The offices of the Department occupy rooms 311, 315, and 316 in the third story of the building. In addition, the Department has two large class-rooms and a combination drawing-room and class-room in the third story of the building, a large drawing-room 40 feet by 70 feet in the fourth story and an ample sized instrument room in the fourth story, besides a cement laboratory and a masonry laboratory in the first story. The Department also has the use, in common with the other Engineering Departments, of the photographic and blue print rooms in the fourth story, the large Engineering Museum in the third story, and the large Assembly Room in the second story. All of these rooms are finely furnished and equipped throughout.

*Elective on consultation with the Professor of Mechanical Engineering.
In connection with the offices provision is made for the systematizing of all the work of the Department, and card indexes for correspondence, equipment, and for general engineering literature are provided.

In addition to the space occupied in the new Engineering Hall part of the equipment of the Department is placed in the old Engineering Building. Here are located one drawing room, the hydraulic laboratory, and most of the apparatus for testing the materials of construction. In these lines of work the Departments of Civil Engineering and Mechanical Engineering cooperate.

The Instrumental Surveying Equipment is nearly all kept in room 409 on the fourth floor, where suitable cases and racks are provided for storing it in a systematic way. The instrumental equipment includes eleven complete engineer's transits, one plain transit, one astronomical transit, one plane table, one surveyor's compass, one railroad compass, one solar compass, six traverse tables, eleven engineer's levels, and numerous chains, tapes, rods, etc. The Department is also well supplied with minor instruments, such as drawing instruments, clinometers, computing machines, planimeter, hand levels, etc. This equipment is being constantly added to from yearly appropriations.

In giving out the instruments for the field work in the Civil Engineering course the captain of each field party signs a receipt for all apparatus taken out, and upon return of the same these receipts are cancelled and kept on file. Students are required to return all apparatus in as good condition as when taken out.

Although the instrument room is located on the fourth floor of the building an electric elevator is provided, landing within a few steps of the door of the room, which makes access to the apparatus convenient.

The Cement Laboratory is located in the first story, occupying room 105. Stone topped tables are provided on three sides of this room on which the mixing and breaking of briquettes and similar work is done. On two sides of the room are provided tanks underneath these tables for the storage of briquettes. Investigations are constantly under way with cements and similar substances, so that ample storage room is required. Under the stone topped table on the other side of the room are provided cement bins for storing cement and standard sand.
A Fairbanks testing machine is used for breaking the briquettes. There is an ample supply of molds for making the briquettes and the usual apparatus is provided for testing soundness, fineness, and rate of setting.

The Masonry Laboratory occupies room 106 of the first floor. This room is intended for the testing of building materials, especially brick and stone. Laboratory tables are provided for microscopic work and other work in this line. Grinding apparatus is arranged for preparing specimens for crushing and other tests and is separated from the rest of the room by a glass enclosure, the dust from within which is removed to the outside of the building through a flue. It is intended to place a large testing machine in this laboratory.

The apparatus for freezing and thawing tests of brick and stone is also located here.

The Hydraulic Laboratory is located in the basement of the old Engineering Building. The quarters here are not very suitable but it is intended to improve them as soon as possible. Water is supplied by about 700 feet of 8 inch and 10 inch cast iron pipe from the college elevated tank of 163,000 gallons capacity. The available head is about 150 feet. Arrangements are made for measuring the loss of head from friction in the supply pipe and in its special castings. In the laboratory a tank is provided 50 feet long by 6 feet wide and 4 feet deep, which is used as a measuring and discharging tank for the various pieces of apparatus. The water is removed from this tank by two sewers, one 6 inches and the other 15 inches in diameter. These are arranged to be used in experiments on the laws of flow in sewer pipes. The laboratory is also provided with wrought iron pipes of different sizes, so arranged that measurements of friction losses in these pipes and in their fittings can be made. Additional apparatus in the nature of weirs, hydraulic motors and pumps of various types is provided.

Laboratory Facilities for other tests of the materials of construction are provided for in connection with the Mechanical Engineering Department in the old Engineering Building. The Civil Engineering Department owns an abrasion testing machine and, jointly with the Mechanical Engineering Department, a 100,000 pound Riehle testing machine. The Civil Engineering students also have the use of other testing machines belonging to the Mechanical Engineering Department.
Standard Engineering Plans.—The Department has a large collection of blue print plans of bridges, roof trusses, buildings and similar structures, which have been kindly donated by the principal corporations engaged in structural engineering throughout the country. In a similar way, the principal railway companies of the country have donated standard plans of railway structures; and many plans and specifications of water works, sewer systems, and other engineering work are also to be found in the Department's collection of standard plans. This collection is constantly being added to. It is arranged systematically in large drawers, in filing cases provided in connection with the office equipment. In the general arrangement, plans relating to the same subject are kept in the same drawer. In addition, a card index is provided whereby any drawing in the collection can readily be found.

The Engineering Museum on the third floor of the new Engineering Hall, 60 feet in diameter, is intended for the joint use of all the Departments of Engineering. This room is completely supplied with museum cases, and space is provided in which will be placed large models of engineering structures. The collection of specimens for this Museum is just beginning, but the Civil Engineering Department has already a set of the full sized sections of wrought iron and steel commonly used in engineering structures and a collection of specimens of Iowa building brick, paving brick, building stone, and other building materials. The Museum collection will be extended as rapidly as possible.

Water Works and Sewage Disposal Plant.—The Civil Engineering Department designed and supervised the construction of the college water-works. The College water tower is the largest in the west. It was designed with special reference to its architectural appearance and cuts of it have been published in four of the books treating of the design of such structures. The pumping machinery is so arranged that college students can readily make tests of the efficiency of the apparatus as part of the class work.

The Civil Engineering Department has also designed and supervised the construction of the college sewage disposal system. This is the first purification plant installed in the state and has been very successful.

The water works system and sewage disposal plant are utilized, so far as possible, to furnish practical object lessons to the students in Hydraulic and Sanitary Engineering.
For many years the Civil Engineering Department has been engaged in conducting various investigations helpful to the industrial interests of Iowa, and the results have been made available in numerous publications. This work is now merged in that of the Engineering Experiment Station, described later in this catalogue.

The Alumni of the Department.—The Civil Engineering Department of the Iowa State College is proud of the record made by its Alumni, in all branches of Civil Engineering, as shown by their eminence as engineers. They are to be found located in responsible positions throughout this country and abroad. The Department maintains an Alumni Directory and endeavors to keep in touch, so far as possible, with its graduates. It is often the case that the Department is able to be helpful to the Alumni by recommending them for positions. The Department receives more and more calls for men to fill good positions. Many of these calls come from the older Alumni themselves.

The nature of the positions open to new graduates may be seen from those occupied by last year's class. Of this class, which graduated in June, 1904, two are engaged in railway engineering in Florida, two are employed by the largest dredging company in the country (of which an earlier alumnus is president), and are stationed respectively at Savannah, Ga., and Washington, D. C., several are engaged in bridge engineering, being employed by the American Bridge Co., several are employed by Iowa engineering and contracting firms, in lines of railway, bridge, water supply, sewerage and drainage engineering. One is on the engineering corps of the Philippine government, and one is engaged in engineering work in Slam. The salaries of these men range up to $100 per month.

COURSE OF STUDY.

One of the most eminent of American engineers has said, "The civil engineer of the new epoch must be an educated man. In no profession will this be more necessary." The work of the course of study in Civil Engineering has been arranged to give as thorough a training as practicable in those fundamental subjects, a knowledge of which must form the foundation of the equipment of the competent civil engineer. The work may be classified under the heads, Culture Studies, Mathematical Studies, Science Studies, and Professional Studies.
Culture Studies include History, English, French or German, and Political Economy. Thorough work in English is especially necessary in the training of the engineer to enable him to express himself with the utmost clearness and conciseness, in his reports and in papers on technical subjects. No one can attain great success as an engineer who fails in these particulars. His success in carrying out projects upon which he is engaged will often depend upon his ability to convince his superiors or public officials of the correctness of his views. The really successful engineer also must come in close contact with other members of his profession, and must exchange information of value with them through the medium of papers on technical subjects. For the attainment of these ends the engineer should give especial attention to the thoroughness of his training in English. The work in English begins in the Academic year and continues to the end of the Sophomore year. Much training in the writing of essays is given, and the last three terms are devoted wholly to this kind of work, which is of especial importance to the engineer. A course in debating is offered throughout the Junior year which all students who can do so are advised to elect. It is of importance to the engineer to be able to express himself creditably orally as well as in writing. The drill in English is continued to some extent throughout the Junior and Senior years by the work in the Engineering Seminar, which requires careful preparation of papers on professional subjects.

The work in pure mathematics continues throughout the Academic course and the Freshman and Sophomore years, and includes instruction in Algebra, Plane and Solid Geometry, Plane and Spherical Trigonometry, Analytical Geometry and Calculus. Thorough preparation in mathematics is one of the most essential things in an engineer’s education, and without it he can never pass beyond the mere workman stage in his profession. It is especially necessary that he should be able to apply his knowledge of mathematics with facility to the actual problems he encounters in his professional work. Hence the instruction in mathematics is specially directed to giving facility in the solution of problems. The work in pure mathematics is supplemented in the Freshman year by a course in Descriptive Geometry, which gives the application of mathematics to draughting, and in the Junior and Senior years by thorough courses in Analytical Mechanics, Strength of Materials, and Hydraulics,
which give the mathematical applications of physical laws to the designing of engineering structures and to the study of the laws of liquids. Practical Astronomy is studied in the second term of the Senior year.

The successful engineer must also be thoroughly familiar with the scientific principles relating to the laws and forces of nature which he must use in his professional work. Instruction in the physical sciences begins with Chemistry and Physics in the Sophomore year. Geology is taught in the Senior year. The College laboratories are especially well fitted for giving training in scientific work. It is by a study of scientific subjects supplemented by laboratory work that the engineer becomes familiar with those sources of power in nature which it is his life work to direct for the use and convenience of man.

For detailed information as to the nature of the professional work given in the course in Civil Engineering the reader is referred to the statements regarding each specific subject under the head of "Courses" below. It may be said here in a general way that the instruction in Free-Hand Drawing begins in the Academic course. Mechanical Drawing, Lettering, the use of Water Colors and Pen Topography are studied in the Sophomore year. In the course of instruction in Drawing it is attempted to give the student such facility in drawing that he can do creditable work in an engineering draughting office. Especial attention is paid to the lettering of all drawings, both in the direct class work in Lettering, and in the finishing up of all other drawings made in connection with his other professional work. The student is required to letter them plainly and neatly and to make finished plates. Throughout the Sophomore, Junior and Senior years the student has practice in the preparation of maps and of drawings and plans of various engineering structures.

The work in Field Surveying practice begins in the Freshman year and continues for three years, seven hours per week. The student serves in a subordinate position until he becomes familiar with the instruments and the work, and finally he has charge of a small party. He becomes familiar with land surveying, leveling, topographical surveying and railway surveying by actual work in the field. It is the aim of the course to give the student the facility in the handling of instruments and in the carrying out of operations in field surveying which can only
be acquired by considerable practice. It is also attempted to
give him as much experience as possible in the handling of small
parties of men. Besides the above work students actually camp
in the field for two weeks in each of three summer vacations,
and so become familiar with topographical work on a more ex­tended scale. In lieu of this summer surveying many students
obtain renumerative work with engineers throughout the sum­mer vacation. Such work, when properly certified to by the
engineer under whom it is taken, is accepted in lieu of the sum­mer camp surveying. Students are encouraged and urged to
secure positions of this kind, as it not only assists them finan­cially, but also is of great benefit to them in connection with
their professional training.

A course of instruction in Land and Topographical Surveying
runs throughout the Sophomore year and one in Railway Engin­
eering runs throughout the Junior year.

Electric Railways and Power Transmission are also studied
in the Junior year.

Instruction in Roads and Pavements is given in the second
semester of the Senior year. Sanitary Engineering, Water Works
Engineering, Bridge Engineering, and Masonry Structures and
Foundations are taught in the Senior year. For the details of
each of these courses reference should be made to the informa­
tion given below under the specific course named. The designing
of engineering structures by the student begins in the second
semester of the Junior year and continues throughout the Senior
year. In this work the student actually designs roof trusses and
stone and steel truss bridges, preparing the working drawings.
A course of actual practice in testing the various materials of
construction in the Engineering Laboratory is given in the Junior
and Senior years, and is of great value in familiarizing the stu­
dent with methods of testing and with the properties of the
materials of construction.

A valuable part of the work of the course is not laid out on
paper, but is gained by inspection of engineering work on the
inspection tours arranged for the upper classmen. It is planned
at least once a year to have the Junior and Senior students go
on an inspection trip to some point where various engineering
works can be inspected and their instructive features noted.
Trips are made to Chicago, St. Paul, St. Louis, and other places.
Valuable instruction is also obtained by listening to lectures given by non-resident lecturers. Practicing engineers are invited to the College to give lectures to the engineering students upon the subjects in which they are experts. During the present year a course of ten railway lectures is being given by prominent railway engineers and officials, and is proving of great interest and value. Other lines of engineering work are presented in a similar manner.

The work of the course finally culminates in the thesis, an original investigation carried on by the student to demonstrate his ability to do such work before he graduates. In the past large amounts of time have been devoted by students as a rule to this work, and it has often been the case that the results have been found worthy of publication. Each student should attempt to make his thesis one of the things of which he can justly be proud throughout the remainder of his professional career.

The following courses of study are given by the Civil Engineering Department:

Course I.—Lettering.—Three hours per week throughout the first semester, Freshman year. Text-books, Reinhart’s “Lettering” and “Technic of Mechanical Drafting.” Practice work on plain and ornamental alphabets, both free hand and mechanical, with special attention to the simple, free hand lettering. Preparation of plates illustrating the various types of letters and their uses in working drawings, maps, titles, etc. Also practice work and preparation of plates of conventional symbols used in engineering drawings.

This work is introductory to all other courses in Civil Engineering drawing and designing, and thus continues throughout the course. Mr. Stewart.

Course II.—Field Work.—Seven hours per week during the first semester, Freshman year. Fee, $2.00. See Course III. Prof. Ashbaugh, Mr. Stewart and Mr. Johnson.

Course III.—Field Work.—Seven hours per week during the second semester, Freshman year. In Courses II and III the men are assigned to do duty as chainmen, axemen and rodmen in the squads in Sophomore Surveying and Junior Railway Surveying, of which Sophomores and Juniors have charge, besides serving as instrument men. Frequent lectures are given on methods of field work, note books, mapping, etc. A fee of $2.00 is charged
to pay for stakes, ordinary wear of instruments, etc. Professor Ashbaugh, Mr. Stewart, and Mr. Johnson.

Note. The work in Courses II and III is preparatory to the Field Work of the Sophomore and Junior years, which takes the same number of hours per week each year. Thus the student has the training to be obtained by three years' actual experience in the field. He begins in a subordinate position, but for a part of the time he is in responsible charge of a small party.

Course IV.—Descriptive Geometry.—Two recitations and six hours drawing per week throughout the second semester, Freshman year. Text-book, MacCord's "Descriptive Geometry." Many original problems are also solved in class and in the draughting room. Descriptive Geometry is the connecting link between pure mathematics and technical drawing, and is taught partly as a theoretical and partly as an applied subject. Many of the problems have direct application to engineering work. This course is open to students who have completed Mechanical Drawing, Plane Geometry, and second semester Academic Algebra. Professor French, Mr. Stewart, and Mr. McDonald.

Course V.—Drawing. Tinting and Shading and Pen Topography.—Six hours per week throughout the second semester, Freshman year.

This work continues Course I, and consists in practice with water colors, as used in tinting and in shading, the formation and use of topographical symbols, contours and hatchings, and the preparation of topographical maps. Course I required. Mr. Stewart and Mr. Johnson.

Course VI.—Drawing, Shades, Shadows and Perspective.—Three hours per week throughout the first semester, Sophomore year. The drawing is based on the principles of Descriptive Geometry, including the solution of a number of problems with various sources of light and points of view, and including the preparation and architectural rendering of a perspective drawing of a building or engineering structure, from the detailed plans. This course is open to students who have completed Course IV. Mr. Stewart.

Course VII.—Drawing, Plans of Structures.—Three hours per week throughout the second semester, Sophomore year. This work continues Course V, and consists in the preparation of working drawings for culverts, trestles, cattle guards, switches, small bridges and other standard structures, especially railway structures. This course is open to students who have completed Course V. Prof. French and Mr. Stewart.
Course VIII.—Surveying.—Two recitations and seven hours field work per week throughout the first semester, Sophomore year, in the Civil Engineering and Mining Engineering courses, and elective throughout the first semester, Junior year, in the Animal Husbandry and Dairying courses.

This course is open to students who have completed Geometry and Plane Trigonometry. A fee of $3.00 is charged to pay for stakes, ordinary wear of instruments, etc. Professor Ashbaugh and Mr. Johnson.

Course IX.—Surveying.—Two recitations and seven hours field work per week throughout the second semester, Sophomore year, of the Civil Engineering and Mining and Engineering courses, continuing Course VIII. Fee $3.00. Professor Ashbaugh and Mr. Johnson.

Courses VIII and IX.—The text-books used are Johnson's "Theory and Practice of Surveying" and Elliott's "Engineering for Land Drainage." The topics treated in the class-room are the use and care of surveying instruments, problems in surveying, including methods of calculating areas of tracts of land, the study of the United States public land surveys with special reference to the restoration of lost or obliterated corners, and sub-division of sections, the best methods of doing field work and keeping notes for the same, and the making of maps and profiles.

The study of Drainage Engineering demands special attention in this state and the course is adapted to such needs. The principles of the subject receive careful attention in the class room and are put into immediate practice in the investigation of various tracts of land in the vicinity of the College where development by drainage is advisable. The thorough drainage of individual farms is considered, and also the engineering and legal methods employed on large districts under county control. The usual reports of the engineer are required from each student, including complete maps and profiles, estimates of cost, and the report of the Commission on the assessment of the various properties. During the past few years it has frequently been found practicable for students to find remunerative work at drainage engineering at various places in the state in addition to their regular class work.

The field work, which occupies seven hours each week, gives practice in the use and adjustment of surveying instruments, various methods of careful measurements with tapes, and with
transit and level, exact methods of triangulation, and the making of surveys for maps and profiles. The data used in the land survey practice are obtained from official records at the County Recorder's office. The usual office work of making maps and profiles for surveys is carried out by each student. Frequent reference is made to the best engineering periodicals and the students prepare abstracts of articles of interest as the topics are studied in the class room. While the aim of this course is to hold rigidly to exact methods consistent with results required and to give the student a broad knowledge of principles of surveying, at the same time he is taught to use the methods employed in the best engineering offices that he may be ready to fall in line with his associates on entering his actual practice.

Special attention is given to the various methods of Topographical Surveying. During the past year each party has made a complete stadia survey of a half section of farm land, each student making a map thereof. Other subjects treated in this course are Hydrographic Surveying, Mining Surveying, City Surveying, and Geodetic Surveying.

Course X.—Railway Engineering.—Three recitations and seven hours field work per week throughout the first semester, Junior year. See Course XI. For one of the recitations three hours office work are substituted part of the term. A fee of $3.00 is charged for stakes, ordinary wear of instruments, etc. Professor French.

Course XI.—Railway Engineering.—Three recitations and seven hours field work per week, throughout the second semester, Junior Year. For one of the recitations three hours' office work are substituted during part of the term. Fee $3.00. Professor French.

For Courses X. and XI. the text-books are Searle's "Field Engineering," Crandall's "Transition Curves," Tratman's "Railway Track and Track Work," and Professor Marston's and Professor French's Notes. In the Notes, practical details of railroad location and construction are given, standard plans for railway structures are given and discussed, and the economic theory of railway location is treated at some length. In the text-books some of the topics are simple, compound and transition curves, the location and construction of railways, track standards and maintenance, etc. In the field work a preliminary survey of about four miles of railway is made, from which a contour map is prepared. On
this a “paper location” is laid down, after a careful study to determine the best route. This located line is then run in the field and cross sectioned. The grading is calculated, bills of material for culverts and bridges are made, bridges are staked out, and the cost of the line is estimated.

During the past year complete location surveys for private companies, including complete estimates of cost and all the maps, profiles and other data needed to inaugurate construction were made of two interurban railways in Iowa by parties made up of students selected from the regular class, under direction of the professor in charge. One of these lines was thirty miles in length. It is the general policy to continue such work from time to time as opportunity occurs, selecting the students to do the work from those showing greatest proficiency in this and related studies.

Courses X. and XI. are open to students who have completed Geometry, Plane Trigonometry, and Courses VIII. and IX.

Course XII.—Roads and Pavements.—Two recitations per week throughout the second semester, Senior Year, in the course in Civil Engineering. Text-book, Baker’s “Roads and Pavements.” Among the topics studied are the good roads problem, traffic over country roads, tractive resistance, the best method of constructing and maintaining earth roads, gravel roads, and broken stone roads, and the costs of various kinds of roads. In the study of country roads, especially as relating to Iowa conditions, great assistance is given by the fact that the college is by law the State Highway Commission of Iowa. All its data, plans, maps and publications are available and are largely made use of.

In connection with pavements among the topics studied are city streets and grades, classes and methods of construction of pavements, and the costs of various kinds of paving. Professor Marston and Mr. McDonald.

Course XIII.—Roads and Pavements.—Two recitations throughout the second semester, Junior year in the courses in Animal Husbandry, Dairying and Horticulture. Text-book, Baker’s “Roads and Pavements.” The work is similar to that in Course XII. except that during the latter part of the semester less attention is paid to city pavements and in place of this the class will undertake field and office work in connection with road improvement, such as making survey of road, preparing map and profile of improvement, staking out the work, and estimating the cost. Professor Marston and Mr. McDonald.
Course XIV.—Engineering Laboratory.—Six hours per week throughout the second semester, Junior year. Fee $5.00. The work is done in the testing laboratories, and consists in making the various standard tests of the materials of construction, including cement, building stones, paving brick, wood, cast iron, wrought iron, and steel. This course is open to Juniors. Professor French.

Course XV.—Engineering Laboratory.—Three hours per week throughout the first semester, Senior year. Fee, $3.00. The work consists of experiments in the Hydraulic laboratory, such as gauging the flow of water over weirs, through orifices and in sewer pipes, measuring the friction in pipes, and testing the efficiency of pumps and hydraulic motors. This course is open to Seniors who are at the same time studying hydraulics. Professor French.

Course XVII.—Designing, Structural.—Two lecture hours and four hours designing per week throughout the second semester, Junior year. Text-book, Ketchum's "Steel Mill Buildings." A study of stresses in roof trusses and mill buildings, followed by the design of the building and complete shop details of the roof truss and parts of the columns, crane girders, etc. In stress calculations graphic analysis is largely used and checked by the algebraic methods. Several leading types of trusses, monitors, roof and wall coverings, etc., are considered, thus furnishing many different subjects for the designs. It is the aim of this course to give the student such practice in the use of the standard hand-books, methods of design, and the making of shop drawings, that he may be of some service in the drawing room of a bridge company during the summer vacation. Students are urged to secure such practice, when possible, during the vacation preceding the work of the Senior year. This course is open to students who have completed the first semester Junior work in Analytical Mechanics, and are pursuing simultaneously the second semester Junior work in the same subject. Professor Ashbaugh.

Course XIII.—Framed Structures.—Four recitations, one lecture and eight hours designing per week during the first semester, Senior year, continuing Course XVII. Professor Ashbaugh.

Course XIX.—Framed Structures.—Three recitations, one lecture and three hours designing per week during the second semester, Senior year, continuing Course XVIII.

For Courses XVIII. and XIX., the text-books are Merriman
and Jacoby's "Roofs and Bridges," and Greene's "Arches," with special notes in mimeograph and blue-print form. The class room work consists of the study of methods for computing the stresses, proportioning members, designing joints, etc., for bridge and roof trusses and other framed structures. Many problems in stresses are worked out, including various types of simple bridge and roof spans, cantilevers, two and three hinged arches, draw bridges, towers, etc. A complete design of a bridge is also given in class preparatory to the drawing room work. Construction in reinforced concrete is also given special attention.

An outline of the work in designing is as follows, each student working independently and usually on a design different from all others: Complete design and shop details of a short plate girder, a pin connected through highway bridge, a riveted lattice girder, and a long plate girder of special type, also design and show drawing of a steel water tank and tower. Professor Ashbaugh.

Course XX.—Stereotomy.—Six hours per week throughout the second semester, Senior year. Reference texts, Greene's "Arches," and other works on arches and reinforced concrete by Marsh, Cain, Buell and Hill, and others. The works consists of the design of stone brick and reinforced concrete arches. This course is open to students who have completed Course XVIII.

Course XXI.—Sanitary Engineering.—Three recitations per week throughout the first term, Senior year. Text-book, Folwell's "Sewerage," and Professor Marston's Notes. The work consists in the study of the principles and methods involved in the design, construction and maintenance of sewerage systems. House plumbing and sewage disposal are studied in the Notes. Professor Marston.

Course XXII.—Hydraulic Engineering.—Three recitations per week throughout the second semester, Senior year, on the principles and methods involved in the design, construction and maintenance of water works systems. Text-book, Turneaure and Russell's "Water Supply Engineering." Professor Marston.

Course XXIII.—Masonry Structures.—Three recitations per week throughout the first semester, Senior year. Text-book Baker's "Masonry Structures." The work consists in the study of principles involved in the design and construction of foundations, and in the design, construction and maintenance of all classes of masonry structures. Professor Marston.

Course XXIV.—Practical Astronomy.—Four recitations and
three hours field work per week for the last ten weeks of the first semester, Junior year. Required, Mathematics VII. and IX. The work covers the ordinary methods of determining latitude, longitude, and time, with their applications to Geodetic Surveying. Text-book, Hayford's "Geodetic Astronomy." Professor French.

Course XXV.—Thesis.—Credit equivalent to one recitation per week throughout the first semester, Senior year, is given for the thesis work required during that semester. See Course XXVI. Professor Marston.

Course XXVI.—Thesis.—Credit equivalent to three recitations per week throughout the second semester, Senior year, is given for the thesis work required that semester. The credits for thesis, Courses XXV. and XXVI. require at least three hours per week thesis work throughout the first semester, Senior year, and nine hours per week throughout the second semester, Senior year. Students are required to put in as much additional time as may be necessary to thoroughly work up the subject chosen, and to prepare a well-digested and complete writeup of the results. Most students devote much extra time to the work. The subject chosen must be one requiring original work. It may be the study and design of some engineering project (including the surveys), the investigation of some engineering question, or an experimental investigation. Professor Marston.

Course XXVII.—Engineering Seminar.—Credit is given equivalent to one recitation per week, first semester, Junior year. See Course XXX. Professor Ashbaugh.

Course XXVIII.—Engineering Seminar.—Credit is given equivalent to one recitation per week, second semester, Junior year. See Course XXX. Professor Ashbaugh.

Course XXIX.—Engineering Seminar.—Credit is given equivalent to one recitation per week, first semester, Senior year. See Course XXX. Professor Ashbaugh.

Course XXX.—Engineering Seminar.—Credit is given equivalent to one recitation per week, first semester, Senior year. Professor Ashbaugh.

The Civil Engineering Seminar, Courses XXVII. to XXX., inclusive, meets once each week, while College is in session, and has for its members the professors and the instructors in Civil Engineering, and all students in the Junior and Senior classes in the course in Civil Engineering. At each meeting five students give "journal reviews" of the most timely articles and topics
found in the current numbers of the technical journals, a large number of which are regularly taken by the College Library. Another student then reads a paper on some engineering subject. Both the journal review and the paper are discussed by the other members of the Seminar. The subjects for the papers follow a regular, connected program, arranged in advance for each semester.

Course XXXI.—Summer Surveying.—Thirteen entire days’ work in the field in the summer vacation following the Freshman year. See Course XXXIII. Professors Ashbaugh and French, and Mr. Stewart and Mr. Johnson.

Course XXXII.—Summer Surveying.—Thirteen entire days’ work in the field in the summer vacation following the Sophomore year. See Course XXXIII. Professors Ashbaugh and French, and Mr. Stewart and Mr. Johnson.

Course XXXIII.—Summer Surveying.—Thirteen entire days’ work in the field in the summer vacation following the Junior year. Professors Ashbaugh and French, and Mr. Stewart and Mr. Johnson.

In the work of Courses XXXI. to XXXIII., inclusive, the professors of Civil Engineering and the students in the course in Civil Engineering go into camp for fifteen days each summer vacation, beginning the Saturday before Commencement, and conduct an organized topographical survey of some region in the state. Each year’s work continues that of the preceding year, until a large area is mapped. At present a strip about three miles wide, half on each side of the Des Moines river, south of Boone, is being mapped. Lower classmen will serve in subordinate positions. Upper classmen will have responsible charge of parties, and will do the triangulating and final mapping. All camp equipage, including tents and cooking utensils, will be furnished by the College. Students must pay their own traveling and living expenses. A corps of student officers has direct charge of the work, part of these officers being elected by the students and part appointed by the department. It is one of the greatest honors in the course of Civil Engineering to be chosen on this corps of officers. The list of student officers for the summer camp of 1904 was as follows:

Chief Engineer—N. B. Garver.
Assistant Chief Engineer—L. L. Hidinger.
Computer—W. D. Truman.
Chief Draughtsman—J. W. Johnston.
Junior Commissary—B. C. Jacobsen.
Sophomore Commissary—W. D. Maxwell.
Freshman Commissary—Carl Kupfer.
COURSE IN CIVIL ENGINEERING.

*Academic Course.

**FIRST SEMESTER.**

Algebra, 5  
English, 5  
History, 5  
**Field Work, 2**  
Civics, 2  

**SECOND SEMESTER.**

Algebra, 5  
Elementary Rhetoric, 5  
History, 2  
French, 5, or  
German, 5  
**Field Work, 2, or Drawing, 1**  

**THIRD SEMESTER.**

Plane and Solid Geometry, 5  
English Literature, 5  
French, 5, or  
German, 5  
Drawing, 2  
**Field Work, 2, or Drawing, 2**  

**Freshman Year.**

**FIRST SEMESTER.**

Advanced Algebra, 5  
French, 5, or  

*Students who at entrance present satisfactory credits for part of the Academic work, or who by examination pass part of it satisfactorily, will be classified in the remaining studies to the best advantage. Frequently such students can take 10 hours of Mathematics in preparing for the Freshman work.*

Opportunity will be offered during the four weeks winter vacations whereby students somewhat deficient in Mathematics, English or Modern Language can make up some work in those lines under private tutors.

**The field work and drawing marked thus in the Academic course are optional, but all students are urged to take them, with a view to preparing to secure remunerative engineering work during the summer vacations.*
German, 5  (Languages, VII.)
Civil Engineering Drawing, 1  (Civil Engineering, I.)
Advanced Rhetoric, 5  (English, III.)
History, English History, 1  (History, XVII.)
Mechanical Drawing, 2  (Mechanical Engineering, XXI.)
*Field Work, 2  (Civil Engineering, II.)
Military Drill, 2  (Military, I.)
*Shop Work, 2  (Mechanical Engineering, XXIX.)
Library Work, 4 hours  (Library, I.)

SECOND SEMESTER.

Solid Geometry and Plane Trigonometry, 5  (Mathematics, VI.)
French, 5, or  (Languages, IV.)
German, 5  (Languages, VIII.)
Composition, 1  (English, IV.)
History, Formation of the Union, 1  (History, XVIII.)
Descriptive Geometry, 4  (Civil Engineering, IV.)
Civil Engineering Drawing, 2  (Civil Engineering, V.)
*Field Work, 2  (Civil Engineering, III.)
Military Drill, 2  (Military, II.)
*Shop Work, 2  (Mechanical Engineering, XXXIII.)
**Summer Surveying,  (Civil Engineering, XXXI.)

Sophomore Year.

FIRST SEMESTER.

Analytical Geometry, 5  (Mechanics, VIII.)
Physics, 5  (Physics, III.)
Surveying, 4  (Civil Engineering, VIII.)
Chemistry, 5  (Chemistry, III.)
Drawing, 1  (Civil Engineering, VI.)
Composition, 1  (English, V.)
Military Drill, 2  (Military, III.)

SECOND SEMESTER.

Calculus, 5  (Mathematics, IX.)
Physics, 5  (Physics, IV.)
Surveying, 4  (Civil Engineering, IX.)

*Students who have completed Field Work can elect Shop Work.
**All students in Civil Engineering go into camp thirteen days each summer vacation and conduct an organized topographical survey.
IOWA STATE COLLEGE

Chemistry, 5 (Chemistry, VI.)
Drawing, 1 (Civil Engineering, VII.)
Composition, 1 (English, VI.)
Military Drill, 2 (Military, IV.)
*Summer Surveying, 2 Weeks, (Civil Engineering, XXXII.)

Junior Year.

FIRST SEMESTER.

Spherical Trigonometry, 2 (Mathematics, VII.)
Analytical Mechanics, 4 (Mechanical Engineering, I.)
Electric Railways and Power Transmission, 3 (Electrical Engineering, XXXI.)
Practical Astronomy, 3 (Civil Engineering, XXIV.)
Railway Engineering, 5 (Civil Engineering, X.)
Physical Laboratory, 2 (Physics, XIV.)
Seminar, 1 (Civil Engineering, XXVII.)
***History, XIXth Century, 2 (History, VII.)
**Debating, 1 (English, VII.)

SECOND SEMESTER.

Analytical Mechanics, 4 (Mechanical Engineering, II.)
Materials of Construction, 3 (Mechanical Engineering, III.)
Railway Engineering, 5 (Civil Engineering, XI.)
Political Economy, 5 (Economic Science, I.)
Structural Designing, 2 (Civil Engineering, XVII.)
Engineering Laboratory, 2 (Civil Engineering, XIV.)
Seminar, 1 (Civil Engineering, XXVIII.)
**Debating, 1 (English, VIII.)
***History, XIXth Century, 2 (History, VIII.)
*Summer Surveying, 2 weeks (Civil Engineering, XXXIII.)

In place of the two weeks' summer vacation for any year there may be substituted not less than four weeks' actual engineering work done for some competent engineer, a reputable firm, or department engaged in engineering work, if certified by engineer under whom taken, on regular blank furnished by Department of Civil Engineering.

*All students in Civil Engineering go into camp thirteen days each summer vacation and conduct an organized topographical survey.
**Elective, subject to approval of Professor of Civil Engineering.
***Elective in either term of Junior or Senior year, subject to approval of Professor of Civil Engineering.
Senior Year.

FIRST SEMESTER.

Framed Structures, 7  
Hydraulics, 4  
Masonry Structures and Foundations, 3  
Sanitary Engineering, 3  
Engineering Laboratory, 1  
Specifications and Contracts, 1  
*History, XIXth Century, 2  
Thesis, 1  
Seminar, 1

(Civil Engineering, XVIII.)  
(Mechanical Engineering, VI.)  
(Civil Engineering, XXII.)  
(Civil Engineering, XXI.)  
(Civil Engineering, XV.)  
(Engineering, II.)  
(Civil Engineering, XXV.)  
(Civil Engineering, XXIX.)

SECOND SEMESTER.

Framed Structures, 4  
Geology, 4  
StereotomY, 2  
Roads and Pavements, 2  
Hydraulic Engineering, 3  
History of Engineering, 1  
*History, XIXth Century, 2  
Thesis, 3  
Seminar, 1  
*Wood Technology, 3  

(Civil Engineering, XIX.)  
(Geology, III.)  
(Civil Engineering, XX.)  
(Civil Engineering, XII.)  
(Civil Engineering, XXII.)  
(Engineering, I.)  
(Civil Engineering, XXV.)  
(Civil Engineering, XXVI.)  
(Civil Engineering, XXX.)  
(Forestry, IV.)

DEPARTMENT OF ELECTRICAL ENGINEERING.

LOUIS BEVIER SPINNEY, PROFESSOR.
FRED A. FISH, ACTING ASSOCIATE PROFESSOR.
ADOLPH SHANE, ACTING ASSISTANT PROFESSOR.

This department aims to meet the needs of young men who have in mind the practice of electrical engineering in any of its various applications. In outlining the courses the object in view has been to secure for the student a thorough drill in those sciences, the principles of which underlie all electrical engineering practice, to secure for him a training in the application

*Elective subject to approval of Professor of Civil Engineering.
of scientific principles to the solution of practical problems in engineering, and to familiarize him with such methods of the laboratory and testing room as are available for practical and commercial determinations.

The sciences of Mathematics, Physics and Chemistry, are emphasized, as it is believed they are of first importance in such a course. The attention of the student is directed to the value of these subjects and he is urged to give them his most careful consideration.

In recognition of the fact that a knowledge of Mechanical Engineering is essential to many electrical engineering operations a large part of the student's time is devoted to a training in this direction. The mechanical engineering work required of students in this course, includes mechanical drawing, shop-work, kinematics, machine design, analytical mechanics, hydraulics, materials of construction, engineering laboratory and the study of the steam engine.

Mechanical drawing is taken up in the first term of the Freshman year and extends through the Sophomore year.

Shop Work extends to the end of the Junior year and includes work in the carpenter shop, in the forge shop and foundry, and in the machine shop.

In the course in Engineering Laboratory the work consists in the tests of strength of materials, viscosity of oils, efficiency of belt transmission, measurement of power, etc.

The study of the steam engine is made as practical as possible by the taking and studying of indicator cards, the setting of valves, the measurements of clearance, etc.

These several topics are fully discussed elsewhere under the head of Mechanical Engineering.

Physics is the basis of the study of electricity and magnetism, the phenomena of which underlie electrical engineering theory and design, and is manifestly of sufficient importance to demand considerable time and attention in the training of the electrical engineer. In addition to the work in physics prescribed for all engineering students, the electrical engineering student spends six to twelve hours per week in the Junior and Senior years in the physical laboratory and class room.

Specialization begins in the Junior year with the advanced course in Electricity and Magnetism.

Laboratory work begins in the first semester of the Junior
year with a two hours (i. e. two afternoons per week) course in general physics. Laboratory work in electricity and magnetism, including work in the dynamo room and testing laboratory extends throughout the last two years of the course.

The first work in the physical laboratory embodies the accurate measurements of length, mass and time, the adjustment and use of physical instruments and the determinations of physical constants. In the laboratory course in electricity and magnetism the student makes a study of primary and secondary batteries and the electrical instruments of the laboratory, the determination of the constants of measuring instruments and the methods of measuring the several electrical quantities.

The laboratory work in Light consists largely in photometric measurements of various forms of commercial lamps.

In the laboratory work of the Senior year the more practical applications of the principles of electro-magnetism are studied, together with the principles of the magnetic circuit, of current flow, etc.

The topics of electric wiring, power transmission, electro-chemistry, telegraphy, telephony and electric signalling receive attention in the latter part of the course. The laboratory work in these various topics is made to conform to the text-book and lecture work.

The study of alternating currents is taken up in the Junior year. In the class-room work much stress is placed upon the theory of alternating currents and in the laboratory the student is afforded opportunity to study and familiarize himself with the phenomena peculiar to such currents.

The department possesses seventeen experimental dynamos, including two arc machines, one 250 light Diamond alternator and one 10 light Pony alternator, also one 25-horse-power M. P. Ahlms-Edwards, direct current motor; also one 45 K. W. Edison generator, and other series and shunt wound continuous current machines. There are also transformers of various types and a storage battery of sixty cells.

In addition to this equipment the student has access, for experimental and test purposes, to the electric machinery of the College power house and lighting plant. Among other machines in this plant are two 15 K. W. Edison dynamos; one 30 K. W. Edison dynamo; one 15 K. W. 500 volt generator; one four-pole 18 K. W. compound-wound generator; one 15 K. W. alternator;
one 30 K. W. alternator, and one 60 K. W. alternator. There is also a series of motors for driving the machinery of the Mechanical Engineering Department which range in size from five to twelve horse-power, which are available for test purposes.

An extended system of wiring connects all rooms of the department with the switchboards of the dynamo laboratory and the apparatus room. At these switchboards are the terminals of a line connecting with a 110 volt, 45 K. W. direct-current machine, which is available as a current source during the day. During the evening hours there are available 110 volt direct or alternating current circuits.

The courses offered by the Department of Electrical Engineering are outlined specifically below. The course numbers are those given in the discussion of courses offered by the Department of Physics:

Course III.—Mechanics and Heat.—First semester.

Course IV.—Light and Sound, Electricity and Magnetism.—Second semester. Two lectures and three recitations per week. Mathematics IV., V. and VI. required. Course III. is a prerequisite of Course IV.

In this course stress is placed upon the fundamental principles of the subject and a very thorough study is made of vector quantities and their graphical treatment in problem work.

The various subjects are discussed from a mathematical standpoint, and the student is urged to familiarize himself with the theoretical side of the work, as it is believed such a foundation is very helpful, if not absolutely essential to the work which follows. Text-book, Hastings and Beach, "General Physics." Professor Spinney, Mr. Tuttle and Mr. Wenner.

Course VI.—Electricity and Magnetism.—Three hours per week, first semester. Physics III. and IV., and Mathematics IX. required.

Lectures, recitations and problem work. A course in the elementary theory of electricity and magnetism. Discussion of the principles of electro-magnetism. Discussion of the principles of electro-magnetic action and their application in various forms of measuring instruments, and the development of laboratory methods of measuring the several electrical quantities. Text-book, Nichols and Franklin's "Elements of Physics," Vol. II. Professor Shane.
Course VII.—Theory of Alternating Currents.—Two lectures per week, second semester. Physics VI. and Mathematics X. required.

Discussion of the theory of alternating currents, study of circuits containing self-induction, mutual induction and capacity.

Course VIII.—Theory of Electrical Measurements.—Two lectures per week, first semester. Physics VII. required. Professor Spinney.

Course X.—Dynamo Electric Machinery.—Lectures and recitations three hours per week, second semester. Physics VI. is a prerequisite of this course.

General theory of the direct-current dynamo, the establishment of electro-motive forces by induction, the magnetic circuit, armature winding, etc. A study of "characteristic curves" and the adaption of the different types of direct-current machinery to various commercial purposes is included.

As a text and reference book S. P. Thompson's "Dynamo Electric Machinery" is used. Professor Shane.

Course Xa.—Dynamo Electric Machinery.—Two hours per week, second semester, Junior year. For students in Mechanical Engineering. Physics VI. is a prerequisite of this course, and this course is a prerequisite of Course XXXII.

Sheldon's "Dynamo Electric Machinery" is used as a text-book. Professor Shane.

Course XIII.—Telephony.—Lectures and recitations, two hours per week, second semester. A general study of the principles of telephony, the telephone, telephone lines, cables and commercial apparatus. Physics VIII. required. Professor Fish.

Course XIV.—General Physical Laboratory.—Two afternoons per week. First semester, or

Course XIVa.—One afternoon per week, first semester.

Measurements of length, mass and time, determination of Physical constants, use of the barometer, thermometry, calorimetry, etc. Mr. Tuttle and Mr. Wenner.

Course XIVb.—One afternoon per week. Second semester. Continuation of Course XIVa.

Course XV.—Physical Laboratory, Elementary Electrical Measurements.—One afternoon per week, second semester, or

Course XVI.—Two afternoons per week, first semester, or

Course XVII.—Two afternoons per week, second semester. The measurement of the electro-motive force and internal resist-
ance of primary and secondary batteries, the use of Wheatstone's bridge, measurement of current, determination of galvanometer constants, high resistance measurements, insulation tests, etc. Mr. Tuttle and Mr. Wenner.

Course XVIII.—Physical Laboratory, Electrical Testing.—Two afternoons per week, first semester, or

Course XIX.—Two afternoons per week, second semester. Calibration of instruments, absolute measurements, etc. Professor Spinney, Mr. Tuttle and Mr. Wenner.

Course XX.—Physical Laboratory, Dynamo, Motor and Commercial Plant Testing.—Two afternoons per week, first semester.

The efficiencies of dynamos and motors, experimental determination of characteristic curves, magnetic leakage, etc. Critical study of commercial plants, determination of efficiencies, etc. Professor Shane.

Course XXa.—Physical Laboratory.—Study of alternating currents. One afternoon per week, first semester. Laboratory methods for measuring inductance, capacity, etc., and

Course XXI.—Physical Laboratory.—Study of alternating currents. Two afternoons per week, second semester, Senior year.

Continuation of Course XXa. The study of alternating current dynamos and motors and commercial transformers. Professor Spinney and Professor Shane.

Course XXII.—Electric Circuits.—Two hours per week, first semester. Physics VI. required.

A study of the most economical size of conductors for the transmission and distribution of electrical energy, taking into account current prices of material, rates of interest and depreciation, and cost of power. Abbott's "Electrical Transmission of Energy" is used as a text and numerous original problems will be given. Professor Fish.

Course XXIV.—Electrical Designing.—Two afternoons per week, first semester, Senior year. The design of dynamos, motors, transformers, etc. Professor Fish.

Course XXV.—Electrical Designing.—Two afternoons per week, second semester, Senior year. Continuation of Course XXIV. Professor Fish.

Course XXVI.—Thesis begun, and

Course XXVII.—Thesis finished. Total equivalent of four hours per week of one semester.
Each student in the course of Electrical Engineering is required to prepare a thesis in the Senior year representing, in the work done upon it, the equivalent of at least four hours per week of one semester.

This thesis may be of the nature of the design and construction of some electrical machine or measuring instrument, the efficiency test and critical study of some dynamo-electro machine or power plant, or of electrical research work of special direction. Professor Spinney.

Course XXIX.—Electrical Seminar.—One hour per week, first semester, and

Course XXX.—Electrical Seminar.—One hour per week, second semester. A continuation of Course XXIX.

This course consists of the preparation, presentation and discussion of papers upon special assigned topics in electrical engineering.

It is required that the papers presented shall be carefully written out and submitted for critical reading to the professor in charge. Journal reading is made part of this course. Professor Spinney.

Course XXXI.—Electric Railways and Power Transmission.—An elementary study of the application of the principles of electro-magnetism to the transmission and distribution of power for industrial purposes, including power plants, transmission lines and electric motors.

Lectures, recitations and problem work, three hours per week, first semester. Physics III., IV., and Mathematics IX. required. Professor Shane.

Course XXXII.—Electrical Machinery.—A discussion of the construction and operation of electrical machinery and its application to electric lighting and power distribution. Two hours per week, second semester. Professor Shane.

Course XXXIII.—Alternating Current Machinery.—Two hours per week, first semester. Physics VII. and X., and simultaneous work in Course VIII. required. Study of alternating current generators, motors, transformers, etc. Professor Fish.

Course XXXIV.—Alternating Current Machinery.—Two hours per week, second semester. Continuation of Course XXXIII. Professor Fish.
Course XXXV.—Electric Light and Power Installations.—Two hours per week, second semester. Course XXXIII required. Professor Fish.

For laboratory courses of two afternoons per week a fee of $5.00 is charged. For courses of one afternoon per week the fee is $3.00.

ELICITRICAL ENGINEERING.

*Academic Course.

FIRST SEMESTER.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Algebra, 5</td>
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<td>English, 5</td>
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<tr>
<td>History, 4</td>
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<td>Civics, 2</td>
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SECOND SEMESTER.

<table>
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<th>Subject</th>
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<tr>
<td>Algebra, 5</td>
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<tr>
<td>Elementary Rhetoric, 5</td>
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<tr>
<td>History, 2</td>
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<tr>
<td>French, 5, or</td>
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<tr>
<td>German, 5</td>
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THIRD SEMESTER.

<table>
<thead>
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<th>Subject</th>
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<tbody>
<tr>
<td>Plane and Solid Geometry, 5</td>
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<td>English Literature, 5</td>
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<td>French, 5, or</td>
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<tr>
<td>German, 5</td>
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<tr>
<td>Drawing, 2</td>
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Freshman Year.

FIRST SEMESTER.

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<tr>
<td>Advanced Algebra, 5</td>
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<tr>
<td>French, 5, or</td>
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*Students who at entrance present satisfactory credits for part of the Academic work, or who by examination pass part of it satisfactorily, will be classified in the remaining work to the best advantage. Frequently such students can take 10 hours of Mathematics in preparing for the Freshman work.

Opportunity will be offered during the four weeks winter vacations whereby students somewhat deficient in Mathematics, English or Modern Language can make up some work in these lines under private tutors.
German, 5
Advanced Rhetoric, 5
History, English History, 1
Shop-Work, 2 (Mechanical Engineering, XXIX., XXX. or XXXI.)
Mechanical Drawing, 2 (Mechanical Engineering, XXI.)
Military Drill, 2
Library Work, 4 hours

SECOND SEMESTER.

Solid Geometry and Plane Trigonometry, 5 (Mathematics, VI.)
French, 5, or
German, 5
Composition, 1
History, Formation of the Union, 1 (History, XVIII.)
Descriptive Geometry, 4 (Civil Engineering, IV.)
Machine Sketching, 1 (Mechanical Engineering, XX.)
Shop-Work, 2 (Mechanical Engineering, XXIX., XXX. or XXXII.)
Military Drill, 2

Sophomore Year.

FIRST SEMESTER.

Analytical Geometry, 5 (Mathematics, VIII.)
Physics, 5 (Physics, III.)
Chemistry, 5 (Chemistry, III.)
Shop Work, 2 (Mechanical Engineering, XXX, XXXI, or XXXII.)
Mechanical Drawing, 2 (Mechanical Engineering, XXII.)
Composition, 1 (English, V.)
Military Drill, 2 (Military, V.)

SECOND SEMESTER.

Calculus, 5 (Mathematics, IX.)
Physics, 5 (Physics, IV.)
Chemistry, 5 (Chemistry, VI.)
Shop Work, (Mechanical Engineering, XXX, XXXI, or XXXII.)
Mechanical Drawing, 2 (Mechanical Engineering, XXIII.)
Composition, 1 (English, VI.)
Military Drill, 2 (Military, IV.)
### Junior Year.

#### FIRST SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Differential Equations</td>
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<tr>
<td>Analytical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Electricity and Magnetism</td>
<td>3</td>
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<tr>
<td>Physical Laboratory</td>
<td>2</td>
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<tr>
<td>Political Economy</td>
<td>5</td>
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<tr>
<td>Engineering Laboratory</td>
<td>1</td>
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<tr>
<td>Shop Work</td>
<td>2</td>
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<td>*Debating</td>
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<tr>
<td>**History, XIXth Century</td>
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#### SECOND SEMESTER.

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Dynamo Electric Machinery</td>
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<tr>
<td>Theory of Alternating Currents</td>
<td>2</td>
</tr>
<tr>
<td>Analytical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Steam Engine</td>
<td>3</td>
</tr>
<tr>
<td>Materials of Construction</td>
<td>3</td>
</tr>
<tr>
<td>Physical Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Shop Work</td>
<td>2</td>
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<tr>
<td>*Debating</td>
<td>1</td>
</tr>
<tr>
<td>**History, XIXth Century</td>
<td>2</td>
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### Senior Year.

#### FIRST SEMESTER.

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Theory of Electrical Measurements</td>
<td>2</td>
</tr>
<tr>
<td>Alternating Current Machinery</td>
<td>2</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>4</td>
</tr>
<tr>
<td>Steam Engine Design</td>
<td>3</td>
</tr>
<tr>
<td>Physical Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Design</td>
<td>2</td>
</tr>
<tr>
<td>Electric Circuits</td>
<td>2</td>
</tr>
<tr>
<td>Specifications and Contracts</td>
<td>1</td>
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</tbody>
</table>

*Elective.

**Elective in either Semester of Junior or Senior year, subject to the approval of Professor of Electrical Engineering.
History, XIXth Century, 2
Seminar, 1
Thesis, 1

SECOND SEMESTER.

History of Engineering, 1
Alternating Current Machinery, 2
Electric Light and Power Installations, 2
Constructive Engineering, 3
Physical Laboratory, 2
Electrical Design, 2
Telephony, 2
*History, XIXth Century, 2
Seminar, 1
Thesis, 3

DEPARTMENT OF MINING ENGINEERING.

SAMUEL WALKER BEYER, PROFESSOR.
E. E. BUGBEE AND I. A. WILLIAMS, ASSISTANT PROFESSORS.

The courses in Mining Engineering are planned to give the student a ready familiarity with the branches which form the ground work of the science of Mining and Metallurgy. The Department of Mining Engineering aims to give him such a thorough training in the fundamentals as will enable him after graduation to acquire in a comparatively short time the practical experience absolutely necessary before he is fitted to assume positions of great responsibility in the mining industries. The department offers two courses: A four years'; and a two years,.. The first is intended for those students who desire a "thorough course in Theoretical and Practical Mining," and underlying sciences, and leads to the degree of Bachelor of Mining Engineering. The requirements for admission are the same as those for admission to other Engineering courses. Students who pursue this course to completion are expected to be able to undertake the "full management of mining in its various branches," at least as practiced in Iowa, and become familiar

*Elective in either Semester of Junior or Senior year, subject to the approval of Professor of Electrical Engineering.
with the principles involved and the methods employed in good mining engineering practice in general.

The latter course is designed for young men who have had some practical experience in mines, and wish to study mine surveying, drafting, the problems of ventilation, drainage, haulage, mine operating, etc., and also to learn something of the sciences which bear upon their work but have neither the time nor the preparation for a full college course. Elementary mathematics, drawing and shop work receive considerable attention during the first year, while the professional studies are reserved for the second year. Candidates who are twenty-one years of age or over are admitted without examination. All others must give evidence of a thorough grounding in the common branches.

Equipment.

The Department of Mining Engineering occupies six rooms on the third floor and one on the first floor of Engineering Hall and shares in common with the other Engineering departments the blueprint, photographic, Engineering Museum and Assembly rooms. Of the rooms used exclusively by the Department of Mining Engineering, one is used for laboratory purposes only, two for laboratory and lecture purposes, one as a museum, and three afford space for supplies, instruments, books and filing cases, in addition to their use for office purposes.

Lecture Room and Laboratory in Mining Engineering.—This room is provided with seventy-five opera chairs with folding arm rests, a wall table cabinet occupying all of the outside wall space and so arranged as to provide excellent working space in front of the windows while the space between the windows is utilized for the filing of study material. Above the wall table, lockers with glass doors are provided, in which students may keep books and small pieces of apparatus free from dust. The windows are all provided with opaque shades and the room with a permanent lantern screen. The balance of the interior wall space is occupied by slate blackboards. A large cabinet lecture table completes the equipment of the room.

Seminar Room.—The seminar room is used for both laboratory and lecture purposes as in the case of the preceding, in addition to serving as a conference room and headquarters for the Junior and Senior students in Mining Engineering. It is equipped with two long tables standing at right angles to and
directly connected with a large cabinet lecture table, the whole forming a continuous table in the form of a U. The room has a seating capacity of thirty-six and is equipped with movable revolving chairs, and slate blackboards on the interior walls. In addition the room contains a twenty-two tray filing case for large drawings, plats and maps, and a supply case.

Metallurgical Laboratory.—The laboratory for Metallurgy and Ceramics is located on the ground floor and is fitted with soapstone topped cabinet wall tables occupying all the outside walls and a large fume chamber, supply and display cases. It is supplied with water, gas, compressed air, exhaust and electrical connections. It already contains a Hoskin’s No. 4 muffle furnace and a Bosworth assay furnace with the usual accessories for doing metallurgical and ceramic work.

The Museum.—The museum for Geology and Mining Engineering is fitted with eight museum cases with sloping glass tops and cabinet bases. The bases supply room for one hundred and ninety-two trays in which the working collections and duplicate material in Geology and Mineralogy are filed. One large central case containing the larger casts of the “Ward Series,” a series of cases, showcase tops and cabinet bases, occupy the space between the windows, and permanent cases occupy all of the partition wall space.

The offices supply room for apparatus, supplies, books, and filing cases.

The department is supplied with a Sullivan core drill with a complete set of tools and accessories for carrying on actual field operations, a “Queen” Light Mountain mining transit; two “Berger” No. 4 Mining transits with interchangeable side and top telescopes; a Brunton transit; a sensitive six-dial anemometer reading to ten millions of feet and adapted for the measurement of currents of air through mines and tunnels—an instrument absolutely necessary in order to deal intelligently with the problems of mine ventilation; rods and sighting poles; a set of miner’s tools; a barometer, clinometer, a series of miner’s lamps and various instruments used in ascertaining distances.

During the past year the department has received through the generosity of the J. George Leyner Engineering Works of Denver, Colorado, one Water Leyner Rock Drill, with column condenser, and full complement of steel.
The laboratory in Metallurgy and Ceramics, aside from the list of utensils to be found in any well equipped laboratory for that branch of chemical work, is supplied with the following special pieces of apparatus: Weatherhead mortar and porcelain mortars for pulverizing; a set of brass brickette molds, chemical balance; torsion balance; one Hoskin's No. 4 muffle furnace; one Bosworth assay furnace; Le Chatelier thermo-electric pyrometer; and a Seger volumeter.

The proximity of Ames to the Iowa coal fields affords easy access to the coal mines of Boone and Polk counties. The great centers of the clay industry, Des Moines, Boone, and Fort Dodge are equally accessible, while the quarries of Marshall county are scarcely more than an hour's ride from the College. These and numerous allied industries are, after all, the most important and indispensable laboratories for the practical mining engineer. The department undertakes to present the accepted theories concerning mineral aggregation, origin and occurrence but these theories can be put to test only by an intelligent use of the drill, the level and the plane table. The accredited methods of winning the ores and minerals receive full discussion in the class room, but only render obvious the necessity of becoming familiar with the practical workings of the sluice box, the tipple and the stamp mill. The chemical and physical properties of a clay may be ascertained in the laboratory, but a complete knowledge of its properties and its mode of treatment can be gained only by following it from the pit to the street. In short, the department aims to give as complete an exposition of the theories and laws which underlie the science of mining as time will permit, but the verification and application of these theories and laws must be made, in large measure, in the field and in the industries.

It is the settled policy of the department to carry on such investigation work as may be of benefit to the mining and manufacturing interests of the state. In cooperation with the other Engineering departments considerable work has been done and is being done on fuels, clays and structural materials. The department is also prepared to do a limited amount of assaying, test clays and fuels, do mine surveying, prepare mine maps and plats, examine and report on mine and clay properties for citizens of the state at reasonable cost. In fact the atmosphere produced by practical investigation work is believed to be necessary to
the healthful growth of the engineer, and no opportunity is lost to encourage work along these lines.

Courses in Mining.

The work of the first two years in the four years' course in Mining Engineering is exactly the same as that required in the course in Mechanical Engineering, with the exception that Surveying takes the place of Mechanical Drawing, and the addition of Principles of Mining in the second semester (Freshman.) The professional studies are given due prominence during the last two years of the course and the student is required to take continuous work in mining, chemistry and metallurgy, and geology, through the last three terms. He is expected to make one of these branches the subject of special investigation and to embody the results of such investigation in a thesis, which is required of every student who is a candidate for graduation.

It is generally recognized that there is of necessity a considerable gap between the work included in the College curriculum and that of the professional engineer; and that the student in Engineering must gain the larger part of his professional training outside of college walls. The courses in summer field work are offered in the hope that his apprenticeship may be reduced to a minimum, and are required of all students in the four years' course in Mining Engineering.

Course I.—Principles of Mining.—Two hours per week, second semester, Freshman year. The student receives instruction in the general and elementary principles of mining in order that he may appreciate something of what he sees and hears before he makes a detailed study of Prospecting, Exploitation, Mining Methods, and the various subjects included in Courses II., III. and IV. Special attention is given to mining terms and local mining methods.

Course II.—The Principles of Mining.—Second semester, Junior year, and counts three hours per week. The first ten weeks of the term are devoted to a consideration of the methods employed in excavating, boring and shaft-sinking, and in mining and the support of mine excavations, while the remainder of the term is given up to a critical study of methods employed in exploration, development and mine working in general.

Course III.—Continuation of Course II.—Three hours per week and runs through the first semester, Senior year. The work
embraces a thorough discussion of the principles involved in coal mining in general and is followed by a careful consideration of those principles which are applicable to the Iowa coal fields in particular. Mine ventilation, drainage and lighting receive due attention.

**Course IV.**—**Mining Engineering.**—Second semester, Senior year, and counts four hours per week. Mine plant, administration and mine accounts receive special attention. The semester's work involves a critical study of mining machinery, with especial reference to the types best adapted to meet the requirements of the various conditions in actual practice. Also mine buildings and the general equipment and administration of a mine plant are considered. About one-half of the semester will be devoted to ore dressing.

**Course V.**—**Mining Law.**—One hour per week, second semester of Senior year. An outline of the most important laws affecting the mineral industry is presented to the men as they are completing their work in the department. While the laws on the statute books at the present time are for the greater part local and while an exhaustive study of them in the time available is out of the question, the necessity of some knowledge of the law is impressed upon the student and he is shown where he can obtain information on the simpler questions.

**Course VI.**—**Seminar.**—Required of the students in Mining Engineering, first semester, Junior year, and counts one hour.

**Course VII.**—**Seminar.**—Continues the work of Course VI. Counts one hour, second semester, Junior year.

**Course VIII.**—**Seminar.**—A continuation of Course VII. and counts one hour, first semester, Senior year.

**Course IX.**—**Seminar.**—Continues the work of the three semesters preceding and counts one hour, second semester, Senior year. Courses VI. to IX., inclusive, are for the purpose of bringing together the students of the Junior and Senior years and members of the instructing corps for weekly conferences. Such conferences afford occasion for the discussion of timely topics in which the student members take part freely.

**Course X.**—**Mine Surveying.**—Two hours per week first semester, Junior year. During the Sophomore year the mining student takes the regular course in Surveying offered by the Department of Civil Engineering. Mine Surveying supplements the work of the Sophomore year and presents various methods of
surveying especially adapted to mines and tunnels. Part of the time is given to practical work with top and side telescope and the various calculations which its use requires.

Course XI.—Thesis.—Required of all candidates for graduation in the course of Mining Engineering and counts one hour during the first semester, Senior year, and three hours during the second semester.

Course XII.—Summer Field Work in Mine Surveying.—The work is carried on in one of the coal mining districts of the state and comprises the complete survey of a mine and a thorough examination of the equipment and mode of operation of a typical mine for the district, and leads in the first place to a mine map, and in the second to a careful report on mine property, accompanied by the necessary illustrations. The time required is two full weeks. Open to students who have completed the Freshman or Sophomore years.

Course XIII.—Summer Field Work in the Study of Mine Operation and Equipment, and of Concentrating Plants.—This course necessitates a visit to one of the great metal producing centers outside of the state. A careful study of mine properties is made, and a detailed report, properly illustrated by sketches and drawings, is required. A portion of the time is devoted to a study of ore dressing and concentrating plants. The time required is four weeks, and the course is open to students who have completed the Junior or Senior years.

Course XIV.—Metallurgy.—Three hours per week, second semester, Junior year. The semester's work comprises a study of refractory materials, fluxes, fuels and furnaces and the metallurgy of iron and steel. Especial attention is given to pyrometry, calorimetry, fire clays and coke. The various metallurgical furnaces are studied from working drawings. At the close of the semester a few weeks are devoted to the science of metallography.

Course XV.—Metallurgy Continued.—Five hours per week, first semester, Senior year. Instruction in this course is confined to the processes relating to copper, lead, silver, gold and zinc. In the time allotted to the work, a study of the metallurgy of all the metals could not be made satisfactorily, and it is deemed best to confine the work to the most important metals and the most important processes. The principles of ore dressing and prepara-
tion for metallurgical treatment is given in the second semester, Senior year, in Course IV.

**Course XVI.—Ceramics.**—The work of the semester is devoted to a consideration of the origin, composition, properties and distribution of the crude materials used in the clay and cement industries. The physical properties of clays are studied and mechanical analyses are made in the laboratory, paralleling the class-room work.

**Course XVII.—Ceramics.**—This course includes a discussion of the principles involved in the manufacture of clay goods. Methods of selecting and winning the raw materials, their preparation, standard processes of manufacture, burning and clay testing are treated as fully as the time will permit.

**Course XVIII.—Ventilation and Haulage.**—Five hours per week, first semester, second year in the two years' course in Mining. The work of the semester is devoted to a careful consideration of the problems affecting the distribution of air in mines and mine drainage. Some attention is given to the discussion of standard methods of hoisting and haulage in mines.

**Course XIX.—Mine Exploration and Operation.**—Five hours per week during the last semester in the two years' course in Mining. Exploration, shafting, timbering, and methods of mine operation, especially as adapted to the Iowa coal fields are the principal topics treated. Mine accounts and administration receive such attention as their importance and the time will permit.

**Course XX.—Mining Arithmetic.**—Five hours per week, first semester of first year in the two years' course in Mining. The fundamental operations in arithmetic are reviewed rapidly during the first half of the semester, while measurements, square and cube root and practical problems relating to mining are made duly prominent during the last half of the semester.

**Course XXI.—Field Work in Mine Surveying.**—First semester, first year in the two years' course in Mining Engineering. The first year men serve as apprentices in the work of mine surveying, acting in the capacity of rodmens and chainmen to the parties conducted by higher classmen.

**Course XXII.—A Continuation of Course XXI.**—During the first half of the semester on account of the usual inclemency of the weather, one-half day per week is devoted to a study of mine plats and maps.

**Course XXIII.—Field Work in Mining.**—First semester, sec-
ond year, and required of students in the two years' course in Mining.

Course XXIV.—Continues the Work of Course XXIII.—Special attention is directed to mine operation and equipment.

Courses in Geology Required of Students in Various Engineering Courses.

Course I.—Physiography.—First semester, Freshman year, three hours per week; serves as an introduction to the science of Geology. The first half of the semester is devoted to the study of the agents which have to do with modifying the earth's crust, while the resultant earth features receive careful consideration during the second half of the semester. Davis' or Tarr's "Elements of Physical Geography" is the text-book used. Required in the Division of Science, in the courses of Agronomy and Horticulture in the Division of Agriculture and the two years' courses in Mining Engineering and Clay Working.

Course II.—General Geology.—Five hours per week first half of Junior year. This course embraces a discussion of the principles which form the ground work of the science. The first ten weeks are devoted to dynamic and structural geology and the last six weeks to stratigraphic and historical geology. The student is required to make several excursions to points of geological interest to verify the more salient facts discussed in the class room. Prerequisites: Physics III. and IV., and Chemistry III. and IV.

Course III.—Engineering Geology.—The semester is devoted to a discussion of the fundamental principles of dynamical and structural geology, and study of the common minerals and rocks, especially those important in structural materials. The course is given in the second semester and counts four hours per week. Prerequisites the same as for Course II.

Course IV.—Geology, Advanced.—Five hours per week second semester of Senior year. The nature, mode of occurrence and origin of the minerals and rocks which constitute the earth's crust, are considered in some detail in the first half of the semester, while rock alteration as involved in metamorphism and weathering receives special attention during the second half. Excursions are continued as in Course II, and students are encouraged to familiarize themselves with the methods employed
in doing research work and to make independent observations. Prerequisite: Geology II. or III.

Course VI.—Mineralogy.—Two hours class room and one hour laboratory per week, second half of Junior year. This course is intended to give the student a clear idea of the morphological and physical properties of crystalline substances. Prerequisites: Physics III. and IV., Chemistry III. and IV., and Mathematics VI.

Course VII.—Mineralogy, Descriptive and Determinative.—Two hours class-room work and one hour laboratory per week, first semester, Senior year. This work is devoted to the study of the more important mineral species, their properties, uses, distribution and methods of determination. Prerequisites: Geology VI.

MINING ENGINEERING.

*Academic Course.

FIRST SEMESTER.

Algebra, 5  
English, 5  
History, 4  
**Civics, 2

(SECOND SEMESTER.

Algebra, 5  
Elementary Rhetoric, 5  
French, 5, or  
German, 5  
History, 2

THIRD SEMESTER.

Plane and Solid Geometry, 5

*Students who at entrance present satisfactory credits for part of the Academic work, or who by examination pass part of it satisfactorily, will be classified in the remaining studies to the best advantage. Frequently such students can take 10 hours of Mathematics in preparing for the Freshman work.

Opportunity will be offered during the four weeks winter vacations whereby students somewhat deficient in Mathematics, English or Modern Language can make up some work in these lines under private tutors.

**Elective, but students are urged to take this technical work.
DIVISION OF ENGINEERING

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>(Subject, Series)</th>
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<tr>
<td>English Literature, 5</td>
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<td>French, 5, or German, 5</td>
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<tr>
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<td>Advanced Rhetoric, 5</td>
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**Freshman Year.**

**FIRST SEMESTER.**

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**SECOND SEMESTER.**

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<tr>
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<tr>
<td>Solid Geometry and Plane Trigonometry, 5</td>
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<td>Descriptive Geometry, 4</td>
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<tr>
<td>Military Drill, 2</td>
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<td>(Military, II.)</td>
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<td>Principles of Mining, 2</td>
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<td>*Summer Field Work, Two Weeks</td>
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**Sophomore Year.**

**FIRST SEMESTER.**

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<th>Course</th>
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<tbody>
<tr>
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<td>Surveying, 4</td>
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<tr>
<td>Physics, 5</td>
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</table>

*Students who secure instructive employment during their summer vacations between Freshman-Sophomore and Sophomore-Junior years will be excused from summer field work providing they are so employed for at least one month subject to the approval of the head of the department.

**Elective, but students are urged to take this technical work.**
<table>
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<tr>
<th>Course</th>
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<td>Calculus</td>
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<td><strong>Junior Year.</strong></td>
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<td>Analytical Mechanics</td>
<td>4</td>
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<td>Electric Railways and Power Transmission</td>
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<td>(Chemistry, XII.)</td>
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**Elective, subject to the approval of the Professor of Mining Engineering.

****Elective in either term of Junior or Senior year, subject to the approval of the head of the Mining Engineering Department.
Metallurgy, 3  
*History, XIXth Century, 2  
Seminar, 1  
**Debating, 1  
***Summer Field Work, Four Weeks (Mining Engineering, XIII.)

Senior Year.

FIRST SEMESTER.

Railway Engineering, 5  
Mineralogy, 3  
Metallurgy, 5  
Mining, 3  
Chemistry, 2  
Engineering Laboratory, 1  
Specifications and Contracts, 1  
*History, XIXth Century, 2  
Seminar, 1

SECOND SEMESTER.

History of Engineering, 1  
Materials of Construction, 3, or  
Political Economy, 3, or  
Constructing Engineering, 3  
Geology, 5  
Mining, 4  
Engineering Laboratory, 1  
Mining Law, 1  
*History, XIXth Century, 2  
Seminar, 1  
Thesis, 3

*Elective in either term of Junior or Senior year, subject to the approval of the head of the Mining Engineering Department.

**Elective, subject to the approval of the Professor of Mining Engineering.

***Junior students in Mining Engineering who secure instructive employment in one of the great metal mining districts of the country will be excused from the Junior summer field work providing they are so employed for at least six weeks, subject to the approval of the head of the department.
TWO YEARS' COURSE IN MINING ENGINEERING.

First Year.

FIRST SEMESTER.

Mining Arithmetic, 5  (Mining Engineering, XX.)
Elementary Algebra, 5  (Mathematics, I.)
Elementary Physics, 5  (Physics, I.)
Drawing, 2  (Mechanical Engineering, XXII.)
Shop Work, 2  (Mechanical Engineering, XXIX. or XXX.)
Field Work in Mine Surveying, One-half Day per Week,
   (Mining Engineering, XXI.)

SECOND SEMESTER.

Geometry, 5  (Mathematics, V.)
Advanced Algebra, 5  (Mathematics, II.)
Plane Trigonometry, 5  (Mathematics, VIb.)
Physical Geography, 3  (Geology, I.)
Drawing, 1  (Mechanical Engineering, XX.)
Shop Work, 2  (Mechanical Engineering, XXIX. or XXX.)
Field Work in Mine Surveying, One-half Day per Week,
   (Mining Engineering, XXII.)

Second Year.

FIRST SEMESTER.

Mining, 5  (Mining Engineering, XVIII.)
Mine Surveying, 2  (Mining Engineering, X.)
Engineering Geology, 4  (Geology III.)
Chemistry, 5  (Chemistry, III.)
Mechanical Drawing, 2  (Mechanical Engineering, XXII.)
Field Work in Mining Engineering, 1
   (Mining Engineering, XXIII.)
Engineering Laboratory, 1  (Mechanical Engineering, XII.)

SECOND SEMESTER.

Mining, 5  (Mining Engineering, XIX.)
Steam Engineering, 1  (Mechanical Engineering, XVIII.)
Economic Geology, 5  (Geology, IV.)
Chemistry, 5  (Chemistry, VI.)
Engineering Laboratory, 2  (Mechanical Engineering, XII.)
Field Work in Mining Engineering, 1
(Mining Engineering, XXIV.)

COURSE IN CLAY-WORKING AND CERAMICS.

The short course in Clay-Working is designed to assist young men to a knowledge of the fundamental principles which underlie the science of Ceramics. The course is offered with a view of extending the same sort of service to the Ceramic industries as the course in Agriculture renders to the Agriculture industries, or the course of Mechanical Engineering renders to the Mechanical industries.

TWO YEARS' COURSE IN CERAMICS.

First Year.

FIRST SEMESTER.

Elementary Mineral Chemistry, 5 (Agricultural Chemistry, XIII.)
Elementary Algebra, 5 (Mathematics, I.)
Elementary Physics, 3 (Physics, I.)
Drawing, 2 (Mechanical Engineering, XXI.)
Shop Work, 2 (Mechanical Engineering, XXIX. or XXX.)

SECOND SEMESTER.

Mineral and Geological Chemistry, 5 (Agricultural Chemistry, XIV.)
Plane and Solid Geometry, 5 (Mathematics, V.)
Physical Geography, 3 (Geology, I.)
Drawing, 1 (Mechanical Engineering, XX.)
Shop Work, 2 (Mechanical Engineering, XXIX or XXX.)

Second Year.

FIRST SEMESTER.

Chemistry of Clays, 5 (Agricultural Chemistry, XV.)
Ceramics, 5 (Mining Engineering, XVI.)
Engineering Geology, 4 (Geology, III.)
Mechanical Drawing, 2 (Mechanical Engineering, XXII.)
SECOND SEMESTER.

Chemistry of Clays and Glazes, 5
Ceramics, 5
Steam Engineering, 1
Economic Geology, 5
Testing Clay Products, 3

(Agricultural Chemistry, XVI.)
(Mining Engineering, XVII.)
(Mechanical Engineering, XVIII.)
(Geology, IV.)
(Civil Engineering, XIV.)
ENGINEERING EXPERIMENT STATION
EXPERIMENT STATION STAFF

A. B. STORMS, A. M., D. D.
President.

A. MARSTON, C. E.
Director
Civil Engineering.

G. W. BISSELL, M. E.
Mechanical Engineering.

L. B. SPINNEY, B. M. E., M. Sc.
Electrical Engineering.

S. W. BEYER, B. Sc., Ph. D.
Mining Engineering.

W. H. MEEKER, M. E.
Mechanical Engineering.

THE ENGINEERING EXPERIMENT STATION.

While the principal business of the several Engineering departments of the College is perhaps to give instruction to their students, the fact is recognized that the state contributes largely to the financial support of the College and that in return, not only should the College give tuition to the children of Iowa, but it should contribute as much as possible to the successful carrying on of the industrial interests of the state. By the establishment of experiment stations the national government has recognized the duty of the land grant colleges to the agricultural interests. The Engineering departments of this College believe that it is their proper business to aid the other industrial enterprises of the state.

With this thought as the motive, the several Engineering departments have undertaken during the past ten years and will continue in the future to undertake to carry on investigations of interest and value to the industries of Iowa, as need therefor may arise, in so far as the funds available will permit. A number of pamphlets and bulletins giving the results of some of these investigations have already been published, and have been
received with much favor by the people of the state. By strong resolutions numerous industrial and public organizations in Iowa have expressed their approval of this work.

In recognition and furtherance of this work the last General Assembly appropriated a specific sum for the establishment of an Engineering Experiment Station, for carrying on and publishing bulletins of investigations of value to the industrial and municipal interests of Iowa.

Work of the Engineering Experiment Station.

One of the most important lines of investigation already undertaken is sewage disposal. The first sewage disposal plant in Iowa was constructed at the College in 1898 and has been in highly successful operation ever since. The authorities of many cities in the state have visited it. The College is continually carrying on investigations in sewage disposal, both with the large plant and with smaller experimental plants. Among the special subjects now being investigated may be mentioned those of the disposal of creamery sewage, and small plants, built for less than $100 each, for disposing of the sewage of private houses.

In addition a representative of the Engineering Experiment Station each year visits all the sewage disposal plants of the state, making tests of the efficiency and securing the data of the operation of the plants. Each year the results of these examination and of the other investigations are published in the bulletin for free distribution.

Another line of investigation has been tests of building materials, which have also been under way for several years. Thousands of such tests, of all kinds of building materials in Iowa, have been made and the results published for the benefit both of the manufacturers and the consumers of the state.

Investigations helpful to the clay interests of the state have been under way for some years, and additional equipment is being put in for this work. Opportunity is provided whereby anyone can send to the Experiment Station samples of clay, to be tested as to suitability for material for brick, tile or other clay wares.

The investigations of Iowa coals have been of much value to the manufacturers and to the mining interests of the state, as has been shown by the large demand for the bulletin already published. This work is being continued and largely extended.
It is planned to conduct a statistical inquiry of the power plants of the state, with personal examination of each plant and study its conditions. The results of this investigation will be helpful in suggesting improvements in methods and systems in Iowa power plants.

Careful tests of electric lamps have been made a special feature of the Engineering Experiment Station work. Any city or corporation can now send its lamps to the station (which has been made the official testing station of the Iowa Electrical Association) and have careful tests of efficiency, candle power and durability made at short notice and slight cost, and thus determine whether it is getting proper return for the money paid for its lamps. Many such lamps are being sent in, and in addition special investigations along this line are being conducted, the results of which will be published in bulletin form.

An investigation is now under way of the properties of Iowa limes as compared with those from other states.

A bulletin giving the results of thousands of tests of different kinds of cement is ready for the press.

A bulletin on Iowa water works is well along.

Investigations for a bulletin on sewerage, water, and plumbing regulations for Iowa cities are also far advanced.

The above is only a part of the work done or planned by the Engineering Experiment Station.

TESTS OF MATERIALS.

More and more the cities and other public bodies of the state, together with private corporations, are sending in samples of various materials to be tested in the laboratories of the engineering experiment station.

Many places are having their cements tested to see whether they are up to specifications.

The same is true of brick, both for paving and building purposes.

Steel, iron, stone, wood and other materials of construction can be sent in for test to advantage.

Users of cement are sending samples of their sands for tests, to select the best.

Many samples of clay are received for analysis, test, and report as to value.

Ores are received for assaying work.
Coal can be sent in for test of its calorific value for fuel, and the absence of deleterious elements.

Electric lamps are being sent in by many cities and corporations for test to decide whether they are up to the representations on which they were bought.

All such testing work for the people of Iowa is done at bare cost. We invite further work of this kind, and promise our best efforts to be of assistance to all residents of the state along these and similar lines.

LIST OF ENGINEERING EXPERIMENT STATION BULLETINS

Bulletin No. 1.—The Iowa State College Sewage Disposal Plant and Investigations. (Now out of print). This bulletin describes the college plant, the first in the state, and gives the results of the first year of operation, including bacterial and chemical analyses. 21 pgs., 6 cuts.

Bulletin No. 2.—Bacteriological Investigations of the Iowa State College Sewage. Results from Sept. 1, 1899, to Sept. 1, 1900. 22 pgs.

Bulletin No. 3.—Data of Iowa Sewage and Sewage Disposal. This bulletin gives a number of gagings and analyses of Iowa sewage from different towns, and of various kinds, together with the detailed results of the operation of the college sewage disposal plant from May, 1900, to May, 1901. 27 pgs., 5 cuts.

Bulletin No. 4.—Bacteriological Investigations of the Iowa State College Sewage Disposal Plant. Results from 1898 to 1902. 19 pgs., 3 plates.

Bulletin No. 5.—The Chemical Composition of the Sewage of the Iowa State College Sewage Disposal Plant. Results from 1898 to 1902. 11 pgs.

Bulletin No. 6.—Tests of Iowa Common Brick. This bulletin gives the results of several hundred tests of seven different varieties of common brick manufactured in Iowa. Crushing, transverse breaking, absorption and freezing and thawing tests are given in each case. 23 pgs., 28 cuts.
Bulletin No. 7.—Sewage Disposal in Iowa. This bulletin gives detailed descriptions, usually with plans, of all sewage disposal plants in Iowa up to December, 1903, with the history of sewage disposal in the state, and full details of the operation of the several plants, including chemical and bacterial tests of efficiency. This paper was awarded the Fuertes Medal by Cornell University, June, 1904, and the Chanute Medal of the Western Society of Engineers for 1903.

Bulletin No. 8.—This bulletin gives the results of several hundred tests of seven varieties of dry press brick commonly used in Iowa. Crushing, transverse breaking, absorption and freezing and thawing tests are given in each case. 19 pgs., 8 cuts.

Bulletin No. 9.—Notes on Steam Generation with Iowa Coal. This bulletin gives a summary of a number of analyses of Iowa coal and tests of their heating power together with a discussion of the special difficulties encountered in burning Iowa coals and the best methods of overcoming these difficulties. 16 pgs., 3 cuts.

Bulletin No. 10.—Tests of Different Kinds of Cement. This bulletin gives a summary of the results of several thousand tests of many kinds of cement, made in the cement laboratory of the college during a period of several years, and also several thousand special tests made by Messrs G. W. Miller and D. E. Donovan. (Now ready for press.)

Any of the above bulletins not out of print can be obtained free of charge by writing to

A. MARSTON, Director, Ames, Iowa.
GOOD ROADS INVESTIGATIONS, IOWA STATE HIGHWAY COMMISSION.

A. MARSTON,  
Dean of Division of Engineering.  

C. F. CURTISS,  
Dean of Division of Agriculture.  

T. H. McDONALD,  
Assistant in charge of Good Roads Investigations.  

By act of the last General Assembly the College was made the State Highway Commission of Iowa, and a small appropriation was made for good roads investigations. It was made the duty of the commission to conduct road investigations, to furnish expert assistance to the several counties when called on by the proper county authorities, to prepare standard plans and specifications for road work, and to conduct each year a good roads school at the College.

Since July 1, 1904, the Highway Commission has been actively engaged in the above work. A general study is being made of the good roads problem in Iowa, and much information collected. In cooperation with the 1905 state census a careful road census of the country roads of Iowa, the first by any state, is being made. Tests and standard plans of concrete culverts are being made. Standard cross sections of roads are under consideration, as also standard forms for road maps and profiles, and for records of the expenditures of road funds. Visits for investigation and advice have already been made to quite a number of counties, and road maps of these counties prepared. Statistics of the present expenditures of road funds are being collected.

A large amount of good roads machinery has been secured by donation. An experimental section of road has been built.

Good Roads School.

June 12-17, 1905, inclusive, the first session of the Good Roads School will be held at the College. All road officers and others interested in good roads are strongly urged to be present and take part in the work.

Regular instruction will be given in the points of road construction of the various types, and demonstrations of the use of machinery in such work given. Regular instruction in the use
of simple road surveying instruments and the making of road plats and profiles will also be given. Experienced men from different parts of the state have been engaged to assist in the work, and experts from other states will also lecture on different phases of the subject.

It is believed that the work of the Highway Commission can be made of very great value to the state.
DIVISION OF SCIENCE AS RELATED TO INDUSTRIES

MATHEMATICS.
PHYSICS.
CHEMISTRY.
BOTANY.
ZOOLOGY.
GEOLOGY.
ECONOMIC SCIENCE.
DOMESTIC SCIENCE.
PSYCHOLOGY.
LITERATURE AND RHETORIC.
PUBLIC SPEAKING.
MODERN LANGUAGES.
HISTORY.
CIVICS.
MILITARY SCIENCE.
LIBRARY.
MUSIC.
FACULTY

ALBERT BOYNTON STORMS, A. M., D. D., LL. D.,
President, Dean of Science and General and Domestic Science.

EDGAR WILLIAM STANTON, M. Sc., LL. D.,
Dean of the Junior College and Professor of Mathematics and Economic Science.

M. STALKER, M. Sc., V. S.,
Lecturer on Veterinary Medicine.

GEN. JAMES RUSH LINCOLN,
Professor of Military Science.

ALFRED ALLEN BENNETT, M. Sc.,
Professor of Chemistry.

LOUIS HERMANN PAMMEL, B. Ag., M. S., Ph. D.,
Professor of Botany.

GEORGE WELTON BISSELL, M. E.,
Professor of Mechanical Engineering.

ANSON MARSTON, C. E.,
Dean of the School of Engineering and Professor of Civil Engineering.

MISS LIZZIE MAY ALLIS, B. A., M. A.,
Professor of French and German.

LOUIS BEVIER SPINNEY, B. M. E., M. Sc.,
Professor of Physics and Electrical Engineering.

SAMUEL WALKER BEYER, B. Sc., Ph. D.,
Professor of Geology and Mining Engineering.

ALVIN B. NOBLE, B. Ph.,
Professor of Rhetoric and English Literature.

HENRY E. SUMMERS, B. Sc.,
Professor of Zoology.

ADRIAN M. NEWENS, B. O.,
Professor of Public Speaking.

ORANGE HOWARD CESSNA, A. M., D. D.,
Professor of History and Psychology.

JOHN H. McNEIL, V. M. D.,
Dean of Veterinary Science.
MISS GEORGETTA WITTER, B. L.,  
Professor of Domestic Economy.

RICHARD CORNELIUS BARRETT, M. A.,  
Professor of Civics.

ARTHUR THOMAS ERWIN, M. S. A.,  
Associate Professor of Horticulture in charge of Department.

WARREN H. MEEKER, M. E.,  
Associate Professor of Mechanical Engineering.

MISS MARIA M. ROBERTS, B. L.,  
Associate Professor of Mathematics.

BENJAMIN H. HIBBARD, B. Ag., Ph. D.,  
Associate Professor of Economic Science.

LEWIS EUGENE ASHBAUGH, B. S., Ph. B.,  
Associate Professor of Civil Engineering.

WALTER A. STUHR, D. V. M.,  
Associate Professor of Histology, Pathology and Therapeutics.

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Dean of Women.

MISS VINA ELETHE CLARK,  
Librarian.

JOHN PIPER WATSON,  
Physical Director.

WILBERT EUGENE HARRIMAN, B. Sc., M. D.,  
College Physician.

FRANK JORDAN RESLER, B. Ph.,  
Director of Music, Vocalist.

HERBERT WILLIAM DOW, B. S. in M. E.,  
Assistant Professor of Mechanical Engineering.

MISS LOLA ANN PLACEWAY, B. Sc.,  
Assistant Professor of Chemistry.

MISS ELIZABETH MACLEAN,  
Assistant Professor of English.

WILBUR M. WILSON, M. M. E.,  
Assistant Professor of Mechanical Engineering.

JOSEPH EDWARD GUTHRIE, M. Sc.,  
Assistant Professor of Zoology.

PAUL SKEELS PEIRCE, Ph. D.,  
Assistant Professor of History.
WINFRED F. COOVER, A. M.,
Assistant Professor of Chemistry.

FREDERICK R. AHLERS, D. V. M.,
Assistant Professor of Anatomy and Obstetrics.

LESLIE M. HURT, D. V. M.,
Assistant Professor of Physiology and Sanitary Science.

MRS. MARY ELIZABETH RESLER, B. PH.,
Instructor in Instrumental Music.

ERNEST ALANSON PATTENGILL, B. S.,
Instructor in Mathematics.

ELBERT BARRETT TUTTLE, B. S., IN E. E.,
Instructor in Physics.

MISS JULIA COLPITTS, M. A.,
Instructor in Mathematics.

MISS HELEN GERTRUDE REED, Ph. B.,
Instructor in English.

MISS GRACE ISABEL NORTON, B. A.,
Instructor in German.

FRANK WENNER, B. S.,
Instructor in Physics.

MISS FRANCES MARIETTA WILLIAMS,
Instructor in Domestic Art.

MISS ANNIE W. FLEMING, B. Sc.,
Instructor in Mathematics.

MISS MAE MILLER, B. Sc.,
Instructor in History.

MARK PERKINS CLEGHORN, B. Sc., IN E. E.,
Instructor in Mechanical Engineering.

WARD MURRAY JONES, B. C. E.,
Instructor in Mathematics.

CLARENCE ROY MCKINNEY, B. Sc.,
Instructor in Chemistry.

MISS HARRIETTE KELLOGG, A. M.,
Instructor in Botany.

MISS FLORENCE ANN LUCAS,
Instructor in French.

MISS EFFIE ALENE WHITE, A. B.,
Instructor in English.
MISS ROSE ABEL, A. B.,
Instructor in English.

MISS RUTH MORRISON, A. B.,
Instructor in Domestic Economy.

JOHN F. TRAVIS, A. M.,
Instructor in Mathematics.

MISS BLANCHE ISABEL THOBURN, A. B.,
Instructor in English.

MISS ELIZABETH MOORE, Ph. M.,
Instructor in English.

MISS LISLE McCOLLOM, B. A.,
Instructor in German.

MISS SYBIL LENTNER, B. S.,
Instructor in Public Speaking.

MISS WINIFRED TILDEN, B. A.,
Instructor in Physical Culture.

MISS OLIVE STEVENS, B. L.,
Assistant Librarian.

MARGARET B. STANTON, B. Sc.,
Assistant in Mathematics.

ETHYL CESSNA, B. Sc.,
Assistant in History.

C. E. BARTHOLOMEW, B. Sc.,
Assistant in Zoology.

ROBERT EARLE BUCHANAN, B. Sc.,
Assistant in Botany.

ESTELLE DENNIS FOGEL, B. A., B. Sc.,
Assistant in Botany.

EFFIE MAE McKIMM, B. Sc.,
Assistant in Chemistry.

WILLIAM ALFRED BEVAN, B. Sc.,
Assistant in Chemistry.

HOWARD SAMUEL FAWCETT,
Student Assistant in Botany.

MISS VIOLA CHAMBERS,
Student Assistant in Mathematics.

FLORA BELL PADDOCK,
Student Assistant in Domestic Science.

HAROLD MARSHALL HOWARD,
Student Assistant in English.
DIVISION OF SCIENCE AS RELATED TO THE INDUSTRIES.

Many of the courses of study taught in this Division form a very essential part of those belonging to the other Divisions, so that the work required for the various degrees conferred by the College authorities is very thoroughly interwoven.

The object of the work in this Division is very comprehensively expressed in the act of Congress establishing this and similar colleges. The founding of these colleges on a basis of scientific learning has proved to be the beginning of an important epoch in educational history. The courses of study in this Division are less technical than are many of those of the other Divisions. The real advances in modern civilization have been along the lines of science study and investigations. It is the intent therefore to lay a broad foundation in scientific facts and principles in order to fit the graduate to fill his place in the affairs of the world. There can be no better preparation for the duties of life and for citizenship than the knowledge and mental training given by a genuine study of the sciences.

During the first two years the lines of study are well marked out and but little choice of subjects is given. The required mathematics end with the Freshman year. The subject may be pursued, however, during the remainder of the course, provided the student desires and is qualified to do so.

The various branches of the study of the English language extending throughout the Freshman and Sophomore years are sufficient in scope and purpose to give the needed training in the use of English. The modern languages, namely, French and German, are great store-houses of the sciences, and consequently courses of study in these languages are offered to the student in the earlier years of his work to enable him to use these languages in the last two years of his study. The study of the sciences is strongly supported by work in literary, historical and psychological lines.

The course in Science leads to the degree of Bachelor of Science (B. S.).

The course in General and Domestic Science leads to the degree of Bachelor of Science (B. S.).

The course in Domestic Science leads to the degree of Bachelor of Domestic Science (B. D. S.).
For applicants for admission to the academic year of the science courses who are not fully prepared to take up the work therein outlined, the College offers the following preparatory course:

Algebra, 5
English, 5
History, 5
Elementary Botany, 2
Civics, 2

SCIENCE.
(For Men and Women).

Academic Year.

FIRST SEMESTER.

Algebra, 5
Elementary Rhetoric, 5 or
*German, 5
Elementary Speech, 2
Drawing, 2

SECOND SEMESTER.

Plane Geometry, 5
English, 5 or
German, 5
History, Advanced American History, 4

Freshman Year.

FIRST SEMESTER.

~Advanced Algebra, 5
~Botany, Ecology, 2
**German, 5 or
~French, 5
~Physiography, 3
~Advanced Rhetoric, 5
**Domestic Art, 2 (for women)
Military Drill, 2 (for men)
Library Work, 2 (for men)
Physical Culture, 1 (for women)

*Beginning German may be taken only by those students who can show satisfactory evidence of proficiency in the English of the Academic year.
**Elective.
SECOND SEMESTER.

Solid Geometry and Plane Geometry, 5  
**German, 5 or  
French, 5  
Histology, 4  
Entomology, 2  
Voice and Gesture, 1  
Composition, 1  
Domestic Art, 2 (for women)  
Military Drill, 2 (for men)  
Physical Culture, 1 (for women)

(Mathematics, VI.)  
(Languages, VI or VII.)  
(Languages, II.)  
(Botany, III.)  
(Zoology, I.)  
(Public Speaking, II.)  
(English, IV.)  
(Domestic Economy, IV.)  
(Military, II.)

Sophomore Year.

FIRST SEMESTER.

**Analytical Geometry, 5  
**Cryptogamic Botany, 5  
**Vertebrate Zoology, 5  
German, 4 or  
French, 4  
Physics, 5  
Composition, 1  
Domestic Art, 2 (for women)  
Military Science, 2 (for men)  
Physical Culture, 1 (for women)

(Mathematics, VIII.)  
(Botany, IV.)  
(Zoology, II.)  
(Languages, VIII or IX.)  
(Languages, III.)  
(Physics, I.)  
(English, V.)  
(Domestic Economy, VI.)  
(Military, III.)

SECOND SEMESTER.

***Calculus, 5 or  
***Invertebrate Zoology, 5  
Chemistry, 5  
Physics, 5  
Composition, 1  
Domestic Art, 2 (for women)  
Military Drill, 2 (for men)  
Physical Culture, 1 (for women)

(Mathematics, IX.)  
(Zoology, III.)  
(Chemistry, II.)  
(Physics, II.)  
(English, VI.)  
(Domestic Economy, VII.)  
(Military, IV.)

*Elective, if preceded by D. E. I.

**The student shall elect two of these studies. The study omitted may be elected in the Junior or Senior year and counted in those years.

***Choice between Calculus and Invertebrate Zoology. The study omitted may be taken in the Junior or Senior year and counted in those years.
*Junior Year.

FIRST SEMESTER.

Analytical Geometry, 5  (Mathematics, VIII.)
Differential Equations, 3  (Mathematics, X.)
Advanced Cryptogamic Botany, 3  (Botany, VI.)
Vegetable Cytology, 3  (Botany, XII.)
Chemistry, 5  (Chemistry, V.)
Political Economy, 5  (Economic Science, I.)
Advanced Interpretation, 2  (Public Speaking, III.)
Economic Botany, 2  (Botany, X.)
Debating, 1  (English, VII.)
Histology, 2  (Veterinary Science, XXXIII.)
English Drama, 3  (Literature, I.)
The Drama in Translation, 2  (Literature, VIII.)
Domestic Science, 2  (Domestic Economy, II.)
Entomology, 5  (Zoology, IV.)
***Photography, 2  (Physics, IX.)
Embryology, 3 to 5  (Zoology, V.)
Surveying, 4  (Civil Engineering, VIII.)
Physiology, 1  (Veterinary Science, XVII.)

History, Europe in the 16th, 17th and 18th Centuries, 3  (History, V.)

History, The Renaissance, 2  (History, X.)
Geology, 5  (Geology, II.)
Human Physiology, 5  (Zoology, XII.)
Military Science, 1 (for men)  (Military, V.)
Band Work, 1 (for men)  
Physical Culture, 1 (for women).  Required.

*At the beginning of the Junior year students in this course must select a particular science—Botany, Zoology, Physics, Economic Science, Chemistry, Geology or Mathematics—which shall constitute a line of work during the Junior and Senior years. The hours of study given to the science chosen shall not be less than three per week in each term; and not less than thirty-two hours of scientific work shall be taken during the two years. The scientific work outside of the particular line shall be selected by the student after consultation with the president and the head of the department in which the line of study is chosen. The other studies taken shall be selected by the student after consultation with the president and the heads of the departments having charge of such studies. The studies for each term shall not be less than sixteen nor more than twenty hours per week.

***This subject may be taken only on the recommendation of the professor under whom the student takes the major portion of his work.
SECOND SEMESTER.

Calculus, 5
Advanced Differential Equations, 3
Animal Parasites, 2
Bacteriology, 2
Systematic Botany, 3 or 5
Organic Chemistry, 5
Money and Banking, 2
Finance, 3
Expression in Oratory, 2
Comparative Anatomy, 5
Advanced Entomology, 3 to 5
Debating, 1
Epic and Lyric Poetry, 5
**Domestic Science, 2
Mineralogy, 4
Physical Laboratory, 1 or 2
Military Science, 1
Band Work, 1
Public Speaking, 1 (Required)
History, The French Revolution and the 19th Century, 3

Human Physiology, 5
Physical Culture, 1 (for women), Required.

*Senior Year.

FIRST SEMESTER.

Spherical Trigonometry and Solid Analytic Geometry, 5
Economic Problems, 3
History of Political Economy, 3
Mineralogy, 4
History, National Expansion, 1783-1845, 3
History, Diplomatic History of the United States, 2
American Literature, 3
Domestic Art, 1
***Domestic Science, 1

(Mathematics, IX.)
(Mathematics, XI.)
(Zoology, VIII.)
(Botany, VII.)
(Botany, XV.)
(Chemistry, IX.)
(Economic Science, IV.)
(Economic Science, V.)
(Public Speaking, IV.)
(Public Speaking, V.)
(Zoology, VII.)
(Zoology, IX.)
(English, VIII.)
(Literature, II.)
(Domestic Economy, V.)
(Geology, VI.)
(Physics, XV.)
(Military, VI.)
(Public Speaking, VIII.)
(History, VI.)
(History, XI.)
(Zoology, XIII.)
(History, XII.)
(Literature, IV.)
(Domestic Economy, VIII.)
(Domestic Economy, XX.)

*Thesis not required. The head of any department may offer a total of three to six hours of research work.
**If preceded by D. E. II-V.
***If preceded by D. E. I.
**DIVISION OF SCIENCE**

Organic Chemistry, 5 or (Chemistry, XIV.)
Blow-Pipe Analysis and Assaying, 5 (Chemistry, VII and VIII.)
Psychology, 5 (Psychology, I.)
Agrostology, 2 (Botany, XIII.)
Vegetable Pathology, 3 or 5 (Botany, V.)
Advanced Cryptogamic Botany, Ferns, 3 (Botany, XVII.)
Chemistry, 5 (Chemistry, XI.)
Dramatic Art, 2 or (Public Speaking, V.)
Extempore Speech, 2 (Public Speaking, X.)
Physical Laboratory, 1 or 2 (Physics, XIV.)
Morphology, 3 to 5 (Zoology, X.)
Neurology, 3 to 5 (Zoology, XI.)
Principles of American Government, 3 (Civics, II.)
Advanced Entomology, 3 to 5 (Zoology, IX.)
Military Science, 1 (Miltary, VII.)
Band Work, 1 (Public Speaking, IX.)
One Oration, required (Botany, XVIII.)
Botanical Seminar, 1 (Literature, VI.)
The Short Story, 2

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**SECOND SEMESTER.**

Advanced Calculus, 4 (Mathematics, XVI.)
Mathematics, 1 (Mathematics, XVII.)
Evolution of Animals, 1 (Zoology, VI.)
Geology, 5 (Geology, IV.)
Chemistry of the Household, 2 (Chemistry, XVI and XVIA.)
History, The Welding of the Nation, (1846-1900) (History, IV.)
History, The Far Eastern Question (History, IX.)

*Domestic Science, 1 (Domestic Economy, XXI.)
Vegetable Physiology, 2 or 5 (Botany, XI.)
Advanced Bacteriology, 3 (Botany, VIII.)
Ethics, 3 (Psychology, II.)
Advanced Dramatic Art, 2 or (Public Speaking, XI.)
Advanced Extempore Speech, 2 (Public Speaking, XI.)
Chemistry, 5 or (Chemistry, XXXV.)
Chemistry, 4 or (Chemistry, XXXI.)
Chemistry, 4 (Chemistry, XXXII.)
Evolution of Plants, 1 (Botany, XIX.)
Advanced Entomology, 3 to 5 (Zoology, IX.)
Physical Laboratory, 1 or 2 (Physics, XV.)

*If preceded by D. E. II-V or XX.
Evolution of Cultivated Plants, 1
Morphology, 3 to 5
Military Science, 1
Band Work, 1
Botanical Seminar,
Industrial History of U. S., 2
Romance and Novel, 3
The Essay, 2
State and Federal Government, 3

(Horticulture, XIII.)
(Zoology, X.)
(Military, VIII.)
(Botany, XVIII.)
(Economic Science, VI.)
(Literature, III.)
(Literature, VII.)
(Civics, III.)

GENERAL AND DOMESTIC SCIENCE.

(For Women Only).

Academic Year.

FIRST SEMESTER.

Algebra, 5
Elementary Rhetoric, 5 or
*German, 5
Elementary Speech, 2
Drawing, 2

(Mathematics, II or III.)
(English, II.)
(Languages, V.)
(Public Speaking, I.)
(Mechanical Engineering, XIX.)

SECOND SEMESTER.

Plane Geometry, 5
English, 5 or
*German, 5
History, Advanced American, 4

(Mathematics, V.)
(Literature, IX.)
(Languages, VI.)
(History, II.)

Freshman Year.

FIRST SEMESTER.

College Algebra, 5
**German, 5 or

(Mathematics, IV.)
(Languages, V or VII.)

*German may be taken only by those students who can show to the Professor of English satisfactory evidence of proficiency in the English of the Academic year.

**Beginning or Advanced German according to the preparation of the student.
### DIVISION OF SCIENCE

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
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<tr>
<td>French, 5</td>
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<td>Domestic Art, 2</td>
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<td>Ecology, 2</td>
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<td>Advanced Rhetoric, 5</td>
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#### SECOND SEMESTER

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<tr>
<td>Solid Geometry and Trigonometry, 5</td>
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<td>**German, 5 or</td>
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<td>Domestic Art, 2</td>
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<td>Histology, 4</td>
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<td>Gesture and Voice, 1</td>
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<td>Composition, 1</td>
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<td>Advanced Civics, 2</td>
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<td>Physical Culture, 1</td>
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### Sophomore Year

#### FIRST SEMESTER

<table>
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<td>The Drama, 5 or</td>
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<td>Analytic Geometry, 5</td>
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<td>German, 5 or 4 or</td>
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<td>French, 4</td>
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<td>Domestic Art, 2</td>
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<td>Physics, 5</td>
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<td>Composition, 1</td>
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<td>Europe in the 16th, 17th and 18th Centuries</td>
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<td>Physical Culture, 1</td>
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#### SECOND SEMESTER

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<td>German, 5 or</td>
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<td>French, 4</td>
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<td>Domestic Art, 2</td>
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<td>Physics, 3</td>
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<td>Chemistry, 5</td>
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<td>Composition, 1</td>
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<tr>
<td>**Epic and Lyric Poetry, 5 or</td>
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<td>Calculus, 5</td>
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<td>Physical Culture, 1</td>
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**Beginning or Advanced German according the preparation of the student.**

**Students electing Calculus will take Literature II as a required study in the Junior year.**
****Junior Year.

FIRST SEMESTER.

(Required).
Domestic Science, 2  (Domestic Economy, II.)
Public Speech, 2  (Public Speaking, VII.)
Physical Culture, 1  
(Electives).
Chemistry, 5  
Vertebrate Zoology, 5  (Zoology, II.)
Bacteriology, 2  (Botany, VII.)
Analytic Geometry, 5  (Mathematics, VIII.)
Political Economy, 5  (Economic Science, I.)
Differential Equations, 3  (Mathematics, X.)
American Literature, 3  (Literature, IV.)
The Short Story, 2  (Literature, VI.)
Debating, 1  (English, VII.)
The Renaissance, 2  (History, X.)
Advanced Interpretation, 2  (Public Speaking, III.)
Market and Home Gardening, 2  (Horticulture, V.)
Floriculture, 2  (Horticulture, XI.)
Cryptogamic Botany, 5  (Botany, IV.)

SECOND SEMESTER.

(Required).
Domestic Science, 2  (Domestic Science, V.)
The French Revolution and 19th Century,  (History, VI.)
Advanced Public Speech, 1  (Public Speaking, VIII.)
Physical Culture, 1  
(Electives).
Chemistry, 5  (Chemistry, IX.)
Invertebrate Zoology, 5  (Zoology, III.)
Fermentations, 2  (Botany, XXI.)
The Constitutional History of England, 2  (History, XI.)
Calculus, 5  (Mathematics, IX.)
Advanced Differential Equations, 3  (Mathematics, XI.)
Money and Banking, 2  (Economic Science, IV.)

****In the Junior and Senior years a student may take each term not less than sixteen nor more than twenty hours per week. The time given to the sciences—Botany, Zoology, Geology, Physics, Economic Science, Chemistry and Mathematics—shall aggregate not less than thirty-two hours during the two years.
Finance, 3
The Essay, 2
Novel and Romance, 3
Debating, 1
Expression in Oratory, 2
Ferns, 3
Bacteriology, 3
Plant Propagation, 3
French, 5
German, 5

*Senior Year.

FIRST SEMESTER.

(Required).
Advanced Cookery, 1
Laundry, 1
Oration, 1

(Electives).
History of Art, 2
Geography of Foods, 1
Chemistry, 5
American Literature, 3
The Short Story, 2
Debating, 1

Spherical Trigonometry and Solid Analytic Geometry, 5

History, National Expansion, 1783-1845, 3
History, Diplomatic History of the United States, 2

Dramatic Art, or Extempore Speech, 2
Embryology, 3 to 5
Principles of American Government, 3
Vegetable Cytology, 3
Botanical Seminar, 1
General Geology, 5
Psychology, 5
Landscape Gardening, 2
German, 5
French, 5
History of Political Economy, 2
Economic Problems, 3
SECOND SEMESTER.

(Required).

Advanced Cookery, 1  (Domestic Economy, XXI.)
Home Management, 1  (Domestic Economy, XXIII.)

(Electives).

History of Art, 2  (Domestic Economy, XII.)
Geography of Foods, 1  (Domestic Economy, XXVI.)
Home Decoration, 1  (Domestic Economy, XIII.)
Sick Room Cookery, 1  (Domestic Economy, XXII.)
Seminar, 1  (Domestic Economy, XXX.)
Chafing Dish Cookery, 1  (Domestic Economy, XXVIII.)
History, The Welding of the Nation, 1845-1900, 3  (History, IV.)
History, The Far Eastern Question, 2  (History, IX.)
Plant Breeding, 3  (Horticulture, IV.)
French, 5  (Language, IV.)
German, 5  (Language, VIII.)
Chemistry, 2  (Chemistry, XVI and XVIa.)
Ethics, 3  (Psychology, II.)
The Essay, 2  (Literature, VII.)
Novel and Romance, 3  (Literature, III.)
Debating, 1  (English, VIII.)
Division and Reunion, 3  (History, IV.)
The Far Eastern Question, 2  (History, IX.)
Advanced Dramatic Art, 2 or Extempore Speech, 2  (Public Speaking, VI.)
Civics, 3  (Civics, IV.)
State and Federal Constitutions, 3  (Civics, III.)
Systematic Botany, 3 or 5  (Botany, XV.)
Evolution of Plants, 1  (Botany, XIX.)
Botanical Seminar, 1  (Botany, XVIII.)
Comparative Anatomy, 5  (Zoology, VII.)
Geology, 5  (Geology, IV.)
Advanced Calculus, 4  (Mathematics, XVI.)
Mathematics, 1  (Mathematics, XVIII.)
Industrial History of the United States,  (Economic Science, VI.)
Economic Botany, 2  (Botany, X.)
Chemistry, 5  (Chemistry, XXXV.)
DOMESTIC SCIENCE.
(For Women Only).
Academic Year.

FIRST SEMESTER.

Algebra, 5
Elementary Rhetoric, 5 or
*German, 5
Elementary Speech, 2
Drawing, 2

(SECOND SEMESTER.

Plane Geometry, 5
English, 5 or
*German, 5
History, Advanced American, 4

Freshman Year.

FIRST SEMESTER.

College Algebra, 5
**German, 5 or
French, 5
Domestic Art, 2
Ecology, 2
Advanced Rhetoric, 5
Physical Culture, 1.

(SECOND SEMESTER.

Solid Geometry and Trigonometry, 5
**German, 5 or
French, 5

*German may be taken only by those students who can show to the Professor of English satisfactory evidence of proficiency in the English of the Academic year.
**Beginning or Advanced German according to the preparation of the student.
Domestic Art, 2  
Histology, 4  
Gesture and Voice, 1  
Composition, 1  
Advanced Civics, 2  
Physical Culture, 1.

(Domestic Economy, IV.)  
(Botany, III.)  
(Public Speaking, II.)  
(English, IV.)  
(Civics, VI.)

**Sophomore Year.**

**FIRST SEMESTER.**

German, 5 or 4 or  
French, 4  
Domestic Art, 2  
Physics, 5  
Composition, 1  
***The Drama, 5 or  
Analytic Geometry, 5  
Europe in the 16th, 17th and 18th Centuries, 3  
Physical Culture, 1

(Languages, VII or IX.)  
(Languages, III.)  
(Domestic Economy, VI.)  
(Physics, I.)  
(English, V.)  
(Literature, V.)  
(Mathematics, VIII.)  
(History, V.)

**SECOND SEMESTER.**

German, 5 or  
French, 4  
Domestic Art, 2  
Physics, 3  
Chemistry, 5  
Composition, 1  
****Epic and Lyric Poetry, 5 or  
Calculus, 5  
Physical Culture, 1.

(Language, VIII.)  
(Language, IV.)  
(Domestic Economy, VII.)  
(Physics, II.)  
(Chemistry, XXII.)  
(English, VI.)  
(Literature, II.)  
(Mathematics, IX.)

**Junior Year.**

**FIRST SEMESTER.**

Foods, 2  
Laundry, 1  
Home Sanitation, 1  
Geography of Foods, 1  
Chemistry, 5  

(Domestic Economy, II.)  
(Domestic Economy, VIII.)  
(Domestic Economy, XVI.)  
(Domestic Economy, XXV.)  
(Chemistry, XXIV.)

***Students electing Analytic Geometry may take Literature V as an elective in the Senior year.***

****Students electing Calculus may take Literature II as an elective in the Senior year.***
Vertebrate Zoology, 5  
Bacteriology, 2  
Public Speech, 2  
Floriculture, 2  
Physical Culture, 1.

SECOND SEMESTER.

Foods, 2  
Sick Room Cookery, 1  
Home Management, 1  
Geography of Foods, 1  
Chemistry, 5  
Invertebrate Zoology, 5  
Fermentations, 2  
The French Revolution and 19th Century, 3  
Physical Culture, 1.

Senior Year.

FIRST SEMESTER.

(Required).  
Advanced Cookery, 1  
Theory of Teaching D. E., 1  
Dietaries, 1  
Household Accounts, 1  
History of Art, 2  
Physiology, 5  
Oration, 1  

(Electives).

Three to seven hours selected from the studies of the First Semester of the Junior and Senior years of the General and Domestic Science Course; may include "The Drama" if not taken in the Sophomore year.

SECOND SEMESTER.

(Required).  
Advanced Cookery, 1  
Practice Teaching, 1  
History of Art, 2  
Home Decoration, 1  
Physiology, 5  

(Domestic Economy, II.)  
(Botany, VII.)  
(Public Speaking, VII.)  
(Horticulture, XI.)  
(Domestic Economy, V.)  
(Domestic Economy, XXII.)  
(Domestic Economy, XXIII.)  
(Domestic Economy, XXVI.)  
(Chemistry, IX.)  
(Zoology, III.)  
(Botany, XXI.)  
(History, VI.)  
(Domestic Economy, XX.)  
(Domestic Economy, IX.)  
(Domestic Economy, XXIV.)  
(Domestic Economy, XXVII.)  
(Domestic Economy, XI.)  
(Zoology, XII.)  
(Public Speaking, IX.)  
(Domestic Economy, XXI.)  
(Domestic Economy, X.)  
(Domestic Economy, XII.)  
(Domestic Economy, XIII.)  
(Zoology, XIII.)
Seminar, 1  (Domestic Economy, XXX.)  
(Elective).

Chafing Dish Cookery, 1  (Domestic Economy, XXVIII.)

Five to nine hours selected from the studies of the Second Semester of the Junior and Senior years of the General and Domestic Science Course; may include “Epic and Lyric Poetry” if not taken in the Sophomore year.

DEPARTMENT OF MATHEMATICS.

EDGAR WILLIAM STANTON, PROFESSOR.
MISS ROBERTS, ASSOCIATE PROFESSOR.
MR. PATTENGILL, MISS COLPITTS, MISS FLEMING, MR. JONES AND MR. TRAVIS, INSTRUCTORS.

The work of the Department of Mathematics is directed to the following ends:

(1) The Development of Intellectual Strength.—Such a degree of thoroughness is required as awakens interest and stimulates to earnest effort. The work is so arranged as to compel the student to abandon the mere mechanical methods of reaching results. He can make little or no progress except through the mastery of principles and methods; and in their application there is demanded of him a high degree of ingenuity, care and courage. He is subjected to the continuous discipline of holding details in mind, comparing facts, drawing conclusions and advancing to the discovery of new truth. He learns to think, judge, originate, and through his mathematical training gains mental strength.

(2) Accuracy in Presentation of Mathematical Truths.—The student is required not only to think clearly, but to put his thought into concise and precise English. In the explanation of examples he is asked to bring out and emphasize the principles involved, dealing in detail with such equations only as are necessary to this purpose. In the solution of problems an analysis of statement and equation must be given, definitions and theorems must be stated clearly and accurately and in the demonstration of propositions the use of correct language is considered as secondary only to the employment of correct logic.

(3) The acquirement of such Command of the Subject Matter of Mathematics as will make it a Valuable Instrument
in Higher Scientific and Technical Study.—To this end an effort is made to eradicate from the student’s mind the idea entertained by many, that mathematical truths are learned simply to be forgotten, and to awaken in its place an earnest desire to obtain a comprehensive and abiding knowledge of the essential facts of the science. Thoroughness in daily recitation is demanded, frequent reviews are given and final credits are made to depend largely upon the student’s grasp of principles and the readiness and the accuracy with which he performs the simple and the complex operations involved in their application. Each branch as it is taken up is so presented as to require the constant employment of the principles and facts of the preceding mathematical studies. The Department aims in this way to give the student such a degree of mathematical maturity and self-reliant mastery as will enable him to use his mathematical knowledge with profit either in advanced collegiate work or as an instructor in our high schools and academies.

In the Engineering Courses, Algebra, Geometry, Trigonometry, Analytical Geometry and Calculus are required studies. Algebra, Geometry and Trigonometry are required in the science courses, while the advanced mathematical work is either optional or elective. Solid Geometry is the only mathematical study required in the courses in agriculture.

The following are the several courses in Mathematics:

Course I.—Algebra to Involution.—First Semester, Academic year. It is expected that students entering this course will have such a knowledge of elementary algebra through simple equations as may be obtained by thorough work in the high school. If the student’s preparation is in excess of this requirement it will be greatly to his advantage.

The subjects included in the review and advance work of this course are those which generally precede involution in any standard text. They are treated, however, in an exhaustive manner and the examples and problems given are more difficult than those found in the ordinary text-book. Special stress is laid upon the statement of definitions and the demonstration of principles.

Course II.—From Involution to Ratio and Proportion.—Second Semester, Academic year. This course is open to those who have completed Course I. The following subjects are studied: Involution of Monomials and Polynomials; Evolution, including the
consideration of the higher roots of polynomials, and rules for
determining the roots of numbers based upon the algebraic
method of extracting roots; Radicals, including the fundamental
operations, involution, evolution, rationalization, imaginary quan-
tities, extracting the square root of binomial surds and the
solution of equations involving radicals; Pure and Affected Quad-
ratics; Equations solved like quadratics; and Simultaneous Quad-
ratic Equations. Frequent written reviews are given covering
work in this Course and Course I.

At the completion of this course students are expected to
have such grasp of algebra through quadratics as will enable
them to handle its principles up to this point without error and
perform the operations required, with rapidity and accuracy.

Course III.—Algebra to Ratio and Proportion.—Second Se-
mester, Academic year. This Course covers practically the same
subjects as those enumerated in Courses I and II. Much of the
work, however, is taken in rapid review, only one semester being
devoted to the combined courses. The object aimed at is not
elementary instruction in the science, but a wider grasp of
principles and familiarity with their application in more difficult
fields. Many of the examples assigned are such as are met with
in the higher mathematics. The student is thus introduced to a
quality of work demanding a broad view of principles and meth-
ods and a marked degree of skill in algebraic manipulation.

The course should be undertaken by those only who have
already had large experience in algebraic work and who have
developed considerable strength in this study. The minimum
requirement for entrance is a thorough knowledge of algebra
through simple equations. The Course is especially intended,
however, for students who have completed algebra in the high
school and who need to give the work a thorough review before
entering upon advanced work. Admission is secured by examin-
ation or upon the certificate of the proper officer of an accredi-
dited high school.

Course IV. — College Algebra.—First Semester, Freshman
year. The subjects treated in this Course are ratio, proportion,
variation, arithmetical progression, geometrical progression,
harmonical progression, the binomial theorem, convergency and
divergency of series, theorem of undetermined coefficients in-
cluding partial fractions and reversion of series, principles and
use of logarithms, permutations and combinations, probability, determinants and the theory of equations.

The Course is open to students of the College who have taken Courses I and II or Course III; also to graduates of the fully accredited high schools who furnish the proper certificates. The first ten days of the time allotted to the course is devoted to a review of algebra up to and including quadratics. Students who fail to stand the test of this review will be assigned to such work as they are prepared to undertake.

Graduates of accredited schools are earnestly urged to carefully review their work in algebra before entering this course. The sample questions printed elsewhere in this catalogue give a good idea of the knowledge of the subject needed. The Department will gladly unite with the student and his school principal in arranging to test the thoroughness of his home review; such test can be given in connection with the work of the high school and, if satisfactory to the Department, will be accepted in lieu of the review test at the College. The student can then begin his advanced work without delay. Students designing to take the review here must be present promptly at the opening of the semester. Correspondence regarding this whole matter is cordially invited.

Students not graduates of the fully accredited schools will be admitted to this course upon passing a satisfactory examination upon the work covered by Course III. As stated under “Requirements for Admission,” arrangements can be made with the principals of high schools or county superintendents to conduct such examinations. The principal of any school desiring to test the ability of his students to enter upon the work of this course will be furnished, upon request, a list of examination questions. The Department will be pleased to mark the examination papers and enter upon its records as accredited students in the Mathematical Department the names of all students who show that they are prepared to take up the work with success.

Course V.—Plane Geometry.—Second Semester, Academic year. The topics included in this course are those usually treated in a standard text. They include the fundamental definitions and axioms, theorems relating to rectilinear figures and the circle, measurement of angles; doctrine of limits; theory of proportion; similar polygons; comparison and measurement of the surfaces of rectilinear figures; measurement of the circle,
and geometrical construction of plane figures. The text book used is Phillips and Fisher. The proofs outlined in the text must be fully amplified; definitions must be stated with precision; authority cited must be given in full and the logical steps in demonstration must be so arranged and presented as to constitute a complete and rigid proof. The student must understand each proposition and be able to state the demonstration in concise geometric language. Special emphasis will be laid upon the demonstration of original exercises. The course is open to those who furnish the head of the department with satisfactory evidence that they have a thorough knowledge of the subjects in Course I.

Course VI.—(a) Solid and Spherical Geometry.—This course is open to those who have met the requirements for admission to the mathematics of the Second Semester of the Freshman year. A week is given at the beginning to a review of plane geometry, one day being devoted to each book. Students are required to write out or demonstrate orally such propositions as may be assigned, using in preparation the text book studied in the preparatory school. Looking forward to this work the students immediately before leaving home should carefully go over the whole subject of plane geometry. Those who show in the week’s review a satisfactory knowledge of definitions and ability to handle successfully advanced geometric work will be assigned to the classes in solid geometry. The subjects considered in the remainder of the course will be the properties of planes, of dihedral and polyedral angles, of prisms, of pyramids and other polyedrons, of cylinders, cones and spheres, of spherical triangles and spherical polygons.

(b) Plane Trigonometry.—Last 13 weeks, Second Semester, Freshman year. Courses III, IV, V, and VIa are essential preliminary studies. The subjects investigated are definitions; positive and negative angles; circular measures of angles; operations upon angles; functions of angles, their relations and varying values; determination of values of the functions of particular angles; functions of different angles expressed in terms of those of a basal angle; derivation and reduction of trigonometric formulas; solution of right and oblique triangles. The points most strongly emphasized are: Care in tracing the trigonometric functions of varying angles in the different quadrants, readiness and skill in the derivation and reduction of
trigonometric formulas, and accuracy in the use of logarithmic tables.

Course VII.—Spherical Trigonometry.—This work is required in the First Semester, Junior year, of the Civil Engineering course. It is elective to students in the science and domestic science courses. Course VI and the studies necessarily preliminary thereto are required for entrance. The spherical right triangle is investigated; triangles of reference are formed and formulas deduced therefrom; Napier's rules are applied; the six different cases arising in the solution of right triangles are discussed and illustrated by numerous examples. Spherical triangles in general are considered; the formulas relating thereto are derived and applied to the solution of examples; interesting problems connected with the celestial spheres are included in the course.

Course VIII.—Plane Analytic Geometry.—First Semester, Sophomore year. This work is required in all engineering courses and is elective to all students who have completed Courses IV and VI. This subject is taught largely from the standpoint of its value as a disciplinary study. Once the student is impressed with the spirit of its method, the beauty of its logic and the excellent field for analytical reasoning it opens up, he will readily find his way to a mastery of the particular facts it reveals. The student is introduced to the subject through a review of the special algebraic, trigonometric and geometric conceptions upon which it is based; these are applied to the analytic representation of points in a plane and the proposition established that all geometric lines and curves can be represented by equations, and their properties and relations discovered by a study of these equations. The line, the circle and the conic sections are in this way most carefully investigated. Examples involving principles are solved and from a knowledge of particular the student is led to the demonstration of general theorems. The generalized truth is then employed in the development of other truth, and thus the student is given a most excellent drill in both inductive and deductive reasoning. At the same time his needs, as an engineering or scientific student, of a knowledge of the facts of analytic geometry, are fully met. The Analytic Geometry by Tanner and Allen of Cornell University is used as a text.

Course IX.—Differential and Integral Calculus.—Second Semester, Sophomore year. All preceding mathematical work
should be completed before this course is undertaken. Calculus bears to that work the double relation that, while it is based upon it and cannot be pursued successfully except as the work has been well mastered, it on the other hand furnishes a most excellent opportunity for a general review of the preceding mathematical studies and gives to all that has gone before a significance and value which it would otherwise lack. It is therefore a most important part of any extended and thorough mathematical course. The abstruse principles of this higher method of mathematical investigation are explained upon the theory of limits. The theory of infinitesimals is also employed. Instruction is given by daily recitations with a review of the week's work each Friday. In differential calculus the rules of differentiation, expansion of functions, indeterminate forms, tangents, normals and asymptotes, direction of curvature, points of inflection, radius of curvature, order of contact, the osculating circle, envelopes, singular points and maxima and minima of functions are studied. In integral calculus much time is spent in acquiring a usable knowledge of the forms of integration. Application of integration is then made to the determination of the lengths of plane curves, areas of plane surfaces and surfaces of revolution, volumes of solids of revolution and other solids.

Course X.—Differential Equations.—This course is required of electrical engineers in the First Semester of the Junior year, and is open to all students of the College who have completed Course IX. The work covered by it may be considered as supplementary to integral calculus. The course includes the formation of differential equations; solutions of equations of the first order with applications to geometry, mechanics and physics.

Course XI.—Differential Equations.—This course is open to those who have completed Course X. The subjects covered are the methods of handling linear equations with constant and variable coefficients; exact differential equations; integration in series; equations of the second order with geometrical, mechanical and physical applications; ordinary differential equations with more than two variables; partial differential equations of the different orders.

Course XII.—Algebra through Quadratics.—Given First Semester, Academic year. This course, which is designed especially for students in agriculture, covers the work in Course III. To complete it successfully in the time allowed, the student
should have knowledge of at least the fundamental operations. It will be greatly to his advantage if he has taken the work as far as involution.

Course XIII.—Algebra; Permutations and Combinations, Binomial Theorem and Logarithms.—Given Second Semester, Academic year, agricultural courses to those students who have completed Course XII. Four weeks are devoted to this subject. The work includes permutations and combinations; the binomial theorem and logarithms.

Course XV.—Advanced Analytic Geometry.—In the last ten weeks of the First Semester, of the Senior year, advanced work in analytic geometry will be taken up. Some time will be devoted to the general equation of the second degree and to higher plane curves, after which the study of analytic geometry of three dimensions will be considered. Prerequisites Mathematics VIII and IX.

Course XVI.—Advanced Calculus.—Second Semester, Senior year. This course deals with the application of differential calculus to the discussion of the properties of curves. It treats of the application of both differential and integral calculus to functions of a complex variable and also investigates the subject of definite integrals and the use of double integration in measuring surfaces. The principles involved are illustrated by numerous examples. Prerequisites, Mathematics, VIII and IX.

Course XVIII.—Elective in the Science and General and Domestic Science courses, Senior year, Second Semester. All previous Mathematics required. The course consists of lectures on the principles involved in the Mathematical courses already taken. Its main purpose is to emphasize those principles which are most important and to suggest methods of presenting them effectively in the class room. The course is intended especially to help those who expect to teach in mathematical lines.

THE DEPARTMENT OF PHYSICS.

LOUIS BEVIER SPINNEY, PROFESSOR.
MR. TUTTLE AND MR. WENNER, INSTRUCTORS.

This department is located in Engineering Hall. It occupies sixteen commodious rooms, including six laboratories, two standardizing and testing rooms, two research rooms, two apparatus rooms, three offices and a large lecture room.
The lecture room is modern in its equipment, which includes a convenient system of darkening shutters for the windows and a large permanent lantern screen, to facilitate demonstration work. At the lecture room tables are electric, gas and water connections, placing at the disposal of the lecturer a water pressure of fifty pounds per square inch and electric currents from storage batteries, and direct or alternating current dynamos.

The department has a good equipment in apparatus for demonstration purposes, which is stored in apparatus rooms adjoining the lecture room.

The general laboratory rooms are large and well lighted and are equipped with heavy oak tables, slate-top piers and wall tables with heavy stone tops for the support of the laboratory apparatus. Convenient electric, gas and water connections are provided. A very serviceable equipment in the apparatus used in general physical laboratory work is furnished. Among other apparatus may be mentioned a laboratory clock, with electric connections, a chronograph, a reversion pendulum, two torsion pendulums for the experimental determination of "moment of inertia" and the "coefficient of simple rigidity," a physical pendulum, apparatus for the determination of the "intensity of gravity" by observations on a body rolling on an inclined plane, analytical balances, Jolly's balance, hydrostatic balance, apparatus for the determination of "Young's Modulus" by stretching and by bending, apparatus for the coefficient of linear expansion, a cathetometer, optical benches, telescopes and microscopes, spectrosopes, a saccharimeter, hydrometers, thermometers, barometers, galvanometers, Wheatstone bridges, "testing apparatus," electrocalorimeters, silver, copper and water voltameters, etc.

The photometry rooms are equipped with several photometer benches and are furnished with gas and electric connections. The arrangement of apparatus is made with a view of facilitating the regulation tests of arc and incandescent lamps as well as those of other sources of illumination.

The dynamo room is equipped with experimental dynamos, including arc machines and direct and alternating current machinery of various types together with a convenient switchboard and extended system of electric connections. An equipment in ammeters, voltmeters, wattmeters, transformers, dynamosimeters, etc., is provided.

The repair shop is fitted with an engine lathe, a speed drill,
a set of machinist's and carpenter's tools and a stock of shop supplies. This room is used for the repair and manufacture of apparatus.

The photographic laboratory is equipped with cameras and other appliances, dark rooms, skylights, screens, and background for portrait and copying work, and water facilities. The equipment enables the carrying forward of a very practical course in photography in its various applications.

The following courses are offered by the department:

Course I.—Mechanics and Heat.—First Semester, and
Course II.—Electricity and Magnetism and Light and Sound.—Second Semester. Two lectures, one recitation and one laboratory per week. Mathematics IV, V and VI required.

In the First Semester of this course the study of mass, force, energy, and power is emphasized and special attention is given to the graphic methods of solving problems in force-actions, velocities, etc. A portion of this Semester is also given over to the discussion of radiation in general and wave motion. The other general topics are then taken up according to the outline given above.

The laboratory work is kept parallel to the text book and lecture work and enables the emphasizing and fixing of the fundamental conceptions.

This course is designed to meet the needs of students in the course of domestic science. The breadth of the course, together with the emphasis which is placed upon the essentials, adapt it to the needs of teachers and others who desire a general training in physics. Professor Spinney, Mr. Tuttle and Mr. Wenner.

Course III.—Mechanics and Heat.—First Semester, and
Course IV.—Electricity and Magnetism and Light and Sound.—Second Semester. Two lectures and three recitations per week. Mathematics IV, V and VI required.

This course is designed for engineering and general science students, although it is open to others who are properly prepared for the work. As in Course I, much stress is placed upon the fundamental principles of the work and in addition thereto a more thorough study of vector quantities and their graphical treatment is made.

A view of the subject from the mathematical standpoint is emphasized and the student is urged to familiarize himself with the theoretical side of the question, as it is believed that such a
foundation is very helpful if not absolutely essential to the work which follows. Text-book, Hastings and Beach, "General Physics." Professor Spinney, Mr. Tuttle and Mr. Wenner.

Course VI.—Electricity and Magnetism.—Three hours per week, First Semester. Physics III and IV and Mathematics IX required.


Course VII.—Theory of Alternating Currents.—Two lectures per week. Second Semester. Physics VI and Mathematics X required. Professor Spinney.

Course VIII.—Theory of Electrical Measurements.—Two lectures per week. First Semester. Physics VII required. Professor Spinney.

Course IX.—Theory and Practice of Photography.—Class room and laboratory work, one hour each per week. First Semester. Open to upper classmen only, upon recommendatino by the head of the department in which the student takes his major work.

In the class room work is given a discussion of the optics and chemistry of photography. The manipulation of the negative and positive under the various processes to which it is subjected is also presented and the laboratory work is planned to give the student some skill in carrying forward the various methods of practical photography. The student is given practice in developing over and under exposed negatives, in copying and enlarging work, etc. Mr. Tuttle.

Course X.—Dynamo Electric Machinery.—Three hours per week. Second Semester. Prerequisite, Physics VI. Professor Shane.

Course XIV.—General Physical Laboratory.—Two afternoons per week. First Semester.

Course XIV A.—One afternoon per week, First Semester.
Measurement of length, mass, and time, determination of physical constants, use of the barometer, thermometry, calorimetry, etc. Mr. Tuttle and Mr. Wenner.

Course XIV B.—One afternoon per week. Second Semester. Continuation of XIV A.
Course XV.—Physical Laboratory, Elementary Electrical Measurements.—One afternoon per week, Second Semester, or
Course XVI.—Two afternoons per week, First Semester, or
Course XVII.—Two afternoons per week, Second Semester.
The measurement of the electro-motive force and internal resistance of primary and secondary batteries, the use of Wheatstone's bridge, measurement of current. determination of galvanometer constants, high resistance measurements and insulation tests, etc. Mr. Tuttle and Mr. Wenner.

Course XVIII.—Physical Laboratory, Electrical Testing.—
Two afternoons per week, First Semester, or
Course XIX.—Two afternoons per week, Second Semester.
Professor Spinney, Mr. Tuttle and Mr. Wenner.

Course XX.—Physical Laboratory, Dynamo, Motor and Commercial Plant Testing.—Two afternoons per week, First Semester.
The efficiency of dynamos and motors, experimental determination of characteristic curves, magnetic leakage, etc. Critical study of commercial plants, determination of efficiencies, etc. Professor Shane.

Course XXA.—Physical Laboratory. Study of Alternating Currents.—One afternoon per week, First Semester. Laboratory methods for measuring inductance, capacity, etc., and,
Course XXI.—Physical Laboratory. Study of Alternating Currents.—Two afternoons per week, Second Semester, Senior year.
Continuation of XXA. The study of alternating current dynamos and motors and commercial transformers. Professor Spinney and Professor Shane.

Course XXII.—Electric Circuits.—Two lectures per week, Second Semester. Physics VI required. Professor Fish.

Course XXIV.—Electrical Designing.—Two afternoons per week, First Semester, Senior year. The design of dynamos, motors, transformers, etc. Professor Fish.

Course XXV.—Electrical Designing.—Two afternoons per week, Second Semester, Senior year. Continuation of Course XXIV. Professor Fish.

Course XXVI.—Thesis in Electrical Engineering begun, and
Course XXVII.—Thesis in Electrical Engineering, finished
Total equivalent of four hours per week for One Semester.

Course XXVIII.—Thesis in Physics.
For a discussion of Courses X to XIII, XVIII to XXVII and XXIX to XXXII, see the Course in Electrical Engineering.

The department offers thesis work in general physics, in heat, in light and sound, and in electricity and magnetism to students in other than the engineering courses.

Courses III and IV and Courses X to XV are designed especially for engineering students. Courses III, IV, XIV, XV, XVI and XVII are, however, open to other students as electives.

For laboratory courses of two afternoons per week a fee of $5.00 is charged. For courses of one afternoon per week the fee is $3.00.

DEPARTMENT OF GENERAL AND APPLIED CHEMISTRY.

ALFRED A. BENNETT, PROFESSOR.
L. A. PLACEWAY AND W. F. COOVER, ASSISTANT PROFESSORS.
R. C. M'KINNEY, INSTRUCTOR.
EFFIE M'KIMM, BIRD SLATER AND W. A. BEVAN, ASSISTANT INSTRUCTORS

The study of chemistry begins in the Sophomore year with all students, excepting those in the Department of Veterinary Science, who begin their work the First Semester of the Freshman year.

METHODS AND OBJECT OF INSTRUCTION.

The aim of the instruction in Chemistry is to develop in the student the inductive and experimental method of study, to excite in him an appreciation and love for true experimentation and to train his powers for inductive thinking, thus laying a foundation for technical or applied Chemistry.

The method of study is, therefore, distinctively the laboratory method. On the average, the student employs two hours of time in laboratory study for every hour of recitation. This proportion of time for the two divisions of work is especially carried out in the earlier part of the class study. The class room work aims to fix in the mind of the student chemical principles and facts based upon what has been learned by the actual handling and study of chemical substances.

The work is arranged in courses, the course referring to the pursuit of a division of the subject for one semester without re-
gard to the number of hours per week that may be devoted to it. Three hours of laboratory study is equivalent to one hour of recitation.

DESCRIPTION OF COURSES OF STUDY.

The work is conveniently grouped under the following general heads: (a) General and Descriptive Chemistry; (b) Analytical Chemistry, Qualitative and Quantitative Analysis; (c) Organic Chemistry; (d) Studies in Applied Chemistry.

(a) General and Descriptive Chemistry includes an elementary study of the non-metallic and metallic elements, their history, occurrence, preparation, properties and their principal compounds. In order better to train his powers of observation the student is required to describe the apparatus used and the phenomena produced, and to trace the relation of the results obtained to laws and principles.

The different courses in General and Descriptive Chemistry are arranged to meet, as far as is practicable, the special needs of the students of the various departments. However, it is recognized that at this stage of the work the Science of Chemistry is the student's most practical acquisition.

(b) Analytical Chemistry, both Qualitative and Quantitative, is taken up in an elementary way at first and may be followed by courses in more advanced work. After this preliminary knowledge is obtained, the direction of the work will depend to a great extent on the degree the student is aiming to obtain. For the degree in Agriculture the analytical study is directed to an examination of those substances of agricultural interest, and to prepare the student for an intelligent use of the scientific data upon which agriculture is founded. In any case the purpose is to study Applied Chemistry from the standpoint of its fundamental principles.

In the recitations, methods of analysis are described and discussed and the study of the theoretical chemistry carried forward. In this work, courses of study are arranged for graduate as well as for under-graduate students.

(c) In Organic Chemistry, courses are offered for the first degree and also as major and minor subjects for graduate students.

The course required of the students of the Veterinary Department is of an elementary nature and is intended to give a suffi-
cient knowledge of the subject to lay the foundation for the study of Physiological Chemistry which follows. The latter course considers the chemical changes going on in the living animal body; the essential composition of foods and the changes through which they pass in the animal economy; the chemistry of the secretion and excretion. The laboratory study is devoted to the three principal food constituents and to urine analysis.

The undergraduate in the division of Agriculture under the topic Organic Chemistry, studies in addition to the general principles of the subject, the chief food substances, i.e., the carbohydrates, fats, and proteids, poisonous substances found in the organic world, such as the alkaloids, ptomaines; the chemistry of milk and of the manufacture of butter and cheese. In a word, the student will consider, as completely as the time allotted to the subject will allow, the important questions that concern agriculture from the chemical standpoint.

To undergraduate students in the Division of Science is given a fairly complete outline of the theory of the structure and formation of organic compounds, but special attention is given to those compounds that are of commercial importance. In the laboratory the student prepares many of the more important manufactured organic substances, such as alcohol and soaps, and makes a special study of vinegars, sugar, petroleum and its products, glycerine, etc.

With this work as a foundation the graduate student selects some feature or features for more complete study. The amount and character of the work is left for arrangement between the individual and the head of the department. However, this will embrace such work as the analysis and study of foods, oils, fats, and the methods of preparation, purification, and adulteration of commercial organic substances.

(d) It is recognized among persons whose opinions are worthy of consideration that the application of any science to the problems of life can be profitably taken up by the student only after a thorough grounding in the principles upon which the science rests. The purpose of the preliminary courses in this subject is to give this training as completely as possible.

Some eighteen courses of study in applied chemistry are offered, or are required of the students for the various degrees open to them. In the nature of the case, this work is essentially quantitative analysis and consists of courses in the analysis of
Agricultural products; Fuel and Gas Analysis; Blowpipe Analysis; Assaying and Metallurgy; Chemistry of the Household; The Preparation of Organic and Inorganic Compounds.

The courses in Agricultural Analysis will include both inorganic and organic substances; such as: Soils, fertilizers, water, fodders and dairy products. This work will be open to undergraduate and graduate students, i.e., the latter class of students will carry forward the work begun in the usual college courses.

The course in Fuel and Gas Analysis will consist of the study of solid, liquid and gaseous fuels, in reference to their composition, and to their relative economic values. The student may devote the time of this course, principally, to technical analysis. Although the work is largely done in the laboratory it will be supplemented by lectures and recitations. The standard forms of apparatus will be used.

The principles and methods of quantitative analysis learned in the elementary course will be applied in the advanced work to the analysis of various organic and inorganic substances, such as foods, iron and steel. The application of the facts of Electrochemistry to the quantitative analysis of ores. and in the manufacture of chemicals will be studied in an elementary manner.

Quantitative Analysis by the "fire methods" is applied to gold, silver, copper and lead ores. This work is introduced by a blowpipe study of minerals, and is intended to support and supplement the subject of Descriptive Mineralogy and Crystallography which are studied in the Department of Geology.

The study of Metallurgy will consider the chemical changes going on in the separation of the principal metals of the industries and the assaying of metallurgical substances by wet process. This will include the chemical changes in the ores, fluxes, and fuels, occurring during the processes in the preparation of metals, and also the quantitative analysis of such substances. The subject is considered in lectures, recitations and laboratory practice.

The courses in chemical preparations will include the formation of pure and commercial articles from raw materials, and the common adulterations of these products.

The Chemistry of the Household considers the elementary chemistry of the principal food materials, changes produced in them during cooking and digestion, of cleaning and of adulteration of the chief food substances.
This course can be accompanied by a laboratory study of soaps, soap preparations, sugars, syrups, vinegars, and baking powders. It must be preceded by a course in elementary quantitative analysis.

The work in Physiological Chemistry for the student in the Science Division (Course XXXV) includes a careful study in the laboratory, of the composition of foods, the chemical characteristic of their constituents, the changes during digestion and assimilation and the products of metabolism. The classroom work correlates these facts and by lectures and text-book they are given their appropriate explanation.

The work in Water Analysis covers a study of the methods employed, namely the so-called mineral and sanitary analysis, and the interpretation of these results, especially from the standpoint of the household, and for use in boilers in the production of steam. Methods of purification of water and a study of sewage will receive attention.

COURSES OF INSTRUCTION.

FIRST SEMESTER.

Course I.—Elementary Inorganic Chemistry.—Recitations two hours. Laboratory practice, one afternoon. Veterinarians. Freshmen.

Course II.—General Chemistry.—Recitations, three hours. Laboratory practice, two afternoons. Engineers, Sophomores.

Course V.—Qualitative Analysis.—Recitations, three hours. Laboratory practice, two afternoons. Continuation of Course II. Junior or Senior year.

Course VII.—Blowpipe Analysis.—Recitations, two, and laboratory practice, three afternoons for one-half semester. Required of Mining Engineering students, and elective for students of Division of Science. Junior year. Courses II and V, or III and VI, required.

Course VIII.—Assaying.—Recitations, two hours, and laboratory practice, three afternoons for one-half semester. Junior year. Required of Mining Engineering students. Elective for students in Division of Science. Junior year. Courses II and V. or III and VI, required.

Course X.—Elementary Organic Chemistry.—Lectures, two hours. For students in the Veterinary Department only. Sophomore year.
Course XI.—Quantitative Analysis.—Recitations, two hours. Laboratory practice, three afternoons. Junior and Senior years. Must be preceded by Courses II and V or III and VI.

Course XIV.—Organic Chemistry.—Five hours. A continuation of Course IX. Work subject to arrangement by head of department and student. Senior year, or as a major or minor graduate study.

Course XVII.—Fuel and Gas Analysis.—Three hours. Elective for students of Division of Science. Courses II, V, IX and XI required. Major or minor graduate study.

Course XVIII.—Electro-chemistry.—Three hours. Senior year. Elective for students of Division of Science. Courses II, V and XI required. Major or minor graduate study.

Course XXI.—For students in the Agricultural Division, which see.

Course XXIV.—Elementary Applied Chemistry.—Recitations, three hours. Laboratory practice, two afternoons. G. D. S. and D. S. students. Junior year.

Courses XXV, XXVII, XXVIII are for students in the Agricultural Division, which see.

Course XXX.—Continuation of Course XII. Two hours. Mostly laboratory practice. Senior year. Courses II, V, XI or XII required when elected by Division of Science students. Required of Mining Engineering students.

Course XXXIII.—Qualitative Analysis.—Continuation of Course V. Recitation, two hours. Laboratory practice, two or three afternoons. Elective Junior or Senior years. Division of Science.

Course XXXV.—Organic Preparations.—Recitations, two hours. Laboratory practice, two or three afternoons. Elective in Division of Science. Courses II, V and IX required.

SECOND SEMESTER.

Course II.—General Chemistry.—Recitations, three hours. Laboratory practice, two afternoons. Sophomore year. Division of Science.

Course IV.—General Chemistry (Metals).—Recitations, two hours. Laboratory practice, one afternoon. Freshman. Veterinary Science students only.

Course VI.—Qualitative Analysis.—Recitations, three hours. Laboratory practice, two afternoons. Continuation of Course III.
Course IX.—Organic Chemistry.—Recitations, four hours. Laboratory practice, one afternoon. Junior or Senior years. Science, G. D. S. and D. S. Must be preceded by Courses II and V.

Course XII.—Metallurgy.—Lectures and recitations, one hour, Junior year. Laboratory practice, two afternoons. Required of Mining Engineering students. Elective for students in Division of Science. Courses II., V., VII. and VIII. required.

Course XIII.—Physiological Chemistry.—Recitations, two hours. Laboratory practice, one afternoon. Sophomore year. Required for students in Veterinary Department.

Course XV.—Analysis of Foods.—Three hours. Elective for students in Division of Science. Courses II., V., IX. and XI. required. Major or minor graduate study.

Course XVI.—Chemistry of the Household.—Sixteen lectures, Senior year. Must be preceded by Courses XXII., XXIV. and IX. Offered to students of science as related to the industries, and in domestic science.

Course XVI (a).—This course is to accompany Course XVI. and is wholly laboratory study. Senior year. Must be preceded by Courses XXII., XXIV., IX. and XI. Domestic Science students, one or two afternoons.

Course XIX.—Water Analysis.—Three hours. Senior year, Elective for students in Division of Science. Courses II, V, IX and XI. required. Major or minor graduate study.

Course XX.—Special Work in Chemistry for the Preparation of a Graduate Thesis.—This subject is usually selected along the line of applied chemistry.

Course XXI.—Elementary Chemistry.—Recitations, three hours. Laboratory practice two afternoons. G. D. S. and D. S. students. Sophomore year.

Course XXIII.—For students in the Agricultural Division, which see.

Courses XXVI., XXIX. and XXXIV.—For students in the Agricultural Division, which see.

Course XXXI.—Inorganic Preparations.—Recitations, two hours. Laboratory practice, two or three afternoons. Courses II, V, and IX required. Elective in Division of Science.

Course XXXII.—Quantitative Analysis.—Continuation of Course XI. Recitation and laboratory practice, four hours. Elective Junior or Senior years. Division of Science.
Course XXXVI.—Physiological Chemistry.—Recitations, three hours per week. Laboratory practice, two afternoons. Elective for the Science, G. D. S. and D. S. students. Courses II., V. and IX. are requisite for this course.

Graduate students will be provided with work in Organic and Inorganic Chemistry extending through two years if desired.

This subject is open as a major study to graduates of this and other colleges of equal standing who have pursued the study of chemistry for two years and who are by this prepared to carry on independent work in the various directions that may be arranged by them and the head of the department. The courses of study will be along the lines of Applied or Industrial Chemistry with a sufficient ground work of theoretical study to give a rational explanation and conception of the processes involved. The work will include advanced analytical and synthetical chemistry, i. e., a study of the methods of chemical analysis and of the preparation of organic and inorganic compounds of industrial and commercial importance. The graduate student will select work along some one of these general lines of study and will devote his time to this, supporting it by other necessary collateral study, and such research in the literature of the subject as the library facilities will permit. A good reading knowledge of the German language will be essential to good progress in the prosecution of the work. Minor subjects in this department will be arranged so as to help as much as is possible the major subjects selected in the other departments.

Equipment and Accommodations.

The Chemical department occupies the whole of the four floors of the building known as Chemical Hall. The building is "T" shaped with a front 70 feet by 40 feet and a wing 60 feet by 32 feet. The space is divided into twenty-seven rooms, ten of which are laboratories, the remainder being lecture, office, balance, and store rooms.

The laboratories contain working tables which by a system of lockers can accommodate six hundred students. The assaying laboratory is well supplied with tables, furnaces and other apparatus for fire assaying. The laboratory for the course in blow piping is fitted with air blast and all of the usual conveniences for such laboratories.
The department is well supplied with accurate weights and balances for the courses involving quantitative analysis.

The department is amply equipped with apparatus and chemicals for all of the work outlined in the courses of study offered.

Persons desiring to prepare themselves to become teachers of chemistry, analytical chemists, or those seeking a preparation for the study of medicine will find here good facilities for study. The expenses are only sufficient to cover the actual cost of the material used in the prosecution of the work.

**AGRICULTURAL CHEMISTRY.**

A. A. BENNETT, PROFESSOR.

W. F. COOVER, ASSISTANT PROFESSOR.

The aim of the work in Agricultural Chemistry is twofold; namely, to give the student a fundamental knowledge of chemistry, and then to apply this knowledge to the chemical problems of agriculture.

A sufficient amount of time during the first year and a half of study is applied to the acquiring of chemical principles and relations, yet at the same time the application of these facts is considered and constitutes a portion of the work. In other words the study of the science of chemistry accompanies its application to agricultural questions. The later work of the courses is principally devoted to Applied Chemistry.

The courses of study open to the undergraduate students are briefly described as follows:

**Course XXI.**—Elementary Experimental Chemistry.—This is the introductory work for the students in the agricultural courses and is intended to give knowledge of matter by actual handling and experience with it. The recitations are upon the laboratory work for the purpose of obtaining a first-hand knowledge of chemical changes. The student learns the necessity for taking notes of useful data, and how to interpret these facts and apply them to common chemical changes that are going on in nature. This course includes a study of the so-called non-metallic elements that are present in the air and soils, etc. There are three recitations and two afternoons of laboratory practice per week. First Semester, Sophomore year.

**Course XXIII.**—This course is a continuation of Course XXI, dealing with the metallic elements and their relations to those
studied in the preceding term. In this course the student becomes acquainted with the basic elements in the soil and their relations to non-metallic compounds, i.e., the acids and their place in the formation of salts. He learns how to separate and recognize these elements, their compounds, preparatory to determining them quantitatively. Three recitations and two afternoons of laboratory work are required each week. Second Semester, Sophomore year.

Course XXV.—Organic Chemistry.—This course follows regularly Courses XXI. and XXIII. and deals with substances produced by animal and plant life. The laboratory study brings the student in touch with the properties and methods of preparing organic food material. The sugars, starches and proteids, the simpler food material will be studied and at the same time the fundamentals of organic chemistry will be required. The work is divided into three recitations and one laboratory period per week, during the First Semester, Junior year.

Course XXVI.—Chemistry Applied to Agriculture.—This work will be introduced in the laboratory study by quantitative analysis of inorganic substances followed by analyses of soils, fertilizers and other inorganic substances related to agricultural processes. The recitation work, two hours per week, will follow the laboratory practice and be accompanied by text-book and lecture study.

Course XXVII.—Chemistry Applied to Agriculture.—This course will consider in an elementary manner the organic phase of Agricultural Chemistry and will deal with the chemical changes in foods during digestion and assimilation, and the changes that occur in the plant and animal body. Some time will be devoted to dairy products and especially to the methods of analyzing such substances for adulteration. Laboratory practice will occupy two afternoons per week.

Course XXXIV.—This is a continuation of Course XXVII. It is expected that the student electing this work will take up some special line of investigation as a result of the work done in the courses that have preceded it. The requisite courses are XXI, XXIII, XXV, XXVI, XXVII. For example, the student may desire to investigate somewhat fully the kind and character of organic matter in fertile soils; the effect of the composition of food on the composition of milk, as a whole or as to any of its constituents; changes in the composition of cheese during ripen-
This course is intended to take the student into the subject as far as can be profitably done by the undergraduate.

The time devoted to the subject is not less than three hours nor more than five hours per week in the Second Semester of the Senior year. The work is largely done in the laboratory but is supplemented by consulting authorities and conferences with the instructor.

Course XXVIII.—Dairy Chemistry.—Lectures and laboratory practice. This course is for students in the one year course in dairying, and will be arranged to fit the needs and the preparation of such students, but it will be an elementary character throughout. First Semester.

Course XXIX.—Continuation of Course XXVIII. Second Semester.

Graduate Work in Agricultural Chemistry.

Advanced work in Agricultural Chemistry leading to the Master's degree in Scientific Agriculture may be selected either as a major or minor study. This work may be taken in the Chemical department as a continuation of the work begun as an undergraduate of this or any other college of equal rank, or the student may elect to do this work with the chemical section of the Experiment Station, thus coming in touch with the research work and investigations being carried on there. The following courses of graduate work are offered:

Course I.—Chemistry of Soils.—This course embraces a study in Soil Chemistry and its relation to plant life, including the chemical composition, its relation to fertility, the determination of available plant food, fertilizers and other substances which are effective in the production of crops, also the study of rain and drainage waters, the loss of plant food due to improper drainage and other conditions.

Course II.—Chemistry of Dairying.—This work will cover a general survey of the field of chemistry applied to dairy problems such as the composition and chemical changes of butter, milk and cheese, and also other oils and fats used as food products and for adulteration.

Course III.—Chemistry of Feeds.—This course includes a careful study of the chemistry of plants and field crops, such as the chemical composition of corn, wheat and oats, methods of modifying and improving the chemical composition by selection.
and plant breeding, chemical study of growing plants during the various stages of development, etc., the effects of various elements in the soil on the composition and quality and the yield or productiveness of the grain and forage crops. The study of the chemical composition and nutrients of the various refuse and by-products used for stock feeding.

Course IV.—Chemistry of Horticulture.—This course includes a careful study of the chemical composition of fruits, including the influence of various elements present in the soil on the composition, quality and productiveness of the orchard, vineyard or garden; also the influence of climatic conditions upon the composition and quality of fruits, and the influence of selection and breeding.

DEPARTMENT OF BOTANY.

LOUIS HERMANN PAMMEL, PROFESSOR.

R. E. BUCHANAN, ESTELLE D. FOGEL, H. S. FAWCETT, CHARLOTTE M. KING, HARRIETTE KELLOGG.

The Department of Botany has temporary quarters on the first floor of Margaret Hall and in part of the annex. The botanical laboratory has an east and south exposure. The room is divided up into sections permitting instruction in Botany I. and II as well as the advanced work. For the purpose we have ten research tables, five large laboratory tables and ten tables for the students in Botany I. and II. The lecture room is in the west end of the room and has a seating capacity for sixty students. There are charts for the purpose of illustration, and mounted specimens of weeds, diseases of plants, etc. There are twenty-five compound microscopes of the following makes: Bausch & Lomb, Zeiss, Leitz & Beck, microtomes, various accessories, and reagents for the purpose of doing cytological work. The bacteriological laboratory has a general equipment consisting of the various forms of apparatus. Arnold's Steam Sterilizer, dry oven for dry sterilization, platinum needles, plate holders for plates, Petri dishes, leveling tripod, incubator, thermo-regulators, etc.

Beginning with the fall of 1905 the Department of Botany will be housed in the new central building. Laboratories will be fitted up here with the most modern equipment, and splendid facilities offered for the pursuit of botanical work along every line.
The Department of Botany offers excellent facilities, not only to the under-graduate students, but to the graduate students along the lines of botany.

HERBARIUM.

The various collections of the Department of Botany now amount to about seventy thousand specimens. The herbarium is very full in plants from Iowa and the Mississippi valley, and contains in addition a large number of plants from the eastern states, California and Europe. The collection may be divided into several parts; the General Phanerogamic Herbarium which was started by Dr. C. E. Bessey and continued by Dr. Halsted; the Parry collection and the Cryptogamic Herbarium; the Holway Herbarium, except the Uredineae, the Fink Herbarium except lichens, and the Andrews' collection.

Grass Collection.—The Herbarium contains an excellent collection of grasses, having material from every part of the state, besides a very representative collection from various parts of the United States and Europe. This collection is invaluable to the students of Agrostology.

The Parry Collection.—This contains 22,000 specimens. It was purchased at a considerable expense from Mrs. Parry and contains hundreds of new species found by Dr. Parry on his collecting trips, and is especially rich in the plants of California, Mexico and the Rocky Mountain region. Many of these specimens were collected before the advent of the railroad. Many of the specimens in this collection are type specimens and hence are invaluable.

Dendrological Collection.—The College Herbarium has a good representative collection for dendrological study. Many of the trees are likewise represented by photographs of the living trees. Of these photographs there are several thousand from Iowa, the Mississippi valley and the Rocky Mountains.

Economic Collection.—Aside from the economic trees the Department of Botany has an excellent collection of the cultivated plants of the United States and Europe. There is a collection of the weedy plants of Iowa.

Seed Collection.—The seed collection contains the sets distributed by the United States Department of Agriculture, several German sets of weed seeds and a large collection of the seeds of
the native plants, wild and cultivated. The collection is of use in studying the commercial seeds and their adulterations.

The Cryptogamic Collection.—This contains a large number of very valuable exsiccati. It contains the Ravenel Fungi Americani Exsiccati, Ellis' North American Fungi, the Von Thuemen Mycotheca Universalis, and numerous smaller collections.

Living Material.—Living material is obtained from the plants grown by the Departments of Agriculture and Horticulture, the grounds of the latter being very rich in ligneous plants from Europe, Asia and America.

Courses of Instruction.

Course I.—Elementary Botany.—This course embraces a study of the morphology of flowering plants, the terms used in descriptive botany and the determination of simple flowering plants. Leavitt's Lessons and Gray's Manual are used as texts, accompanied by lectures and specimens designed to illustrate the subject. The lecture work is supplemented by a thorough laboratory course covering the chief points in elementary botany such as the germination of seed, the different plant members, root and shoot, and the lateral appendages, the leaves, the flower, the fruit and the seed. A brief outline of the vegetable kingdom beginning with the lower forms of plant life, bacteria, algae, mosses and ferns and the minute structure of plants supplemented with the study of the more common flowering plants found in the vicinity of Ames. A collection of fifty specimens of flowering plants is required. Excursions to some convenient point for the purpose of studying the native flora are obligatory. No student will be given credit for this work who has not given evidence of a good laboratory course of three hours a week for twenty weeks. Two hours, one lecture and one laboratory, Second Semester, Academic. Required of all students in the Division of Agriculture and the Division of Science. Dr. Pammel and Miss Fogel.

Course II.—Ecology.—A course in which the relations of plants to their environment are considered, the relations between insects and flowers, pollination by the wind and other agencies. Dissemination of plants by various agencies and the distribution of plants over the earth's surface and factors that influence distribution; plant communities. Excursions are an essential feature of this course. The laboratory course covers the work taken up in the lecture room. The more important fall plants are
studied with reference to their pollination. Similar work is done on the dissemination of plants, and also a study of plants with reference to their environments. Two hours. One lecture and one laboratory. Required, First Semester, Freshman year, of all students in the Division of Science, and First Semester, Sophomore year, in Courses in Horticulture, Dairying, Animal Husbandry, and Science and Agriculture. Prerequisite; Botany I. Dr. Pammel and Miss Fogel.

Course III.—Histology.—This course is designed as an elementary one. Since students are unfamiliar with the use of the microscope they are taught the use of the same, beginning with very simple objects, such as an air bubble and cotton fibre, then passing on to a study of the cell with its contents, such as starch, protoplasm, nucleus, and crystals. The division of cells and nucleus are studied in the light of modern investigations. The laboratory work supplements that of the class room; the different organs and parts of a plant are taken up, not merely as histological structures but considered from a physiological standpoint. As an illustration the cuticle, cuticularized and cellulose layers of the leaf of the agave are considered in relation of their significance in preventing transpiration. The absorbing, assimilating, aerating and conducting systems are considered in the same way. Four hours; three lectures and one laboratory. Required, Second Semester, Freshman year, of students in the Division of Science; Second Semester, Sophomore year, in the courses of Agronomy, Horticulture, and Science and Agriculture. Elective in the courses in Dairying and Animal Husbandry. Prerequisite; Botany I. Dr. Pammel and Mr. Fawcett.

Course IV.—Cryptogamic Botany.—A systematic study of all the plants below the flowering plants. Special attention is given to smuts, rusts, molds and mildews from their significance in agriculture. The morphology and life history of the different groups of cryptogams is considered. Frequent excursions are obligatory. Five (Science) or four (Agriculture) hours; three lectures, one or two laboratories. Elective First Semester, Sophomore year in Course in Science, and First Semester, Junior year in G. and D. S., Horticulture, Animal Husbandry, and Science and Agriculture, and First Semester, Senior year in Domestic Science. Prerequisite: Botany I. Dr. Pammel and Mr. Fawcett.

Course V.—Vegetable Pathology.—In this course plant diseases of the farm, garden and horticultural crops are taken up.
Lectures on the more injurious of the fungous diseases of cultivated plants are given in a more extended way than is possible in the Sophomore year. The theories of immunity and prevention of diseases, rotation of crops and fungicides are considered. In this course the diseases are treated from the standpoint of the host plant. Three or five hours, First Semester, Senior year. Required in courses in Horticulture, and Science and Agriculture, and elective in courses in Animal Husbandry and Science. Prerequisites: Botany I and IV. Dr. Pammel.

Course VI.—Advanced Cryptogamic Botany.—This course embraces a study of the more important orders of cryptogams, especially with reference to the flora of Iowa. Three hours, one lecture and two laboratories. Elective First Semester, Junior year, courses in Science and Dairying, and First Semester, Senior year, in courses in Horticulture, and Science and Agriculture. Prerequisites: Botany I. and IV. Dr. Pammel.

Course VII.—Bacteriology.—The laboratory work consists in studying some of the common germs and the general bacteriological technique. In the lectures special attention is paid to the matter of sanitation and means of preventing contagious diseases. The work is taken up in two divisions; first, the making of media, sterilization, biology and classification of bacteria, and general considerations as to the relation of bacteria to human health and hygiene; second, the diseases of the lower animals. Texts, Abbott’s Bacteriology and Muir and Ritchie’s Manual. Two hours; one lecture and one laboratory. Required First Semester, Sophomore year, in Veterinary Course, First Semester, Junior year, in course in Domestic Science; Second Semester, Junior year, in courses in Agronomy, Horticulture, Dairying, and Science and Agriculture, and elective First Semester, Junior year, G. & D. S., and Second Semester, Junior year, Animal Husbandry and Science. Dr. Pammel and Mr. Buchanan.

Course VIII.—Advanced Bacteriology.—This is an elective in the Senior year in which special attention is given to a study of water and micro-organisms. The work is in advance of that done in the Junior year. It is intended especially for persons who intend to enter a professional life either along the lines of sanitary engineering or other professions. Sedgwick’s “Principles of Sanitary Science and the Public Health,” with special reference to the causation of diseases, Muir and Ritchie’s “Manual of Bacteriology” are used. Three hours, one lecture and two
laboratories. Elective Second Semester, Senior year, in all courses in Divisions of Agriculture and Science. Prerequisite; Botany VII. Dr. Pammel and Mr. Buchanan.

Course IX.—Structural Botany.—This course begins in the First Semester of the Freshman year. The work consists of recitations and lectures. The student is expected to become familiar with the morphology of flowering plants and the terms used in descriptive botany. In the study of identification and selection of drugs it is necessary to have a thorough botanical knowledge of general structural botany as well as vegetable histology. Vegetable drugs not only consist of the entire plant but frequently of parts only. In this course the general structure of the plant from the root to the reproductive organs, is taken up and considered. In the laboratory the student takes up the histology of plants especially from the standpoint of pharmacognosy, with a brief survey of the more important plants from a systematic standpoint. Three hours, two recitations and one laboratory. Required First Semester, Freshman year, Veterinary. Dr. Pammel and Miss Fogel.

Course X.—Econom Botany.—In this course special attention is given to a microscopic study of foods. The principal cereals and food plants are studied with reference to their general and minute structure as it gives the student a general idea of the nature of vegetable foods as well as the reserve material of plants and the systematic position of our economic plants, where they originated and where chiefly cultivated. Two hours, one lecture and one laboratory. Required First Semester, Junior year, Horticulture. Elective First Semester, Junior year, in Dairying, Animal Husbandry, Science and Agriculture and Science. and First Semester, Senior year, G. & D. S., and Domestic Science. Prerequisite; Botany I. Dr. Pammel.

Course XI.—Vegetable Physiology.—A course of lectures with demonstrations on the functions of plants, nutrition, growth, movements and reproduction of higher plants. Two or five hours, two lectures and three laboratories. Required Second Semester, Senior year, Horticulture, elective Second Semester, Senior year, Animal Husbandry, Science and Agriculture, and Science. Prerequisite; Botany I. Dr. Pammel.

Course XII.—Vegetable Cytology and Micro-Technique.—A study of the cell and its divisions in lower cryptogams and higher plants. The use of reagents and staining, methods of sectioning

**Course XIII.—Agrostology.**—This course is intended to give the student a general idea of some of the more important grasses, not only with reference to their botanical position, but also with reference to their economic uses, especially meadow and pasture grasses; the cereal food products, grasses in medicine, as soil binders and for lawn making. Two hours, one lecture and one laboratory, elective First Semester, Senior year; in Courses in Horticulture, Dairying, Animal Husbandry, Science and Agriculture, and Science. Prerequisite; Botany I and XV. Dr. Pammel.

**Course XIV.—Seeds and Seed Testing.**—The principal agricultural weed seeds and their detection in commercial seeds, as well as the structural characters of the more important commercial seeds is given. The germinative energy of various seeds and such other features as are important in connection with seed testing are considered. Two hours, first semester, Senior year. Prerequisite; Botany I and III. Dr. Pammel.

**Course XV.—General Systematic Phanerogama.**—This course consists of lectures and laboratory work on the more important orders of flowering plants, especially with reference to the flora of North America. Definite systems of classification, Prelinnæan, Linnæan, and Post-Linnæan. In the laboratory each student is assigned some special group of plants to work up. The synonymy of the species of plants studied by him are looked up. Frequent excursions are obligatory. Three or five hours, two lectures and one or three laboratories. Elective Second Semester, Sophomore year, Horticulture, and Second Semester, Junior year, in Dairying, Animal Husbandry, and Science, and Second Semester, Senior year, G. & D. S., and Domestic Science. Prerequisite; Botany I. Dr. Pammel.

**Course XVI.—Poisonous Plants.**—The veterinarian is frequently called on to investigate poisoning. He should therefore be familiar with the plants responsible for poisoning live stock. In this course the subject is treated from the historical standpoint, brief reference to the history of toxicology, auto-intoxication, poisoning from ptomaines, toxins and agents responsible
for such poisoning. Poisoning by fungi like toadstools, and ergot, dwelling on life history of these fungi and the poisons they produce. The rusts and smuts as possible causes of disease. The higher plants are then taken up in a systematic order, calling attention to the poisonous plants in the various orders and means for recognizing these plants. Two hours, one lecture and one laboratory. Required Second Semester, Freshman year. Veterinary. Prerequisite; Botany IX. Dr. Pammel and Miss Fogel.

Course XVII.—Advanced Cryptogamic Botany — Ferns.—A course is offered in advanced Cryptogamic Botany in which only the vascular cryptogams are taken up. In this course particular attention will be given to the study of the chief types of ferns in this state and in the United States and the general distribution of ferns and their development. The ferns are frequently cultivated and they are objects of interest to every lover of the study of the science of Botany. Three hours, one lecture and two laboratories. Elective First Semester, Junior G. & D. S., and First Semester, Senior, Science and Domestic Science. Prerequisite; Botany IV. Dr. Pammel.

Course XVIII.—Botanical Seminar.—There has been organized at the College in connection with botanical work, a Botanical Seminar. Here reviews of recent literature and topics of general interest are considered, each member of the Seminar being assigned a topic to report upon. The subjects are then discussed by the members. There are also special lectures upon different topics related to botany. Seminar meets once a week during the school year. One hour. Elective First or Second Semester, Science, G. & D. S., and Domestic Science.

Course XIX.—Evolution of Plants.—A course of lectures dealing with evolution as applied to plants, theories of evolution, heredity, origin of plant life, present and past distribution. One hour, Senior year. Elective First Semester, Senior year, Horticulture. Elective First Semester, Senior year, Horticulture, Dairying, Animal Husbandry, Science and Agriculture, Science, G. & D. S., and Domestic Science. Prerequisite; Botany I, II and III. Dr. 'Pammel.

Course XX.—Botanical Micro-Chemistry.—In this work the student becomes familiar with the microscope and its parts and the structure of cells, and the substances contained therein, special attention being given to micro-chemistry. This work covers
essentially the work given in Zimmermann's Botanical Micro-
Technique.

Course XXI.—Fermentation or Zymotechnique.—In this
course special attention is given to the organisms of fermente-
tion, their morphology and biology. Under this head is taken
up a discussion of the subjects of the making of vinegar, lactic
acid fermentation, Kephir organisms, the making of bread, slimy
fermentations and butyric acid fermentations, in short, the sub-
jects of fermentation such as are connected with the technical
problems of the household and the factory. Two hours, one lec-
ture and one laboratory. Required Second Semester, Junior year.
Domestic Science, and elective Second Semester, Junior year, G.
& D. S., Mr. Buchanan.

POST GRADUATE COURSES.

Course XXII.—Systematic Botany.—The Department offers
unusual facilities for doing systematic work, the collection being
large and well supplied with type material in the way of Phanero-
gams from the Rocky Mountains and Pacific coast. The student
taking this course should be sufficiently familiar with the general
relations of the flowering plants to be able to take up special or-
ders. The student should be familiar with the modern systems of
classification, especially those of Engler and Prantl and Bentham
and Hooker. Courses are also offered in systematic work among
the lower plants, the College having an unusually good collection
in certain orders, especially the economic, such as Uredineæ and
Ustilagineæ. Major or minor work.

Course XXIII.—Advanced Morphology.—In this course the
comparative anatomy of phanerogams as well as cryptogams is
taken up, the student consulting such works as Gray, Engler,
Eichler and DeBary. Minor work.

Course XXIV.—Advanced Economic Botany.—The course in
Economic Botany is offered as a post-graduate minor, and the
student will take up such topics as the adulteration of foods,
seeds, the germination of plants, the vitality of seeds, in fact any
subject especially pertaining to agriculture, horticulture and for-
estry. Minor work.

Course XXV.—Advanced Mycology.—The subject of Mycol-
ogy is offered in post-graduate work, the student taking up the
study of fungous diseases of cultivated and wild plants. Also
work on the life history of fungi. Major or minor work.
Course XXVI.—Advanced Bacteriology.—The student is expected to take up such subjects as sewage pollution of waters, the examination of potable waters, the diseases of plants or fermentations. This course will not be given unless the prerequisite courses in Bacteriology have been taken. Minor or major work.

Course XXVII.—Advanced Cytology.—An advanced post graduate course in Cytology is offered. The student takes up work in advance of that given in Course XII., especial attention being given to developmental studies of higher plants and some of the cryptogams. This study can be taken as a major only in post-graduate work.

DEPARTMENT OF ZOOLOGY.

HENRY E. SUMMERS, PROFESSOR.
JOSEPH E. GUTHRIE, ASSISTANT PROFESSOR.
C. E. BAERTHOLOMEW, ASSISTANT.

Equipment.—The laboratory is well supplied with the usual apparatus, including compound and dissecting microscopes, camera-lucidas, microtomes, incubators, paraffin baths, aquaria, etc. In the way of illustrative material, in addition to the general museum and the entomological collections described below, there is a large series of charts, a set of wax embryological models, lantern slides, mounted microscopic slides, disarticulated and articulated skeletons, and alcoholic preparations.

The general museum consists of specimens selected with great care to show the variation of structure found in the various branches, classes and minor divisions of the animal kingdom. Porifera, coelenterata, vermes, echnodermata, arthropoda, mollusca and veterbrata are all amply represented by actual specimens and Blaschka glass models. It is especially rich, however, in representative birds and mammals. In addition to a good series of skeletons, there are mounted skins of over four hundred, and eggs of three hundred species of birds and over ninety mounted skins of mammals, the latter including such rare or peculiar forms as the echidna, ornithorhynchus, great kangaroo, kaola, wombat, sloth, great ant-eater, armadillo, manatee, peccary, camel, antelope, bison, Rocky Mountain goat and sheep, elk, tapir, porcupine, beaver, fur seal, hedgehog, lemur and monkey.

The collection of insects is very large, embracing about sixty thousand mounted specimens, including a large number of types.
It includes the Van Duzee collection of Hemiptera, from Buffalo, New York, including the types of the numerous species described by him. There is also a large series of microscopic forms on slides, and a large amount of material illustrating life histories, especially of injurious insects.

The work in Zoology is designed, first, to give a knowledge of those biological laws, together with the data necessary for their thorough comprehension, which is today regarded as an essential part of a liberal education; secondly, to furnish the requisite theoretical basis for an intelligent study of certain practical branches of stock breeding, dairying, human and veterinary medicine, and economic entomology, which depend directly upon zoological principles; and, thirdly, to impart a knowledge of the facts and methods of investigation in the last of these practical subjects, namely, economic entomology.

Course I.—Introductory Entomology.—This course is designed as an introduction to all the other work in the department. Insects are used as convenient forms in giving a training in accurate observation, and in the methods of systematic and field zoology. Some training is also obtained in the use of the microscope. The work begins with a thorough study of the structure of the grasshopper and beetle, followed by the collection of insects and their classification. The life histories of certain selected forms are also traced. The lectures deal chiefly with those facts in the physiology and life history of insects that will best serve as a foundation for a knowledge of the general laws of animal life. One lecture and one laboratory exercise per week. Second Semester, Freshman year.

Course II.—Vertebrate Zoology.—A somewhat thorough study of the anatomy of the shark serves as an introduction to the methods of gross dissection. A comparison of the perch with the shark gives an opportunity to impart some knowledge of homology. Following this a similar comparison is made of the anatomy of the necturus and the frog, including a small amount of elementary histology, which gives some practice in the use of the microscope. An outline of the development of the frog lays a foundation for the more extended study of vertebrate embryology in Course V. This is followed by a briefer study of other types, as amphioxus, lamprey, fish, turtle, bird and mammal. Throughout this course the relation of structure to function is kept constantly in view, the end being to give a conception of
each animal as a living being. Three lectures and two laboratory exercises per week in the Science courses and three lectures and one laboratory exercise per week in the Agricultural and Veterinary courses. First Semester, Sophomore year. Prerequisite; Zoology I.

Course III.—Invertebrate Zoology.—A continuation of the preceding course, devoted to the morphology, physiology, and especially the ecology of selected types of the more important groups of invertebrates, including the amöeba, hydra, earth worm, crawfish, and mussel. Especial attention is devoted to the Protozoa, a very full discussion being given in the lectures of the fundamental forms in which animal functions are exhibited in this group. Questions of phylogeny are quite fully discussed, thus laying a foundation for Course VI. Three lectures and two laboratory exercises per week in the Science courses and three lectures and one laboratory exercise per week in the Agricultural course. Second Semester, Sophomore year. Prerequisite; Zoology II.

Course IV.—Applied Entomology.—A study of the structure, habits, life-histories and classification of insects with especial reference to economic species; designed to give to Agricultural students, especially those interested in horticulture, a knowledge of the methods of combating injurious species. The course also serves as a foundation for independent investigation in Applied Entomology. Two lectures and three laboratory exercises per week. First Semester, Junior year. Prerequisite; Zoology I.

Course V.—Embryology.—The laboratory work is devoted to a study of the development of the frog and of the chick from preparations made largely by the student, supplemented by others furnished for comparison by the instructor. The methods of making reconstructions from sereal sections may be learned. In the lectures the general principles of development are discussed, beginning with the structure of the germ cells, maturation, fertilization, and tracing the modifications of cleavage and gastrulation found in the different classes of vertebrates. Two lectures and one to three laboratory exercises per week. First Semester, Junior year. Prerequisite; Zoology II.

Course VI.—Evolution of Animals.—A discussion of the problems and factors of organic evolution, heredity, variation, origin and distribution of life, etc. One lecture per week. Second Semester, Senior year. Prerequisites; Zoology II. and III.
Course VII.—Comparative Anatomy.—Advanced work on the comparative anatomy of the chief systems of organs of vertebrates, designed especially to give an understanding of mammalian morphology as derived from that of the lower vertebrates. Second Semester, Junior year. Three lectures and two laboratory periods per week. Prerequisites; Zoology II, III and V.

Course VIII.—Animal Parasites.—A course of lectures upon the more injurious parasites of domestic animals. Intended primarily for students of Veterinary Medicine. Second Semester, Junior year. Two lectures per week. Prerequisite; Zoology II.

Course IX.—Advanced Entomology.—Special individual laboratory work in continuation of Course IV., intended for those who expect to engage in the branches of agriculture, as for example horticulture, in which an especially thorough knowledge of insects is necessary, and for those who expect to pursue entomology as a profession. The exact nature of the work in each case will depend upon the ability and special object of the student. Three to five laboratory exercises per week. First or Second Semester, Junior or Senior year. Prerequisites; Zoology IV.

Course X.—Morphology.—Special individual work in continuation of Courses II., III., V. and VII., designed especially for those who expect to become teachers and investigators in zoology and who are writing their thesis in this department. The work will be given a leaning toward general vertebrate or invertebrate morphology, embryology or taxonomy depending upon the inclination of the student. Three to five hours per week, mainly laboratory. First or Second Semester, Senior year. Prerequisite; Zoology V. and VII.

Course XI.—Neurology.—A course in the comparative morphology of the vertebrate nervous system, with especial attention to the physiological anatomy of the human brain. Two lectures and one to three laboratory exercises per week. First Semester, Senior year. Prerequisite; Zoology II, III and V.

Course XII.—Human Physiology.—A course of lectures, with demonstrations and laboratory work, on the chief functions of the human body, and on the laws of health. The physiology and hygiene proper are preceded by a study of mammalian anatomy, including histology. Three lectures and two laboratory exercises per week. Prerequisite; Zoology II and III and Chemistry XXII, XXIV and IX or II, V and IX.
Course XIII.—Human Physiology.—A continuation of Course XII. Three lectures and two laboratory exercises per week. Pre-requisite; Zoology XII.

In addition to the above, special courses will be laid out for students intending to write a thesis in zoology, and also for graduate students in continuation of the lines of work that they pursued as under-graduates. Special facilities will be offered such students for research work. No one will be permitted to write a thesis in this department who has not completed by the end of the Junior year, work in the line in which he wishes to carry on his thesis investigation at least up to and including either Course VII or Courses III and IX, or Courses XII and XIII.

DEPARTMENT OF GEOLOGY.

SAMUEL WALKER BEYER. PROFESSOR.
I. A. WILLIAMS, ASSISTANT PROFESSOR.

The work of the department is carried on by means of recitations, lectures, conferences, laboratory work and numerous field excursions. The student is not only afforded an opportunity to gain some familiarity with the principles and theories discussed in the leading text-books, but is encouraged to test the theories and verify the principles discussed in the class room. Field excursions, with carefully written reports thereon are required in all of the courses in Geology.

Equipment.

The Department of Geology shares quarters with the Department of Mining Engineering in Engineering Hall and it is unnecessary to repeat the description of rooms given on a preceding page. The working equipment consists of museum materials, field and laboratory instruments.

The museum contains carefully selected series of fossils, minerals, rock and ores; all available for study purposes. Among the more important collections in Geology and Mineralogy are: The educational series of rocks, collected by the United States Geological Survey; the Smithsonian collection of rocks and minerals; the Rohn, Hodson and Young collections of rocks and ores from the Lake Superior region; the English mineral collection, containing 200 specimens and about 150 species; the Baltimore series of more than 200 specimens of rocks and minerals typical
of the petrographic province of Baltimore; the Cushing collection from Clinton County, New York; and a considerable amount of material to illustrate the physical features of rocks and minerals.

In paleontology, the Calvin collection of paleozoic fossils; a large collection of Coastal Plain fossils, principally from the Cre­taceous of New Jersey, the Eocene of Alabama and Maryland, and the Miocene of Maryland and Virginia; the Permo-Carboniferous series from Kansas and Russia; and the coal plants of Iowa, Illinois and Pennsylvania are the most important.

In Applied Geology the department possesses comprehensive series of lead and zinc ores with their characteristic gangue minerals from Joplin, Missouri, and from the Iowa-Wisconsin area; copper and iron from the Lake Superior region and from the celebrated localities in the Ural mountains; copper, manganese and silver from Butte, Montana; lead, silver and gold from Colorado, Nevada and California.

Aside from the collections enumerated, Dr. H. Foster Bain, formerly of the Iowa Geological Survey, has kindly loaned to the department his extensive private collection of rocks and minerals; and the Le Grand Quarry Company generously donated a splendid series of building blocks from their quarries which exhibit the various styles of stone dressing.

The laboratory is supplied with four Bausch and Lomb petro­graphical microscopes; one Fuess, medium model, latest pattern petrographical microscope. All of the instruments are well supplied with accessories; one Ward mineral dresser, one hand goniometer; one set Preston's celluloid crystal models; one set Krantz selected wood models exhibiting complicated forms; the Krantz collection of 120 thin sections of the common rock-form­ing minerals selected and arranged according to Rosenbusch, the collection selected to show the various representative characters of minerals and rocks; one section slicing machine, and complete apparatus for rock separations by heavy solutions; and is supplied with apparatus for doing all kinds of photographic work. A considerable number of instruments for reconnaissance and field work in Geology are owned by the department.

The lecture equipment comprises a Hitchcock's geological may of the United States; one set of Klepert's physical maps; numerous maps and charts of the United States Geological Survey and of the Mississippi River Commission and an elaborate series of lantern slides and photographs.
Courses in Geology and Mineralogy.

Eight courses are offered in Geology and Mineralogy. Physiography is required in the Divisions of Science and Agriculture; Courses II, IV to VII, inclusive, are required of students in Civil Mining Engineering; Course III is elective to students in Civil Engineering; Course IX is specially adapted to students in the Division of Agriculture, while Courses II to VIII, inclusive, are elective to all students in the Divisions of Agriculture and Science.

Course I.—Physiography.—First Semester, Freshman year, three hours per week; serves as an introduction to the Science of Geology. The first half of the Semester is devoted to the study of the agents which have to do with modifying the earth's crust, while the resultant earth features receive careful consideration during the second half of the Semester. Davis' or Tarr's Elements of Physical Geography is the text-book used. Required in the Divisions of Science, in the courses of Agronomy and Horticulture of the Division of Agriculture and two years' courses in Mining Engineering and Clay Working.

Course II.—General Geology.—Five hours per week first half year. This course embraces a discussion of the principles which form the ground work of the science. The first ten weeks are devoted to dynamic and structural geology and the last six to stratigraphic and historical geology. The student is required to make several excursions to points of geological interest to verify the more salient facts discussed in the class room.

Prerequisites.—The elementary courses in physics, chemistry and zoology. Required of students in Mining Engineering; elective in the divisions of Agriculture and Science.

Course III.—Engineering Geology.—The Semester is devoted to a discussion of the fundamental principles of dynamical and structural geology, and a study of the common minerals and rocks, especially those important in structural materials. The course is given in the Second Semester and counts four hours per week. Prerequisites the same as for Course II.

Course IV.—Advanced Geology.—Five hours per week, Second Semester, Senior year. The nature, mode of occurrence and origin of the minerals and rocks which constitute the earth's crust are considered in some detail during the first half of the Semester, while rock alteration as involved in metamorphism
and weathering receives special attention during the second half. Excursions are continued as in II, and students are encouraged to familiarize themselves with the methods employed in doing research work and to make independent observations.

**Prerequisites.**—Course II. Open to students in the divisions of Agriculture and Science.

**Course V.**—Economic Geology.—Three hours per week, Second Semester, Senior year. This course embraces a discussion of the general features and formation of ore bodies, followed by a description of the distribution and the occurrence of coal and the more important hydro-carbons, building stones, potable waters, salines and other products of economic importance.

**Prerequisites.**—Courses II, VI and VII. Required of students in Mining Engineering.

**Course VI.**—Mineralogy.—Two hours class room and one hour laboratory, second half, Junior year. This course is intended to give the student a clear idea of the morphological and physical properties of crystalline substances.

**Prerequisites.**—Elementary courses in physics, chemistry and mathematics. Required in the Mining Engineering course and optional in the Division of Science.

**Course VII.**—Descriptive and Determinative Mineralogy.—Two hours' class room and one hour laboratory in the First Semester, Senior year. This semester's work is devoted to the study of the more important mineral species, their properties, uses, distribution and methods of determination. Required in the Mining Engineering course and elective in the Division of Science.

**Course VIII.**—Petrography.—Two hours per week during the Second Semester, Senior year, and is essentially a laboratory course. It embraces a short course in the microscopic study of rocks.

**Prerequisites.**—Courses VI and VII. Required of students in the Mining Engineering course.

**Course IX.**—Agricultural Geology.—Open to students in the Division of Agriculture, Second Semester, Sophomore year, and counts three hours. The origin, mineralogy and physiography of soils with attendant problems are treated as fully as the time will permit.
DEPARTMENT OF ECONOMIC SCIENCE.

Economic Science has become a well recognized part of almost all scientific and technical education, because it has made itself useful in investigating and interpreting the material phenomena and facts of every-day life. Economic theory is taught as the generalized truth of economic life; inductive methods are given first place, deduction being used with caution. It is the plan and expectation to make the department much more vitally useful to the technical departments of the school in the near future.

Course I.—Outlines of Economics.—This course is begun by a brief study of Industrial History using Cheyney's "Industrial History of England" as the text. The principles of economics are then presented with Seager's "Introduction to Economics" as the basis. In the spring term a sketch of the Industrial History of the U. S. is presented in lectures and class reports. Both semesters. Required of M. E. and E. E. students First Semester, Junior year, C. E. Second Semester, Junior year; elective for Agricultural, Domestic Science, General and Domestic Science, and Science students. Five hours.

Course II.—History of Political Economy.—Given as a lecture course, supplemented by class reports. Omitted in 1904-5. Elective for those who have had Course I. Two hours, First Semester.

Course III.—Economic Problems.—In this course Socialism is studied during the first half of the Semester, Ely's "Socialism and Social Reform," Ely's "French and German Socialism," Hilquit's "History of Socialism in the United States," etc., are used to acquaint the student with the spirit and growth of Socialism. In the second half of the semester attention is given to monopolies and trusts. Elective for those who have had Course I. First Semester, three hours.

Course IV.—Money and Banking.—Kinley's "Money," used as the text. Supplementary work by reading, reports, and lectures. Elective for those who have had Course I. Second Semester, two hours.

Course V.—Finance.—Adams's "Science of Finance," the text. Elective for those who have had Course I. Second Semester, three hours.

Course VI.—Industrial History of the U. S.—Lectures and
class reports. Elective for those who have had Course I. Second Semester, two hours.

**Course VII. — American Labor.** — There is no more vital question than the labor question and in this course an attempt is made to introduce the student to the problems and literature of the subject. Lectures and class reports. Elective for those who have had Course I. First Semester, two hours.

WHERE and WHAT is it.

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**DEPARTMENT OF DOMESTIC SCIENCE.**

GEORGETTA WITTER, PROFESSOR.

BUTH MORRISON AND FRANCES WILLIAMS, INSTRUCTORS.

FLORA PADOCK, LABORATORY ASSISTANT.

The widespread interest in Domestic Science springs largely from the increasing attention accorded to all social problems. The importance of the home as a social factor is paramount; and the application of science and of the scientific method to household management is coming to be regarded as a necessity. It is not surprising therefore that the study of the home, its function, its administration, its sanitary conditions, the preparation of foods, and a score of kindred topics should find place in the courses of instruction in colleges and universities. The study of Domestic Science is profitable not only because of its practical worth, but because of its educative value. Many sciences find direct application in the operations of housekeeping; it is consequently the aim of this department to present this home-study in such a way as to apply the knowledge gained in related and associated sciences. This study seeks at every point the health, convenience and comfort of the members of the household, and by its utility to add to the value of the well kept home.

Domestic Science Hall adjoins Margaret Hall and includes the general office, the sewing-room, fitting-room, bed-room, laboratory kitchen, dining-room, and store-rooms.

The methods of instruction embrace the lecture system, textbook study, laboratory practice, demonstration lessons, class discussions, presentation of topics on assigned subjects by individual members of the class, and expeditions for observation and criticism. By a judicious combining of theory and practice, science and art, the student gains a thorough understanding of
the underlying principles of Domestic Economy and at the same time acquires skill and deftness in execution. Upon completing a systematic course in this department a young woman is prepared to conduct her home successfully and with that ease which comes only through knowledge and experience.

The work offered in Domestic Economy does not constitute a special and separate course of study, but is one of the several lines included in the general College course for all women students and subject to the usual regulations concerning entrance requirements, classification, examinations, and class records.

Materials, tools and utensils for laboratory work are furnished by the department and for the use of these students in the sewing classes pay a fee of one dollar each term; those in cooking, three, four and five dollars.

Four hours each week are devoted to recitation and practice in each of the several subjects included in Domestic Economy, one of which subjects is offered each term of the four years.

DOMESTIC SCIENCE.

D. E. II.—Foods.—This course familiarizes the student with the processes of cooking and with the principles underlying the cooking of proteins, carbohydrates and fats. The various food stuffs are taken up in the order of their simplicity of preparation. The pupil prepares many nourishing and appetizing dishes, and is trained at the same time in the points of accuracy, order and economy and in the general care of the kitchen and its utensils.

The lectures in this Course deal with the various foods prepared in the laboratory, and cover the following general topics: Chemical composition, nutritive value, function in the body, digestibility and cost. In connection with this a study is made of the most wholesome and scientific method of preparing the food under discussion. First Semester, Junior year, two hours. Fee three dollars.

D. E. V.—A continuation of Course II. Second Semester, Junior year. Two hours. Fee four dollars.

D. E. VIII.—Laundry Work.—This course covers One Semester. The exposition of the scientific principles involved in the various processes is followed by actual work in the laundry. Soaps, washing fluids, bleaching powders, bluings and starches are discussed in their scientific and practical relations to laundry
work. Junior year, First Semester. One hour. Fee two dollars.


D. E. XXV.—Geography of Foods.—A study of the production, transportation, preparation, adulteration and consumption of foods, also their market value as compared with their food value. Junior year, First Semester. One hour.


D. E. XXIII.—Home Management.—This course includes instruction in the following subjects: Care of dining-room and pantry; care of cut glass, silver and cutlery; serving of breakfast, luncheon and dinner; buying of supplies, food as an economic factor, dietaries and the administration of the home. Junior year, Second Semester. One hour. Fee five dollars.

D. E. XX.—Advanced Cookery.—The application of heat to food materials. Food principles and the fundamental laws of cookery. The practical application of the chemistry of cookery. Experiments to determine the relative value of different methods of work, and the effect of varying proportions of materials. Senior year, Fall Semester. One hour. Fee five dollars.

D. E. XXI.—A Course in Demonstration Work.—Senior year, Second Semester. One hour. Fee five dollars.

D. E. IX.—Theory of Teaching Domestic Science.—A study of how Domestic Science should be presented to classes, planning of lessons and a study of the school kitchen. Senior year, First Semester. One hour. Fee one dollar.

D. E. X.—Practice Teaching.—Each girl will have the actual experience of teaching and applying knowledge gained in D. E. IX. Senior year, Second Semester. One hour. Fee one dollar.

D. E. XXIV.—Dietaries.—The nature, nutritive constituents
and relative values of foods. Composition of common food materials. Senior year, First Semester. One hour.

D. E. XXVII.—Household Accounts.—A practical course in single-entry bookkeeping, involving the use of day book, ledger, cash book and bill book. Students are required to make out bills and receipts, to use check-book and pass-books. This practical work is supplemented with lectures on business cutoms, notes, drafts, letters of credit, and banking. Senior year, First Semester. One hour.

D. E. XXX.—Seminar.—A study of the history of Domestic Science. The course as offered in our state and training schools, its value to the people of Iowa, and a study of the best way of presenting this work. Senior year, Second Semester. One hour.

D. E. XXVIII.—Chafing Dish Cookery.—Showing how our much abused chafing dish may become an invaluable utensil in every household. One hour. Offered to girls only. Senior year, Second Semester. Fee three dollars.

From January 2 to 14, 1906, there will be offered, to the women of Iowa a short course in Domestic Science.

The work will consist of a series of lectures on subjects such as, What Domestic Science Should Mean to the Women of Iowa, Its Value in Our Public Schools, Home Sanitation, Home Nursing, A Properly Balanced Ration, Drinking Water and Ice Supplies. Each day there will be demonstrations showing how plain food may be well cooked and daintily served.

DOMESTIC ART.

D. E. I.—The first Semester's work in Domestic Art gives the student a practical knowledge of all varieties of stitches in hand sewing. Each girl makes for herself a set of models, including the various stitches, seams, hems, fastenings, plackets, gussets, also patching, darning, lace and embroidery matching and glove mending. Lectures are given upon the use of each model, and a study is made of the various fibers, their growth and process of manufacture. Freshman year, First Semester. Two hours. Fee one dollar.

D. E. IV.—Garment Work.—The work in garment-making is open to young women who have completed D. E. I. Each student selects material for underwear, and plans, cuts, fits and finishes the underwear for herself, under the supervision of the instructor in charge. The lecture work is a continuation of D.
El. I and deals with the manufacture of fabrics and the evolution of textile machinery. The history of tapestry and of rug manufacture is taken up, with the making of miniature looms of early designs. Freshman year, Second Semester. Two hours. Fee one dollar.

D. E. VI.—This course furnishes knowledge of the principles of shirt-waist making. The student purchases, designs, drafts, and makes two unlined shirt-waists. One cotton, the other silk. The lectures of this course consider clothing from the artistic, hygienic and philosophic standpoints. The properties and values of textile materials are studied and in connection with this the work of the Consumers' League and Sweat Shops. Junior year, First Semester. Two hours. Fee one dollar.

D. E. VII.—Drafting and Dressmaking.—Continuation of Course VI. Each young woman designs, drafts and makes for herself an unlined shirt-waist suit. Instruction is offered in Raffia work, woven and sewed basketry. In this course the lectures treat of Historic Costume. Sophomore year, Second Semester. Two hours. Fee one dollar.

Course XI.—History of Art.—This course treats especially the subjects of Architecture and Sculpture. The organic and typical forms of architecture are studied with relation to their origin, character and development, and their particular adaptation to the existing conditions as to building materials and the needs and ideals of men. Sculpture is studied for its own perfection of beauty and grace and its use as an adjunct of architecture. Senior year, First Semester. Two hours.

Course XII.—Continuation of Course XI with Painting as the principal subject where history is conceived as a sequent evolution of races and epochs, unbroken in continuity, the history of art, dealing as it does, with the visible relics of the past; not only with buildings, statues and paintings, but with fabrics, utensils, furniture, indeed all the accessories of daily living, takes rank as a study of first importance. It is not more a history of the arts of design than a history of civilization. In both these courses Goodyear is used as a text, supplemented by lectures and library work. The work is illustrated by photographs of architecture, sculpture and painting. Senior year, Second Semester. Two hours.

Course XIII.—Home Decoration.—In this course no text is used but the principles of construction, ornamentation and color
harmony are applied to furnishings and utensils and to the treatment of walls, floors and ceilings by means of lectures and specimens of textiles, wall papers, pottery, fine glass and silver. Senior year, Second Semester. One hour.

SCIENCE COURSE.

Domestic Science Work.

FRESHMAN YEAR.

**FIRST SEMESTER.**

D. E. I.—Plain Sewing.—1 rec., 1 lab., 2 hours.

**SECOND SEMESTER.**

D. E. IV.—Garment Work.—1 rec., 1 lab., 2 hours. Must be preceded by D. E. I.

SOPHOMORE YEAR.

**FIRST SEMESTER.**

D. E. VI.—Drafting & Dressmaking.—1 rec., 1 lab., 2 hours.
Must be preceded by D. E. I. and IV.

**SECOND SEMESTER.**

D. E. VII.—Dressmaking—Basketry.—1 rec., 1 lab., 2 hours
Must be preceded by D. E. I, IV and VI.

JUNIOR YEAR.

**FIRST SEMESTER.**

D. E. II.—Foods.—1 rec., 1 lab., 2 hours.

**SECOND SEMESTER.**

D. E. V.—Foods (Advanced Course).—1 rec., 1 lab., 2 hours.
Must be preceded by D. E. II.

SENIOR YEAR.

**FIRST SEMESTER.**

D. E. VIII.—Laundry Work.
D. E. XX.—Adv. Cookery.—Must be preceded by D. E. II and V. 1 lab., each; 1 hour credit, (each).

**SECOND SEMESTER.**

D. E. XXIII.—Home Management.
D. E. XXII.—Home Nursing.—Each 1 lab., 1 hour credit.
Must be preceded by D. E. II, V and XX.

All work elective in Science course.
# GENERAL AND DOMESTIC SCIENCE COURSE.

**Domestic Science Work.**

**FRESHMAN YEAR.**

<table>
<thead>
<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td><strong>D. E. I.</strong>—Plain Sewing <em>(required)</em>.—1 rec., 1 lab., 2 hours credit.</td>
<td><strong>D. E. IV</strong>—Garment Work <em>(required)</em>.—1 rec., 1 lab., 2 hours credit.</td>
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**SOPHOMORE YEAR.**

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td><strong>D. T. VI.</strong>—Drafting &amp; Dressmaking <em>(required)</em>.—1 rec., 1 lab., 2 hours credit.</td>
<td><strong>D. E. VII</strong>—Dressmaking — Basketry <em>(required)</em>.—1 rec., 1 lab., 2 hours credit.</td>
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**JUNIOR YEAR.**

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tr>
<td><strong>D. E. II.</strong>—Foods <em>(required)</em>.—1 rec., 1 lab., 2 hours credit. <em>(Elective)</em></td>
<td><strong>D. E. V.</strong>—Foods *(Advanced Course) <em>(required)</em>.—1 rec., 1 lab., 2 hours credit. <em>(Elective)</em></td>
</tr>
<tr>
<td><strong>D. E. VIII.</strong>—Laundry Work.—1 lab., 1 hour credit.</td>
<td><strong>D. E. X.</strong>—Home Nursing.—1 lab., 1 hour credit.</td>
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<tr>
<td><strong>D. E. XXV.</strong>—Geography of Foods.—1 rec., 1 hour credit.</td>
<td><strong>D. E. XXVI.</strong>—Geography of Foods.—1 rec., 1 hour credit.</td>
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<tr>
<td><strong>D. E. XVI.</strong>—Home Sanitation.—1 rec., 1 hour credit.</td>
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**SENIOR YEAR.**

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<tr>
<th>FIRST SEMESTER</th>
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<tr>
<td><strong>D. E. XXIV.</strong>—Dietarles <em>(required)</em>.—1 rec., 1 hour credit. <em>(Elective)</em></td>
<td><strong>D. E. XXIII.</strong>—Home Management <em>(required)</em>.—1 lab., 1 hour credit.</td>
</tr>
<tr>
<td><strong>D. E. XXVII.</strong>—Household Accounts.—1 rec., 1 hour credit</td>
<td><strong>D. E. XII.</strong>—History of Art.—2 rec., 2 hours credit.</td>
</tr>
<tr>
<td><strong>D. E. XI.</strong>—History of Art.—2 rec., 2 hours credit.</td>
<td><strong>D. E. XIII.</strong>—Home Decoration.—1 rec., 1 hour credit.</td>
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<tr>
<td></td>
<td><strong>D. E. XXX</strong>—Seminar.—1 hour credit.</td>
</tr>
<tr>
<td></td>
<td><strong>D. E. XXVIII</strong>—Chafing Dish Cookery.—1 lab., 1 hour credit.</td>
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</table>
# DOMESTIC SCIENCE COURSE.

## Domestic Science Work.

### FRESHMAN YEAR.

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td>D. E. I.—Plain Sewing.—1 rec., 1 lab., 2 hours credit.</td>
<td>D. E. IV.—Garment Work.—1 rec., 1 lab., 2 hours credit.</td>
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### SOPHOMORE YEAR.

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td>D. E. VI.—Drafting and Dressmaking.—1 rec., 1 lab., 2 hours credit.</td>
<td>D. E. VII.—Dressmaking.—1 rec., 1 lab., 2 hours credit.</td>
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### JUNIOR YEAR.

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td>D. E. II.—Foods.—1 rec., 1 lab., 2 hours credit.</td>
<td>D. E. V.—Foods (Advanced Work).—1 rec., 1 lab., 2 hours credit.</td>
</tr>
<tr>
<td>D. E. VIII.—Laundry Work.—1 lab., 1 hour credit.</td>
<td>D. E. XXII.—Home Nursing.—1 rec., or lab., 1 hour credit.</td>
</tr>
<tr>
<td>D. E. XVI.—Home Sanitation.—1 rec., 1 hour credit.</td>
<td>D. E. XXIII.—Home Management.—1 lab., 1 hour credit.</td>
</tr>
<tr>
<td>D. E. XXV.—Geography of Foods.—1 rec., 1 hour credit.</td>
<td>D. E. XXVI.—Geography of Foods.—1 rec., 1 hour credit.</td>
</tr>
<tr>
<td><strong>(Elective)</strong> Home and Market Gardening.—Hort. I, 2 hours.</td>
<td><strong>(Elective)</strong> Elementary Forestry.—Hort. XIV., 3 hours.</td>
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### SENIOR YEAR.

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<tr>
<th>FIRST SEMESTER</th>
<th>SECOND SEMESTER</th>
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<tbody>
<tr>
<td>D. E. IX.—Theory of Teaching Domestic Science.—1 rec., 1 hour credit.</td>
<td>D. E. X.—Practice Teaching.—1 lab., 1 hour credit.</td>
</tr>
<tr>
<td>D. E. XXIV.—Dietaries.—1 rec., 1 hour credit.</td>
<td>D. E. XII.—History of Art.—2 rec., 2 hours credit.</td>
</tr>
<tr>
<td>D. E. XXVII.—Household Accounts.—1 rec., 1 hour credit.</td>
<td>D. E. XIII.—Home Decoration.—1 rec., 1 hour credit.</td>
</tr>
<tr>
<td>D. E. XI.—History of Art.—2 rec., 2 hours credit.</td>
<td>D. E. XXX.—Seminar.—1 hour credit.</td>
</tr>
<tr>
<td><strong>(Elective)</strong></td>
<td><strong>(Elective)</strong></td>
</tr>
<tr>
<td>D. E. XXVIII.—Chafing Dish Cookery.—1 lab., 1 hour credit.</td>
<td>D. E. XXIX.—Household Sanitation.—1 lab., 1 hour credit.</td>
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DIVISION OF SCIENCE

DEPARTMENT OF PSYCHOLOGY.

ORANGE HOWARD CESSNA, PROFESSOR.

Course I.—Psychology.—An optional course of elements and outlines of Psychology is afforded the First Semester of the Senior year to the students of all the College courses. A standard text is used and supplemented by lectures and laboratory work.

Course II.—Ethics.—An optional course in Ethics is afforded the Second Semester of the Senior year to the students of all the college courses. Several standard text-books of Ethics are employed and supplemented by library work and lectures. All callings and pursuits of life are based upon some element of moral obligation. It is the purpose of this instruction in Ethics to give the student a comprehensive acquaintance with the principles and the duties of a faithful life and good citizenship.

DEPARTMENT OF LITERATURE AND RHETORIC.

ALVIN B. NOBLE, PROFESSOR.

MISS LARRABEE AND MISS MACLEAN, ASSISTANT PROFESSORS.

MISS REED, MISS THOBURN, MISS WHITE, MISS ABEL, MISS MOORE, AND MISS TOMPKINS, INSTRUCTORS.

In the courses in English two ends are sought, utility and culture. Utility predominates in the first years and culture in the last, though there is hardly a recitation but contains something of both.

So long as man communicates his thoughts and feelings to his fellows, so long will language have a practical value. The man who speaks in a bungling manner, only half succeeds in communicating his thoughts to others. If they catch his real meaning they do it by a happy inference of their own as to what he meant to say. But no man can afford—certainly no college man can afford—to depend on others to correct his own faulty speech. If he uses a wrong word, arranges the parts of the sentence improperly, gives some part an undue emphasis, or fails to indicate clearly the bearing of one sentence upon another, his language does not truly present his thought, and the world may profit little from his attempt to state it. The more valuable his thought, the greater his need for a clear and effective use of language.

If the student has mastered grammar and rhetoric, that is
if he has been trained to apply the principles gone over, his speech should be free from errors and inaccuracies of expression. More than this: if he has been directed to the study of good models, if he has been taught not merely to correct what is faulty, but also—and this is far more important—to appreciate what is excellent in diction, in sentence structure, in the development of paragraphs and of whole compositions—if he has been made to feel the increased utility, the beauty, and the power of language as used by the masters of expression, he will not be content to use language that has only the negative merit of being without faults, but will press on to attain a style enriched by the presence of real excellence, a positive quality. Such language is not simply clear and accurate, it is pleasing and powerful, and the man who has acquired such skill in the use of language has greatly increased his influence in the world. If he can give his valuable thought an adequate expression, his fellows will learn the thought from him, and give him honor accordingly; if he cannot, they will learn it from one who can state it more clearly or more attractively, and the reward is quite as likely to go to the man who best states the thought as to the one who first discovers it.

The courses in grammar, rhetoric, and composition are devoted primarily to this utilitarian end. The facts and principles of language are studied, not as valuable in themselves, but as useful when applied in spoken or written discourse. To this end the student is required to write much, always with some definite object to be accomplished, and usually with some good model before him to inspire him to more earnest effort. When once he has learned to draw from his reading suggestions that will be helpful in his future compositions, he has found a possible utility in everything he studies as literature and has opened the door to continual improvement. Moreover, in learning to appreciate what is best in the models set before him, he gains insensibly something of culture as well as of utility.

The course in debating is designed as a training toward the effective discussion of live topics. Wherever he goes the college graduate is expected to have opinions of his own on the topics of the day, to be able to state them clearly and forcibly, and, if need be, to defend them. To this end he should train himself to close analysis of complex problems, to a severe testing of every conclusion, his own as well as other people's. Moreover,
the public will not wait for him to retire to his study for labored preparation. They expect him to be ready when the occasion calls, and they have generous rewards for the man who is ready—ready to map out a clear-cut line of argument, ready to support it with proofs, and able to present it clearly and forcibly in off-hand discussion. Such readiness comes only from long-continued right thinking and clear-speaking. It is the aim of this course to start the student toward this goal.

In the courses in Literature it is probably true that the culture side predominates, yet utility is seldom lacking. The study of Literature calls for close observation, correct inference, fine discrimination. When the mind is trained to do such work, it acquires a power that abides, a power that can be applied to any task. Literature deals with the whole range of human experience, emotion, activity. In studying Literature, therefore, we are required to give some study to the mind and heart of man. If such study does not exert an elevating influence, it can only be because the reader does not choose the best, or does not approach the work in the right spirit. At the very least, it ought to give him a deeper insight into human nature, and that is no small gain. But Literature is also an art, an art that engages the attention of more people, and holds that attention for a longer time, than does any other art. In studying it, therefore, we are cultivating the aesthetic sense, a part of our nature not appealed to by most studies. Best of all, perhaps, it brings us into the company of the rarest minds of all times; it gives command of the best thought of the best minds; it brings to us the "blessed companionship of wise thoughts and right feelings." It broadens the mind, quickens the imagination, enlarges the sympathies, enriches the whole nature.

COURSES IN ENGLISH.

Academic Year.

Course 1.—Grammar.—Syntax of good modern prose; copious analysis, with emphasis on phrases and clauses as structural units of the sentence, and careful study as to their proper position and connection; daily drill in sentence construction, the application of what the student has learned from sentence analysis; study of the principles of punctuation, with drill in applying them; correction of errors in grammar. Study of
language direct, with as little use of text-book as circumstances will permit. Designed to give that ready command of the sentence that shall leave the student free to seek excellence of structure without needing to give conscious thought to correctness. For admission to this course students must pass an examination on the eight parts of speech, their subdivisions, inflections, and properties, or else present a teacher's certificate or a satisfactory grade in a good high school. All courses. Belongs properly to the Fall Semester, but is given in the Spring Semester also. Five hours.

Course II.—Elementary Rhetoric and Composition.—Devoted largely to the study of the paragraph, with Scott and Denney's "Composition-Rhetoric" as text-book. Careful analysis of good models, followed by compositions designed to apply the methods just analyzed. An essay once a week, with exercises almost daily; each student to correct the mistakes he has made. Pre-requisite, English I., taken in class or by examination. If a student's essays show need of further drill in grammar or punctuation, he will be required to make up the deficiency. Belongs properly in the Spring Semester, but is given in the Fall Semester also. Five hours.

Course A.—Review of Grammar and Elementary Rhetoric and Composition.—A combination of Courses I. and II. Designed for high school graduates and others who show the need of a review in these subjects. All courses. Both Semesters. Five hours.

Course IX.—Literature.—A course in English Classics, such as are included in the Uniform College Entrance Requirements in English. An elementary study of the forms of literature in both prose and poetry, and of the principles underlying each. Taken up mainly as an incentive to wider and more thoughtful reading, and as an approach to a more intelligent and discriminating appreciation. Prerequisites, English I. and II. Required in the Academic year, leading to the courses in Science and in Engineering. Both Semesters. Five hours.

Freshman Year.

Course III.—Advanced Rhetoric and Composition.—Devoted mainly to the planning of essays and the principles involved in the different forms of discourse. An essay once a week, with frequent exercises in diction and in making plans and outlines.
Analysis of good prose models. Prerequisite, English II., taken in class or by examination, or diploma from a fully accredited high school. If a student's essays show imperfect preparation, he will be required to make up the deficiency. Required in all the four-year courses. Both Semesters. Five hours.

Course IV.—Composition.—Weekly themes in narration and description, based on models read and discussed before the class. Prerequisite, English III. Required in all the four-year courses. Both Semesters. One hour.

Sophomore Year.

Course V.—Composition.—Weekly themes in exposition. Prerequisite, the preceding courses in English. Required in all the four-year courses. Both semesters. One hour.

Course VI.—Composition.—Weekly themes and briefs in argumentation. Prerequisite, the preceding courses in English. Required in all the four-year courses. Spring Semester. One hour.

The aim of the courses in composition is to train the student to express his thought on whatever subject, not only with clearness and ease but with some measure of grace, attractiveness, and power.

Junior Year.

Courses VII. and VIII.—Debating.—A course in stating and defining questions for debate, in making briefs, and in extemporaneous debating; the application of argumentative principles and methods to live topics. Elective in all courses for students who have completed the preceding courses in English. Course VII. in the Fall Semester, Course VIII. in the Spring Semester. One hour each.

COURSES IN LITERATURE.

Course I.—The English Drama.—Devoted mainly to a study of Shakespeare, with a rapid survey, largely by reports and informal lectures, of the English Drama before his time, and a rapid reading of one or two dramas of subsequent time. In Shakespeare three or more plays will be studied carefully and one or two others read rapidly. Character analysis and interpretation, with grouping and contrast. Plot analysis, with stages of
complication and resolution. Prerequisites, the courses in English for the Freshman year. A part of Course V., but may be taken independently. Elective in the Agricultural courses and the course in the Sciences related to the industries. Fall Semester. Three hours.

Course II.—Epic and Lyric Poetry.—A course in English poetry, excluding the drama. Selections from Milton, Pope, Coleridge, Wordsworth, Shelley, Keats, Tennyson, and Browning. Classification of the various forms of poetry. Study of rhythm, meter, rhyme, alliteration, figures of speech, melody, harmony, etc. Principles of criticisms applicable to the poems studied. Prerequisites, the courses in English for the Freshman year. Literature I or V, though not strictly necessary, will yet be of great help. Required in the General and Domestic Science Courses in the Sophomore year; elective in the Agricultural Courses, and in the Course in the Sciences related to the Industries, in the Junior year. Spring Semester. Five hours.

Course III.—Novel and Romance.—A course in the novel and romance from the eighteenth century to the present time. Differences between the two forms. Comparison to the drama. Plot and character analysis. Outline for systematic study. Prerequisites, the courses in English through the Freshman and Sophomore years; should also be preceded by Course VI, The Short Story. Elective in the Agricultural Courses, the Course in the Sciences related to the Industries, and the Course in General and Domestic Science. Spring Semester, Junior or Senior year. Three hours.

Course IV.—American Literature.—A study of our best poets and essayists. Comparison with English authors and works. Interrelations of our Literature and History. The prominent writers of the present day. Prerequisites, the courses in English through the Freshman and Sophomore years; should also be preceded by Course II. Elective as before. Fall Semester, Junior or Senior year. Three hours.

Course V.—The Drama.—A combination of Course I., the English Drama, and Course VIII., the Drama in Translation. Prerequisite, the English courses of the Freshman year. Required in the Courses in General and Domestic Science, in the Fall Semester of the Sophomore year. Five hours.

Course VI.—The Short Story.—A study of the short story from the time of its development as a distinct literary form to
the present time. The various types and classes of the short story, with principal attention to the product of the last fifty years in France, England, and the United States. Prerequisites, the English courses through the Freshman and Sophomore years. Should also be preceded by one course in the Drama, either Course I or Course V. Elective in the Courses in Agriculture, in the Course in the Sciences related to the Industries, and in the Course in General and Domestic Science. Fall Semester, Junior or Senior year. Two hours.

Course VII.—The Essay.—A course in the leading English essayists, such as Addison, Steele, De Quincey, Macaulay, Carlyle, Ruskin, and Matthew Arnold. Prerequisites, the courses in English of the Freshman and Sophomore years. Elective as before in the spring Semester of the Junior or Senior year. Two hours.

Course VIII.—The Drama in Translation.—A study of the leading Greek, French, and German dramatists through an English translation. Prerequisites, the English of the Freshman year. A part of Course V or may be taken independently. Elective in the Agricultural courses and in the Course in the Sciences related to the Industries. Fall Semester of the Junior or Senior year. Two hours.

DEPARTMENT OF PUBLIC SPEAKING.

ADRIAN M. NEWENS, PROFESSOR.
SYBIL LENTNER, INSTRUCTOR IN PUBLIC SPEAKING.
WINIFRED TILDEN, INSTRUCTOR IN PHYSICAL CULTURE FOR WOMEN.

In General.

The relation of the department work to the college course is the same as that of any other study. In some courses Public Speaking is elective, in some years it is required and the credits are given on a basis with every other required or elective study. We aim to equip men and women to speak well, to tell what they know and give their opinions, read and recite in a pleasing and effective manner. All will be called upon at some time to speak publicly, all talk every day, more or less, and for both the more formidable speech and for conversation the work of the department is planned. The subjects which make for perfection along these lines are briefly; emphasis, enunciation, articulation, time,
energy, inflection, appreciation of literature, voice culture, gesture, vocabulary, etc., etc.

Public Speaking has been and still is considered often as a special, peculiar and extraordinary art. There is no denying that it is an art, but first of all it is common sense; common sense applied to speech. The principles which govern conversation to make it dignified, pleasing and forceful may be called Elocution. The mastery of them would make the speaker artistic. These principles are not different when applied to public speech. Public speech is, therefore, conversation, on an enlarged scale.

To reduce Public Speaking to a system is neither possible nor desirable. No one system can be made applicable to all persons, as no one style of clothing is appropriate to all classes and conditions of men. There are as many styles of elocution or systems of expression as there are people. Each one possesses an elocution of his own and that should not be taken from him and an inferior one for him be substituted. The development of that power and manner which one possesses already is our aim in the courses of study outlined below.

We grant that all so-called systems have good suggestions. We attempt to use the best of any and all methods, but the student himself is the system and he and his possibilities should be respected. The elimination of faults in speech which mar his efforts and the correction of mannerisms that hinder his success are subject to adverse criticism. To stand and think and talk well at one and the same time should be the ambition of every student, man or woman, in his chosen occupation.

The theory and practice of Expression,—and speech is more practice than theory,—covers four years of work to those who begin in the Academic year, three years to those who begin as Freshmen. However, not all the college courses grant electives in this course with credit, though none are excluded if the proper consent is given. We begin with the first and fundamental work, i.e., How to Read. The interpretation of thought and sentiment is the first desideratum, after that the attention is turned toward physical expression, then on into more formidable recitation and declamation, oratory and extempore speaking.

Public Speech.

Not the least in point of importance in the course of study is that of special attention to the building of an oratorical
address or speech. Course VIII has to do with how to write an oration. In that course great orations are studied and analyzed. Their language and plans are observed and a critical and careful scrutiny is given to detail. Winning orations in state and interstate contests are closely observed and the principles which seem to have made them win are emulated. The student writes an oration on a selected subject and delivers it as a part of his work and under the direction of the head of the department. In certain courses still another oration is required in the Senior year.

**Interpretation and Dramatic Art.**

The life of literature is in its interpretation. The voice and body are powerful factors in making literature real. The courses in Interpretation include Courses III., IV., V., VI., VII. Here the student is brought in contact with good selections from Lyric and Epic poetry, Dramatic, Rhetorical and Oratorical literature. Throughout the two years, Junior and Senior, he will have gained a command of himself, a power of expression and a repertoire which will well fit him to appear before any assembly to read or recite. Numerous recitals are given before college audiences and there he may gain a confidence in himself and his abilities which will fit him for more formidable work in the future. The work done in these classes is pursued along professional lines. Students wishing to specialize in Public Speaking will get the best of training, along with their college work, in vocal and physical technique. Each student is met privately for drill and individual instruction such as he, personally, needs and for special appearance before the class and other audiences. Students are required to take part in plays and prepare and present monologues as a part of the work of the last year.

**Extempore Speech.**

Courses X. and XI. have to do with Extempore Speech purely. The courses are designed to give students practical training in speaking without notes or without having written and committed to memory a formal address. There is a great demand for men, who are well versed in the sciences and industries as offered in the several departments of the College, to address institutes, conventions, clubs and commissions on
topics related to their chosen work. At gatherings formal and informal that person is in demand who can say the right thing at the right time and in the right way. It is a worthy accomplishment to be able to speak well upon any occasion. For all such, these courses aim to prepare the student. They are in every way practical. The student from the very first is called to the floor to address his class on assigned topics. He is given from three days to a week to gather his material and get it ready for his appearance before the class. As often as once a week each individual is on the floor, oftener if possible. He is subjected to criticisms by the class and the instructor. Criticisms are offered on the prescribed lines of general appearance, force of address, arrangement of material, use of words, vocabulary, etc., etc. By subjecting himself to this severe scrutiny, and by the frequency of his addresses, the student gains an acquaintance with himself and a habit of thinking which is real experience in speechmaking, second only to that which he would gain in appearing before outside audiences.

Courses of Study in Public Speaking.

Course I.—Elementary Speech.—Required First Semester, Academic year, all courses. Two hours per week.

Lectures on Emphasis, Purpose and kindred topics. Students analyze, read and recite selections from masterpieces of rhetorical and oratorical literature, prose and poetry. Thought getting and giving are the objects of this semester's work.

Course II.—Gesture and Voice.—Required Second Semester, Academic year, in Agricultural Courses and Second Semester, Freshman year, in Science, Domestic Science and General and Domestic Science Courses. One hour per week.

Lectures on vocal and physical expression. Class exercises in voice and bodily expression. Recitations and declamations accompanied by coaching and criticism on the floor.

Course III.—Advanced Interpretation.—Elective First Semester, Junior year. Open to students in Junior and Senior years who have completed Course II. or its equivalent. Offered in all courses except Domestic Science, Engineering and Veterinary. Two hours per week.

Lectures on Imagination, Personal Magnetism, Methods and Criticisms and other elements of Interpretation. Drills and exercises on the floor. Selections are assigned and recitals are
given in class. Students are coached and drilled individually outside of class hours.

Course IV.—Expression.—Elective Second Semester, Junior year. Open to students in the Junior and Senior years who have completed Courses II. and III. or their equivalents. Offered in all courses except Domestic Science, Engineering and Veterinary. Two hours per week.

This course is a continuation of Course III., Advanced Interpretation. Lectures on Character Study, Beginnings of Dramatic Interpretation. Selections are assigned, recitals are given in class. Students are coached and drilled individually outside of class hours.

Course V.—Dramatic Art.—Elective First Semester, Senior year. (Option between Course V. and Course X.) Open to students in the Senior year and others who have completed Courses II. and III. or their equivalents. Offered in all courses except Engineering and Veterinary. Two hours per week.

Lectures on Stage-setting, Dramatics, The Monologue, etc. Arrangements of scenes from Dramatic Literature. Original arrangement of Stories from magazines and novels. Coaching and drill of plays and monologues. Continued in Course VI.

Course VI.—Advanced Dramatic Art.—Elective Second Semester, Senior year. (Option between Course VI. and Course XI.) Open to students who have completed Courses II., III. and IV., or II. III. and V. or their equivalents. Offered in all courses except Engineering and Veterinary. Two hours per week.

Continuation of Course V. Advanced Dramatics and Lecture-Recitals.

Course X.—Extempore Speech.—Elective First Semester, Senior year. (Option between Course X and Course V). Open to students in Senior year. No prerequisites. Offered in all courses except Engineering and Veterinary. Two hours per week.

Lectures on Extempore Speech. Library Research work. Topics assigned, speeches made and criticisms offered in class. A practical course in public speaking. Continued in Course XI.

Course XI.—Advanced Extempore Speech.—Elective Second Semester, Senior year. (Option between Course XI and Course VI.) Open to students who have completed Course X. or to those approved by the head of the department. Offered in all
courses except Engineering and Veterinary. Two hours per week.

Continuation of Course X. Extempore Speeches, Forensics, Discussions. The course is designed to make the student an efficient public speaker.

(Note. Engineering students may elect Courses III., IV., V., VI., VIII., X. and XI. by the consent of the Dean of Engineering.)

Course VII.—Public Speech.—Required First Semester, Junior year, Domestic Science and General and Domestic Science only. Two hours per week.

Lectures on the Art of Public Speech. Correlation of Speech Arts with other Arts. Speech forms and values. Interpretation, and Library Research work.

Course VIII.—Advanced Public Speech.—Required Second Semester, Junior year, Science and General and Domestic Science Courses only. Elective in Agricultural Courses. One hour per week.

Lectures on orations and Orators. How to prepare and write addresses. The study of speeches and master orations. At least one formal oration and the delivery of the same is required of each student.

Course IX.—Oration.—Required Second Semester, Senior year, Science, Domestic Science and General and Domestic Science. Elective in the Agricultural Courses. One oration written and delivered under the direction of the head of the department.

Courses of Study.

Besides these specified courses of instruction in class, numerous special lessons and drill are given in the nature of coaching. Special selections are assigned based on the needs of the student as seen in his class-room work and his defects and strengths are given especial attention. Literary society declamatory and oratorical contest work is cared for by the teaching force of the department, such drill and preparation as each may need for his appearance in the contest are provided gratis.
DIVISION OF SCIENCE

PHYSICAL CULTURE FOR WOMEN.

WINIFRED TILDEN, INSTRUCTOR.

Training in Physical Culture is required of the young women in the Freshman, Sophomore and Junior years. The work begins the middle of October and ends the middle of April. Two forty-five minute periods each week are required. Individual daily exercise is strongly urged and is under the personal direction of the instructor. Physical examinations are given and measurements are taken three times a year, at the beginning of the Fall and Spring Semesters and at the end of the Spring Semester.

No one system of exercises, but a combination of the best suggestions from several systems are used. The highest ideals are kept constantly before the mind, not only health and strength, but ease, grace and refinement in manner and carriage of the body. A well poised, erect body is usually indicative of a high moral character.

Indian clubs, wands, dumb-bells, exercisers, Swedish apparatus, etc., are used but the most careful attention is given to free-hand exercises, which strengthen, particularly, the muscles of the vital organs so that means of attaining perfect health may be within the reach of each individual. The advanced work is along the lines of aesthetics. A few minutes each period throughout each year are given to brisk walking and running exercises.

Gymnasium suits of dark-blue flannel or serge, regulation blouse and bloomers, and gymnasium shoes are required, so that the body has perfect freedom in all exercises.

Basket-ball, Tennis and Field-Hockey are the out-of-door sports, and are open to all students, but, hereafter, cannot be substituted for regular gymnasium work.

Courses of Study.

Course I.—Required First Semester, Freshman year. Two hours per week.

Exercises for correct standing, walking and marching. Free-hand exercises while standing, walking and running.

Course II.—Required Second Semester, Freshman year. Two hours per week.

Course III.—Required First Semester, Sophomore year. Two hours per week.
A few minutes each period are given to walking and running steps. This is a course in breathing and breath control combined with suitable free-hand exercises.

Course IV.—Required Second Semester, Sophomore year. Two hours per week.
Specific exercises for all muscles of the body. Floor work, dumb-bell drills.

Course V.—Required First Semester, Junior year. Two hours per week.
Specific exercises continued. Indian club swinging and light apparatus work.

Course VI.—Required Second Semester, Junior year. Two hours per week.
Swedish apparatus. Fancy steps and drills.

DEPARTMENT OF MODERN LANGUAGES.

LIZZIE MAY ALLIS, PROFESSOR.
MISS NORTON, MISS LUCAS, MISS M'COLLOM, ASSISTANTS.

The College now offers a two and one-half years' course in German and two years' course in French.

Students in all the Engineering Courses take French or German two years.

Freshman French or German for Engineering students is second year work.

French or German is required of Agricultural students in the Freshman year.

In the Academic year of the course in Science, German is taken, provided the English grammar of the Academic year has been completed.

In the Freshman year of the course in Science, second year German or first year French is optional.

In the Sophomore year of the same course, for the First Semester, third year German or second year French is optional.

In the course for women, in the Academic year, German is taken, if English grammar of the Academic year has been completed. German or French is optional in the first two years of the course for women.

German and French are electives in the Junior and Senior years of the same course.
French.

Course I.—First Semester.—Fraser and Squair's French Grammar is used as text-book for grammatical work, supplemented by conversation and dictation exercises.

Course II.—Second Semester.—Grammar continued and translation and study of “L'Abbé Constantin,” Halévy.


Course X.—Academic Year. First Semester.—Engineering Students.—Fraser and Squair's French Grammar is used as text-book for the grammatical work, supplemented by conversation and dictation exercises. Three times per week.

Course XI.—Academic Year. Second Semester. Engineering Students.—Grammar continued and “L'Abbé Constantin,” Halévy. Three times per week.

German.

Course V.—First Semester.—Vos's “Essentials of German,” including grammar, composition, reading and conversation.

Course VI.—Second Semester.—Vos's “Essentials of German,” with continued drill in the principles of declension, conjugation and syntax. Storm's “Immensee.”

Course VII.—Third Semester.—“Höher als die Kirche,” Hillern; Carruth's “German Reader.”

Courses VIII. and IX.—Fourth and Fifth Semesters.—“German Science Reader,” Gore; Works of Gæthe and Schiller, conversation and study of syntax being continued throughout the course.

Course XII.—Academic Year. First Semester. Engineering Students.—Vos's “Essentials of German,” including grammar, composition, reading and conversation. Three times per week.

Course XIII.—Academic Year. Second Semester. Engineering Students.—Vos's “Essentials of German,” with continued drill in the principles of declension, conjugation and syntax. Storm's “Immensee.” Three times per week.
Increasing emphasis is rightly placed on the value of the study of history both from the standpoint of general culture and that of usefulness. The men and women who take up the duties of citizenship in this day should have the broadest outlook and come to their tasks with a sympathetic appreciation of what the world has already achieved. No study can have a more practical bearing upon the preparation of the citizen than the evolution of human institutions.

The present day utilitarian view of life may sacrifice the man and the citizen in the interest of the specialist, yet in reality he is the most successful in his specialty, other things being equal, who comes to it with the broadest general preparation.

In view of these facts, the courses in History aim to give, as far as possible in the limited time allotted, a good general view of the evolution of social, economic and political institutions and the main elements of civilization in general, and to fit the student for intelligently assuming the duties of citizenship.

The student has at his command the large College Library, which contains, besides the principal works of reference, an important section devoted to historical subjects. Quite an addition to the library has been recently made of the new books covering the later phases of historical development.

The text-book in each case is equivalent to about one-half the required work. The remainder is covered by the lectures and library work and thesis preparation.

Courses in History.

Course I.—The History of Western Europe.—Beginning with the Middle Ages the aim of this course is to trace the origin and development of the modern states of Europe. The text-book is supplemented by library and written work.

Five hours per week, First Semester of the Academic year of all the Science and Agricultural Courses.

Course II.—Advanced American History.—This course is a careful study of the leading events in American history and seeks
to trace the great historic movements in the evolution of the nation. Text-book and lectures with written and library work.

Four hours per week in the Second Semester of the Academic year of all the Science and Agricultural Courses. Course I is a prerequisite for entering this course.

Course III.—National Expansion, 1783 to 1845.—This course treats of the results of the American Revolution; the critical period and the forming of the Constitution; Federal and Republican supremacy; territorial expansion and the great western movements, together with the social and political readjustments during the the Jacksonian period and the slavery struggle to 1845. Text-book, lectures and library work.

Three hours per week, First Semester of the Senior year of all Science and Agricultural Courses.

Course IV.—The Welding of the Nation, 1845 to 1900.—This course treats of the conditions preceding the Civil War and the causes, principal features and results of the struggle; the Reconstruction period; the political, social and economic movements and foreign relations of America as it faces the problems of the present. Text-book and lectures and library work.

Three hours per week. Elective Second Semester of the Senior year of all Science and Agricultural Courses.

Course V.—Europe in the 16th, 17th and 18th Centuries.—This course aims to give a careful study to historic development during these important centuries. The principal topics treated are: The Reformation, the struggle for constitutional liberty in England, the ascendency of France, the rise of Prussia and Russia and England’s colonial supremacy. Attention is given to the social, economic and literary features as well as the political movements of the period. Lectures and library work.

Three hours per week. Elective First Semester, Junior year of the Science and Agricultural Courses. Required in the First Semester, Sophomore year of the General and Domestic Science and Domestic Science Courses.

Course VI.—The French Revolution and the XIXth Century.—This course is a study of causes and results of the French Revolution, the Napoleonic Era, the reactions and revolutions of the XIXth century to the close of the Franco-Prussian war. Attention will be given to the institutional changes touching the political, social and economic aspects of the movements. Text-book, lectures and library work.
Three hours per week. Required Second Semester, Junior year of the General and Domestic Science and Domestic Science Courses. Elective in the Science and Agricultural Courses.

Course VII.—The XIXth Century (First Half).—The aim of this course is to study the causes and significance of the French Revolution; the reactionary movements under Metternich and the Revolutions of 1830 and 1848. Lectures with library work.

Two hours per week, elective, and may be taken in First Semester of either the Junior or Senior year of the Engineering Courses.

Course VIII.—The XIXth Century (Last Half.)—Beginning with a brief review of the French Revolution and the events of the early part of the century this course traces the causes and results of the Reconstruction of Europe during the last half of the century. Special attention is given to German and Italian unity; the French Empire and Republic; the Victorian Era in English history and the Eastern Question. Lectures, papers and library work.

Elective, two hours per week and may be taken in the Second Semester of either the Junior or Senior year of the Engineering Courses.

Course IX.—The Far Eastern Question.—This course covers the questions growing out of the later developments in the Far East. It is a study of world movements at the beginning of the new century. It is based on Reinich's "World Politics at the Close of the XIXth Century." Lectures and library work.

Two hours per week, elective Second Semester, Senior year of the Courses in Science, General and Domestic Science, Domestic Science, and Agriculture.

Course X.—The Renaissance.—This course is a study of the Renaissance Period. It is a survey of the causes and movements leading to the great intellectual quickening during the latter half of the Middle Ages. It traces the development of these forces both in Italy and the Northern Countries in their influence upon civilization. It emphasizes the agents and events which contributed most largely to that transformation of Europe which ushers in the Modern Period. Text-book, lectures and library work.

Two hours, First Semester. Elective. First Semester, Junior year of the Science, General and Domestic Science and Agricultural Courses.
Courses XI.—The Constitutional History of England.—This course traces the development of English Political History. It treats of the steps in the growth of Constitutional Government and Anglo-Saxon institutions and their influence upon American ideals. The constitutional aspect of England's History is most interesting and significant. "In no other field of English activity is to be found so clear a revelation of English National Character." This course serves as an introduction to Course III. Text-book, lectures and library work.

Elective. Two hours per week, Second Semester, Junior year. Science, General and Domestic Science, and Agricultural Courses.

Course XII.—Diplomatic History of the United States.—There is an increasing demand for a knowledge of our foreign relations. The great development of the industrial resources of the country and recently acquired territorial possessions have given new interest and importance to international relations of the United States. This course gives at least a survey of the more important of these diplomatic transactions.

Elective in the First Semester of the Senior year in the Science, General and Domestic Science, Domestic Science, and Agricultural Courses.

Course XV.—The History of Western Europe.—Same as Course I except that it is a four-hour course.

Required of all Engineering students, First Semester of the Academic year.

Course XVI.—Advanced American History.—A two-hour course covering the same general field as Course II.

Required of all Engineering students in the Second Semester of the Academic year. Course XV is a prerequisite for entering this course.

Course XVII.—English History.—A general survey of the field, with emphasis upon the growth of the English Constitution and its relation to the constitutional development of the United States. This course will serve as a background for Course XVIII. Lectures, text-book, and assignments.

One hour per week. Required of all Engineering and Agricultural students in the First Semester of the Freshman year.

Course XVIII.—The Formation of the Union.—A special study of the period of the making of the American nation. The achieving of independence, the securing of the Constitution, the inauguration of the new government, early national problems,
and the formulation of parties and policies, will fall within the scope of this course. Lectures, text-book, and assignments.

One hour per week. Required of all Engineering and Agricultural students in the Second Semester of the Freshman year.

DEPARTMENT OF CIVICS.

RICHARD CORNELIUS BARRETT, PROFESSOR.

Civics as herein used means the science that treats of citizenship and of the relations between citizens and the government; ethics, or the doctrines of duty to society; civil policy, or governmental methods and machinery; law, in its application most directly involving the interests of society; history of civic development and movement, and the structure and the working of the government and the interrelation of states.

While it is planned to give instruction concerning the American government as it now exists, the student will be expected to look forward to the solution of such problems as may confront the people and the government. At the same time such definite and fixed historical information will be expected from each student as will enable him to have a clear understanding of present governmental forms and practices.

No system of human government is perfect. The discussion of defective laws and the non-enforcement of present laws are common topics of conversation in every state and union.

Believing that in a republic where the people are supreme, an education is incomplete, if not a failure, that does not relate itself to the duties and opportunities of citizenship it will be a purpose to point out to the student a reasonable and patriotic duty touching present laws, and to aid him in all possible ways to become a useful, honored, and law abiding member of the civic community, and to give him suitable instruction with regard to public affairs.

The courses are planned to give such knowledge and training as it is believed should be a part of a liberal education.

The courses offered in Civics are more or less closely interrelated with those given in the Departments of History, and Economics, but it is believed that the association will prove in every way helpful to the student.

Courses in Civics.

Course 1.—When deemed advisable to the proper instruction and advancement of students attention will be directed particu-
larly to the following topics: City, county, and state governments; constitutional conventions; constitutions as "Supreme Law!" checks and balances; the presidency; the senate; the house of representatives; general powers of Congress; the judicial system, federal and state; divisions of powers between the Union and the states; comparison with other federal governments; the spoils system and civil service; government of territories and colonies. A text-book is used which is supplemented with papers and library work. Two hours per week, First and Second Semesters of the Academic year of the Engineering and Science Courses.

Course II.—Principles of American Government.—A study of the sources and development of the principles of the federal government. In this course the following documents will be studied and analyzed: Magna Charta, the Act of Habeas Corpus, The Petition of Right, The Bill of Rights, Colonial Charters, Plans for Union, the Declaration of Independence, Articles of Confederation, the First State Constitutions, and the Constitution of the United States. The American Party System; origin, structure and administration. Relation between the Federal and State governments will also be studied. As a prerequisite for this course the student must have pursued Course I., or its equivalent. The course calls for individual work and investigation. The library is, in this course the student's work shop. Three hours per week. Elective in the First Semester of the Senior year of the Science and General and Domestic Science Courses.

Course III.—The State and Federal Constitutions.—In this course very little attention is given to theories, but careful consideration is given to principles which have been settled judicially or otherwise. The student will study: The rise of the American Union; distribution of the powers of government; the powers of Congress; the powers of the legislature; the powers of the federal executive; the powers of the state executive; the judicial department of the federal government; the judicial department of the state government; the government of the territories; the admission of new states; civil rights and their guaranties; political privileges and their protections; protection to persons accused of crime; protection to contract and property; the eminent domain; municipal corporations. The text-book is supplemented by lectures, papers and library work.
three hours per week in the Second Semester of the Senior year of the Science and the General and Domestic Science Courses.

Course IV.—The demand for the more adequate teaching of morals, especially with regard to the making of good citizens has prompted the preparation of this course. Among the subjects discussed are the following: The family and its government; conditions of good citizenship; rights and duties of citizens; the citizen's duty to the government; abuses and perils of government; improvement of government; the economic duties of citizens; social rights and duties; the great social subjects; the treatment of criminals, paupers and incorrigible children; international duties, or the rights and duties of nation; ideals, or the higher law. Elective, two hours per week in the Second Semester of the Junior year of the Science and General and Domestic Science Courses.

Course V.—Rural Law.—This course is a discussion of Iowa Laws as related to highways, fences, weeds, water rights, ditching, drainage, live stock, trespassing, etc., and the legal rights, duties and responsibilities of farmers. Attention will also be given to contracts, negotiable instruments, sales and personal property. Elective, one hour per week, Second Semester of the Senior year of the Agricultural Courses.

Course VI.—Actual Government.—It is the aim in this course to aid the student to gain a more intimate knowledge of actual governmental affairs. The American governmental system is treated as a unit; state government and the various phases of local government are taught not as afterthoughts to the national system, but as integral parts of one American government. The student is taught that the Construction and Statutes are only the framework of government and that vitalized government depends upon personal interest and personal action. The constant attempt is to explain both the organization and the functions of government, not simply by what the constitutions and laws say ought to be done, but by the experience of what is done. Two hours per week. Required Second Semester of the Freshman year of the Science and General and Domestic Science Courses.

Course VII.—Comparative Government.—A course of three hours a week, lectures and recitations throughout the First Semester. This course is optional, elective for Course II. Open to all Seniors in the Science and the General and Domestic Science Courses. The work of the Semester will include a com-
parative study of the governments of England, France, Germany, Switzerland, Canada, Mexico and the United States.

DEPARTMENT OF MILITARY SCIENCE AND TACTICS.

JAMES BUSH LINCOLN, PROFESSOR.

It is not intended to complete the education of the thorough soldier, but to fit young men for filling intelligently, positions in the State troops as line officers and company instructors. The constant demand for men thus trained emphasizes the value of a thoroughly organized and well sustained military course. The chief advantages derived are the acquirement of a dignified carriage of the person, a gentlemanly deportment and a self-respecting discipline, with habits of neatness, order and punctuality. Opportunities are afforded each cadet for extending the studies in military science, as desired, the College being provided with the necessary arms, accoutrements and outfits for drill and instructions in the infantry, artillery, and signal tactics, for which special classes will be formed. Lectures on military subjects are delivered throughout the course, and regular battalion drill and parade take place each Monday and Wednesday afternoon. All male students of the College, except such as may be excused on account of physical disability by proper authority, are required to become members of the College battalion, and wear the prescribed uniform during military exercises. Students in the Academic year are not required to drill.

Course I.—First Semester, Freshman Year.—Two drills each week.

Course II.—Second Semester, Freshman Year.—Two drills each week.

Course III.—First Semester, Sophomore Year.—Two drills each week and Non-Commissioned Officers' School of one hour each week; School of the Guides and Guard Duty.

Course IV.—Second Semester, Sophomore Year.—Two drills each week, and Non-Commissioned Officers' School of one hour each week; Drill Regulations and Guard Duty.

Course V.—First Semester, Junior Year, and

Course VI.—Second Semester, Junior Year.—Two drills each week, and Officers' School of one hour each week; Drill Regulations, Guard Duty and Army Regulations. Elective in all courses.

Course VII.—First Semester, Senior Year, and
Course VIII.—Second Semester, Senior Year.—Two drills each week, and Officers’ School of one hour each week; Service of Security and Information; Military Engineering; Military Law, and Military Hygiene. Elective in all courses.

THE LIBRARY.

VINA ELETHE CLARK, LIBRARIAN.
MISS STEVENS, ASSISTANT.

The College Library numbers about 18,000 volumes, these being standard works of history, biography, engineering, agriculture, natural science, mental and moral philosophy, poetry, general literature and reference. It has been arranged with a view to making it especially valuable as a reference library.

The books are selected by specialists, the heads of departments indicating such works as they wish the library to have bearing upon their respective lines of study.

The library is classified according to the Dewey Decimal System of Classification and the card catalog is in two parts, the Dictionary (author and title) and Classed.

The library receives about 225 periodical publications, literary, scientific and general, and there are complete files of many of these upon the shelves.

The library has on file 5,000 unbound pamphlets, and is in constant receipt of large numbers of pamphlet publications from the various departments of the government, agricultural experiment stations and other sources. The library has also several hundred bound volumes of government publications, such as Geological Surveys, United States Experiment Station Bulletins, Congressional Record, War of Rebellion Record, Census Reports, Cabinet Officers’ Reports, etc.

The reading room of the library is a large, well-lighted room, and is open to readers ten hours daily, except Sundays, when it is open five hours. Current numbers of periodicals are kept in the reading room and are accessible to all, as are newspapers, college exchanges, dictionaries, encyclopaedias, Poole’s Index, the card catalog, etc.

The library subscribes for several Chicago and Iowa dailies, and, through the courtesy of the editors, a large number of the daily and county newspapers of Iowa are sent to the reading room for the use of students.
Personal assistance and suggestions upon all matters relating to the library will be given by the librarian and assistant to all who desire such help.

All students in the Freshman year in all courses are required to take library work to the extent of four hours in the Fall Semester.

Course I.—Library Work.—Four hours in the First Semester, Freshman year.

DEPARTMENT OF MUSIC.

FRANK J. BESLER, DIRECTOR.

The general plan of instruction is similar to that of the best conservatories, and aims to cultivate in the pupil an intelligent appreciation of the noble and beautiful in Music. It is designed to lay a sound foundation upon which to build rather than to impart a superficial knowledge for the purpose of display. The branches taught are Piano, Pipe Organ, Voice Culture, History of Music and Sight Singing. For the completion of the work outlined, the College will grant a certificate.

Piano.—Course of Instruction.


Grade 4.—Cramer’s fifty studies. Five Sonatas of Beethoven. Chopin, seven Waltzes, two Polonaises, three Mazurkas, three Nocturnes, one Ballade, one Scherzo, three Etudes. Tausig’s daily studies. Miscellaneous selections.

Grade 5.—Clementi’s Gradus ad Parnassum. Four selections from Bach, two from Rubinstein and Moszkowski each, four from Liszt and four concert pieces of various composers. Tausig’s daily studies, second book finished. Kullak’s Octave studies.
Voice Culture.—Course of Instruction.


Third Year.—Advanced technical study. The study of recitative and advanced work in interpretation, public performance or preparation for teaching. Songs from the great masters, Schubert, Schumann and Franz.

Fourth Year.—The study of advanced repertory. Selections from oratorio and opera. Preparation of recital for completion of course.

A one year's course in Sight Singing will be required for the completion of the Course in Voice Culture. Also at least one year's study of the Piano.

For the completion of the Course in Piano at least one year's study of the Voice or Pipe Organ will be required.

The completion of either course will require the study of History of Music and the Theory of Music.

The candidate for a certificate from the College for the completion of either Course in Music shall possess an English education equivalent to admittance to the Freshman year of the College.

A Choral Society is maintained, membership being open to students and citizens of Ames. Such works as Barnby's Rebekah, Gaul's Holy City and Buck's Forty-Sixth Psalm have been given successfully in concert. Coleridge Taylor's "Hiawatha’s Wedding Feast" will be presented in the Spring Semester of 1905.

An excellent Male Glee Club give concerts each Semester. Membership in this organization is gained by examination.

Public concerts and recitals are given at frequent intervals during the year; also private recitals weekly, in which all Music pupils will be expected to take part.

Music students may enter at any time. Students may enroll for Music alone without additional expense.
Tuition.

For term of twenty lessons in any branch.............$15.00

Piano Rent.

One hour daily practice...........................................$3.50
Each additional hour............................................. 3.00

All tuition is due in advance to the director.
Absence from lessons will not be excused except in case of prolonged illness.
LIST OF STUDENTS
HONORS IN THE LITERARY CONTESTS.

DECLAMATORY CONTEST, SPRING SEMESTER, 1904.

Dramatic—H. Q. Moore, Bachelor.
Oratorical—Jennie Tedson, Clio.

ORATORICAL CONTEST, FALL SEMESTER, 1904.

First Prize—W. A. Tener, Welsh.
Second Prize—G. B. Guthrie, Bachelor.
Third Prize—A. Q. Adamson, Philomathean.

INTER-COLLEGIANTE DEBATES, 1904.

The following students represented the College in the debate with Drake University:
R. L. Collett, Bachelor.
E. S. Guthrie, Pythian.
R. K. Bliss, Welsh.
N. B. Garver, (alternate), Philomathean.

In the debate with the Iowa State Normal School, the College representatives were as follows:
J. E. Bacchus, Philelentheroi.
Leonard Paulson, Welsh.
M. L. Bowman, Pythian.
Charles Reinbott, Welsh.

INTER-SOCIETY DEBATES, SPRING TERM, 1904.

Question: "Resolved, That the United States should adopt a system of banking based on commercial assets similar to the Canadian system in preference to a system based on United States Government Bonds."
Pythian vs. Philomathean—Smith, R. T. Lyons, C. A. Peterson, G. H. Newcom.
STUDENTS OF THE COLLEGE


INTER-SOCIETY DEBATES, FALL TERM, 1904.

First Section.

Question: "Resolved, That the history of trade unionism in the United States for the past twenty years shows a general tendency detrimental to the best interests of the country."


Second Section.

Question: "Resolved, That the Federal Government alone should have the power of taxing interstate commerce. Concedes, that the basis of assessments should be the earnings."


POST GRADUATES.

Candidates for the Degree of Master of Scientific Agriculture.


Nielsen, Harold T., B. S., (Kas. Agr. Coll.) Agronomy, Denmark, Kansas.

**Candidates for the Degree of Master of Science.**


Buchanan, Robert Earle, B. S., (Iowa State Coll.) 1904, Botany, Eagle Grove, Iowa.


**SENIOR.**

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<th>NAME</th>
<th>COURSE</th>
<th>TOWN</th>
<th>COUNTY</th>
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<tr>
<td>Adamson, G. J.</td>
<td>C. E.</td>
<td>Iowa Falls</td>
<td>Hardin.</td>
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<tr>
<td>Anthony, H. F.</td>
<td>C. E.</td>
<td>Camanche</td>
<td>Clinton.</td>
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<td>Avey, H. T.</td>
<td>M. E.</td>
<td>Blockton</td>
<td>Taylor.</td>
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<td>Bechtelheimer, A. E.</td>
<td>C. E.</td>
<td>Ames</td>
<td>Story.</td>
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Cole, Mildred
Collett, R. L.
Cook, A. L.
Cooper, R. D.
Cox, R. L.
Currie, C. H.
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Curtis, J. F.
Curtis, R. S.
Cutler, G. C.
Cutler, J. L.
Daniels, P. H.
Davidson, Jessie
Davidson, Mary
Dean, H. G.
Deshler, W. E.
Dodge, M. V.
Dykstra, R. R.
Ellenberger, Howard
Ellis, J. A.
Epley, A. C.
Fair, D. H.
Fawcett, H. S.
Fegles, D. B.
Fenstermaker, S. E.
Fitch, T. T.
Flynn, J. P.
Fogler, L. H.
Fraser, Jessie
Frederick, H. J.
Fyler, L. S.
Gabrielsen, Carolyn
Galley, J. H.
Garver, N. B.
Gilchrist, W. D.
Gillespie, Leigh
Gillette, Opal
Gillette, R. U.
Goble, Rose
Gordon, W. M.
Greene, Merritt
Gribbin, R. L.
C. E., Ames, Story.
C. E., Ames, Story.
Sc., Waverly, Bremer.
Hort., Valley, Nebraska.
C. E., Osage, Mitchell.
E. E., Ames, Story.
Mn. E., Prairie City, Jasper.
Sc., Ames, Story.
Sc., Ida Grove, Ida.
P. H., Marlon, Polk.
G. & D. S., Monticello, Blackhawk.
G. & D. S., Monticello, New York.
Dairy, Ames, Hamilton.
M. E., Geneseo, Henry.
E. E., Davenport, Scott.
A. H., Columbus Jct., Louisa.
Agron., Ames, Story.
A. H., Orchard, Mitchell.
M. E., Marion, Linn.
G. & D. S., Monticello, Jones.
Dairy, Ames, Jones.
Agron., Waverly, Story.
C. E., Red Oak, Story.
Sc., Salem, Story.
C. E., LaPorte City, Story.
M. E., West Liberty, Story.
E. E., Sac City, Story.
C. E., Belle Plaine, Polk.
Sc., Osceola, Sioux.
G. & D. S., Paulina, Story.
Vet., Ames, Story.
E. E., Shell Rock, Bremer.
Sc., New Hampton, Montgomery.
C. E., Des Moines, Ohio.
C. E., Farmington, Black Hawk.
Vet., Ontario, Muscatine.
E. E., Spencer, Sac.
Sc., Fostoria, Benton.
A. H., Fostoria, Clarke.
Vet., Ames, O'Brien.
Vet., Ames, Story.
Vet., Ames, Butler.
G. & D. S., Ames, Chickasaw.
C. E., Des Moines, Polk.
C. E., Farmington, Van Buren.
Vet., Ontario, Story.
E. E., Spencer, Clay.
Sc., Fostoria, Clay.
A. H., Fostoria, Story.
Vet., Ames, Story.
A. H., Minden, Dallas.
Grubb, Victor, A. H., Panora, Guthrie.
Hibbard, Stella, G. & D. S., Paullina, O'Brien.
Hofacre, F. F., Sc., Monticello, Jones.
Horn, A. R., E. E., Newton, Jasper.
Howard, Chelsea, A. H., New Providence, Hardin.
Jacobsen, B. C., C. E., Walnut, Pottawattamie.
Jorgensen, F. F., Mn. E., Denison, Crawford.
Knickebocker, C. J., A. H., Fairfax, Linn.
Labberton, G. P., M. E., Orange City, Sioux.
Leefer, O. L., C. E., Cedar Rapids, Linn.
Madson, Wm. E. Vet., Vermillion, South Dakota.
Mahanke, Clarence, E. E., Parkersburg, Butler.
Maharg, Earl, A. H., Audubon, Audubon.
Maynard, R. P., C. E., Traer, Tama.
McKinley, Ethel, G. & D. S., St. Ansgar, Mitchell.
Minkler, F. C., A. H., Nevada, Story.
Morris, C. C., C. E., Corning, Adams.
Morison, Margaret, G. & D. S., Hedrick, Keokuk.
Mosher, Agnes, Sc., Sioux Rapids, Buena Vista.
Nelson, Fred O., Agron., Toledo, Tama.
Overholser, Pearl, Sc., Ames, Story.
Page, M. L., M. E., Charles City, Floyd.
Patton, T. J., C. E., Newton, Jasper.
Pendray, E. E., E. E., Oskaloosa, Mahaska.
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Plumley, H. R., E. E., Rockford, Floyd.
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Rasmussen, Fred, Dairy, Jewell Jct.
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Reese, Ed., E. E., Des Moines,
Reinbott, Charles, Agron., Grinnell,
Reinhart, M. J., C. E., Grinnell,
Ricker, F. H., M. E., Mason City,
Roy, F. V., E. E., Colfax,
Rush, H. S., E. E.,
Schwarting, W. W., E. E., Walcott,
Scott, A. B., Min. E., Shelby,
Scott, C. R., A. H., Cambridge,
Scott, R. S., M. E., Glidden,
Secor, A. J., Hort., Melbourne,
Smith, H. M., E. E., Nashua,
Smith, I. R., M. E., Milwaukee,
Stephens, Laura, Sc., Lohrville,
Stevens, Imogene, G. & D. S., Boone,
Stillwell, Jay D., Vet., Ames,
Stinson, R. S., A. H., Marion,
Stouder, K. W., Vet., Newton,
Stout, E. A., A. H., Stout,
Taylor, F. F., M. E., Algonia,
Tener, W. A., A. H., Brevard,
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Treman, A. J., Vet., Ames,
Truman, W. D., C. E., Iowa Falls,
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Wallace, B. R., C. E., Albia,
Washburn, Leo, Vet., Greenwich,
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Western, C. A., A. H., Beaconsfield,
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Williams, M. B., C. E., Manly,
Wood, F., M. E., Sac City,
Woodard, D. C., E. E., Des Moines,
Woodard, Wilton, M. E., Manilla,
Woodman, F. E., M. E., Ames,
Woodman, Lois, G. & D. S., Ames,
Woodruff, Chas., C. E., Glenwood,
Woodruff, Theresa, G. & D. S., Ames,
Zanke, G. J., M. E., Algona,

*Deceased.
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STUDENTS OF THE COLLEGE

Ingels, J. F., A. H., Meriden, Cherokee.
Jory, E. N., E. E., Galva, Black Hawk.
Kenny, G. R., E. E., Early, Sac.
Kimball, G. W., M. E., Waterloo, Black Hawk.
Knox, W. H., M. E., Marshalltown, Cherokee.
Lawrence, C. W., A. H., Paulina, Page.
Lundeen, H. L., C. E., Gowrie, O'Brien.
Lungren, O. E., M. E., Mason City, Webster.
Mable, P. P., A. H., Ames, Cerro Gordo.
Madison, Mathilda, Ames, Story.
Maxwell, W. D., C. E., Des Moines, Polk.
McCarran, A. K., C. E., Oskaloosa, Mahaska.
McEwen, G. F., C. E., Manchester, Delaware.
Meiser, Frank, Dairy, Solon, Johnson.
Miller, H. M., M. E., Council Bluffs, Pottawattamie.
Miller, P. B., E. E., Des Moines, Polk.
Money, F. B., C. E., Forest City, Winnebago.
Moore, H. L., C. E., Medrick, Keokuk.
Mosier, Max, Mn. E., Des Moines, Polk.
Nelson, E., E. E., Pomeroy, Calhoun.
Nye, H. V., Hort., Omaha, Nebraska.
Oppenheim, Ramsey, C. E., New Sharon, Mahaska.
Pawley, J. R., C. E., Tripoli, Bremer.
Patch, J. W., E. E., Perry, Dallas.
Peckstein, Paul, A. H., Keokuk, Lee.
Petersen, C. A., E. E., Red Oak, Montgomery.
Reuling, W. E., M. E., Muscatine, Muscatine.
Rieke, F. C., A. H., Blairstown, Benton.
Sanford, A. L., M. E., Council Bluffs, Pottawattamie.
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<td>Postville</td>
<td>Cherokee.</td>
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STUDENTS OF THE COLLEGE

Brandt, J. W., C. E., Jewel Jct., Hamilton.

Bridges, E. F., C. E., Oskaloosa, Mahaska.

Brintnall, E. P., Dairy, Winthrop, Buchanan.

Brown, C. E., Vet., Prairie City, Jasper.

Brown, E. J., C. E., Sheldon, O'Brien.


Burbridge, H. C., C. E., Manchester, Delaware.

Burke, Tom, M. E., Council Bluffs, Pottawattamie.


Burrows, J. M., C. E., Des Moines, Polk.

Cameron, E. A., E. E., Keswick, Keokuk.

Carpenter, J. C., C. E., Watertown, South Dakota.


Cave, J. H., C. E., Correctionville, Story.

Clapper, Leland, C. E., Ames, Story.

Clark, J. C., M. E., Ames, Story.

Clauson, C. C., Mn. E., Forest City, Winnebago.

Claxton, R. I., A. H., Randalla, Fayette.

Clayton, R. I., A. H., Forest City, Mitchell.

Clyde, Mary, 2 yr. G. & D. S., Osage, Wapello.

Cohagen, O. A., A. H., Blakesburg, Pocahontas.

Cooper, A. R., E. E., Laurens, Tama.

Cooper, H. J., E. E., Toledo, Madison.

Cooper, R. L., C. E., Winterset, Franklin.

Corning, S. T., A. H., Hampton, Story.


Coutts, R. V., M. E., Grinnell, Grundy.

Crouse, R. W., A. H., Dyke, Linn.

Crum, R. W., C. E., Cedar Rapids, Story.

Cutler, F. G., A. H., Ames, Linn.

Daniels, Arthur, C. E., Marion, Polk.

Danielson, W. A., E. E., Des Moines, Sac.

Davenport, Mary, Sc., Odebolt, Sac.


Dickey, A. J., E. E., Cedar Falls, Black Hawk.

Dudgeon, W. S., Sc., Hedrick, Keokuk.

Dunham, F. B., Sc., Manchester, Delaware.

Eastman, W. R., Hort., Nashua, Chickasaw.

Elliott, Jesse, Dairy, Woodward, Dallas.

Ellis, L. W., Agron., Anamosa, Jones.

Elwood, W. D., E. E., Sac City, Sac.

Entwhistle, Edith, 2 yr. G. & D. S., Rutland, Humboldt.

Fleming, R. C., E. E., Storm Lake, Buena Vista.


Forsbeck, C. D., C. E., Gray, Audubon.

Fraser, Edith, G. & D. S., Tipton, Cedar.

Gearhart, F. C., Vet., Hillssworth, Hamilton.


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Greer, Floy, G. & D. S., Ames, Story.
Greer, Shelton, C. E., Marlon, Linn.
Grimm, Irving, C. E., Clear Lake, Cerro Gordo.
Guthrie, C. B., Hort., Coin, Page.
Guthrie, E. S., Dairy, Coin, Page.
Hall, A. G., C. E., Moravia, Appanoose.
Hallowell, Ada, G. & D. S., Dow City, Crawford.

Healy, W. H., E. E., Britt, Hancock.
Heisey, C. J., A. H., Monticello, Jones.
Hennninger, C. E., C. E., Council Bluffs, Pottawattamie.
Herr, Gertrude, Sc., Ames, Story.
Hicks, L. J., E. E., Monticello, Jones.
Hoebel, O. L., C. E., Blairstown, Benton.
Holden, C. L., Sc., Cherokee, Cherokee.
Howard, H. M., C. E., Red Oak, Montgomey.
Hughes, James, E. E., Strawberry Pt., Cherokee.
Hurd, Elmer, E. E., Wood River, Nebraska.
Jackson, Mae, Sc., Knoxville, Marion.
Jones, M. F., M. E., Collins, Story.
Kennedy, Maud, G. & D. S., Grinnell, Poweshiek.
King, P. M., M. E., Winfield, Henry.
Kirkpatrick, R. Z., C. E., Manning, Calhoun.
Lage, John, C. E., Keosauqua, Van Buren.
Landes, C. C., E. E., Meltonville, Worth.
Larson, C. W., A. H., Hampton, Franklin.
Leonard, Emma, D. S., Montezuma, Poweshiek.
Lewis, O. E., C. E., Pueblo, Colorado.
Lewis, Pearl, 2 yr. G. & D. S., Frederickburg, Chickasaw.
Lindeman, L. H., E. E., Newton, Jasper.
Lister, Lily M., Sc., Ames, Story.
Long, L., A. H., Clinton, Clinton.
Ludens, David, C. E., Postville, Allamakee.
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Madsen, Emma, Sc., Johnson.
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Smith, Earle D., Dairy, Galva, Ida.
Snavely, W. A., E. E., Center Point, Johnson.
Snyder, D. C., E. E., Walnut, Linn.
Stahl, Charles, M. E., Lowden, Pottawattamie.
Stanton, Edgar W., C. E., Ellsworth, Story.
Stebbins, A. W., M. E., Packwood, Hamilton.
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Troup, James, E. E., Ames, Story.
Tunis, T. L., E. E., Mitchellville, Story.
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Walters, H. L., E. E., Keokuk, Story.
Watters, V. G., C. E., West Liberty, Pottawattamie.
Whallon, Paul, E. E., Battle Creek, Van Buren.
Whitacre, R. D., E. E., West Liberty, Minnesota.
White, Fred, C. E., Keosauqua, Scott.
Whitehead, D. V., C. E., Pipestone, Hardin.
Wichman, Jno., E. E., Davenport, Story.
Willitts, E. V., A. H., Union, Buena Vista.
Wilson, Fred W., C. E., Atlantic, Story.
Wilson, L. H., M. E., Denmark, Lee.
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Mills.
Calhoun.
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Benton.
Dow, H. J., C. E., Des Moines, Polk.
Drennan, R. E., A. H., Mt. Etna, Adams.
Dunlap, L. B., Vet., Shannon City, Union.
Elwood, Charles, E. E., Sac City, Sac.
Farmer, I. W., C. E., Montezuma, Poweshiek.
Fitts, A. C., A. H., Tipton, Story.
Fitzgerald, John W., E. E., Ames, Madison.
Forman, Elva, G. & D. S., Earlham, Cedar.
Francis, Will, C. E., Ames, Story.
Fraser, Clara, G. & D. S., Tipton, Madison.
Freed, Oscar, Vet., Ames, Cedar.
Freeland, C. H., C. E., Onawa, Story.
Freeman, J. H., E. E., Hazleton, Monona.
French, Leslie R., C. E., Hawarden, Buchanan.
Frudden, C. E., M. E., Charles City, Sioux.
Fuhrmeister, Ralph S., A. H., Cedar Rapids, Floyd.
Fuller, LeRoy, A. H., Bagley, Linn.
Garberson, L. D., Sc., Ames, Guthrie.
Gearhart, Ralph E., E. E., Corydon, Story.
Gill, Walden, E. E., Des Moines, Hamilton.
Gourley, C. M., Vet., Ames, Polk.
Graham, Guy G., C. E., Montgomery.
Gray, Roy B., E. E., Des Moines, Story.
Gray, J. B., C. E., Villisca, Polk.
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Green, S. Rex, C. E., Des Moines, Illinois.
Greiner, Charles T., Vet., Morrison, Jones.
Griggs, E. V., E. E., Onslow, Floyd.
Griswold, Donald T., Agron., Charles City, Hamilton.
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Hanson, H. B., M. E., Nevada, Story.
Harris, T. T., E. E., Des Moines, Polk.
Haskell, E. S., Agron., Des Moines, Polk.
Hayden, Ada, Sc., Ames, Polk.

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Patton, M. C., C. E., Newton, Jasper.
Paulson, Fred, E. E., Avoca, Pottawattamie,
Paulson, Leonard, C. E., Triumph, Minnesota.
Peek, Welton, A. H., Paulina, O'Brien.
Perry, J. B., M. E., LeMars, Plymouth.
Petersen, J. B., E. E., Morrison, Illinois.
Petersen, W. A., C. E., Ames, Story.
Phillips, C. J., C. E., Clarence, Cedar.
Phillips, Howard, A. H., Maquoketa, Jackson.
Powers, George, C. E., Boone, Boone.
Price, W. A., C. E., Clinton, Clinton.
Pullen, M. W., E. E., Onawa, Monona.
Quigley, J. H., M. E., McGregor, Clayton.
Rail, Ellis, A. H., Birmingham, Van Buren.
Randall, W. W., E. E., Rockwell City, Calhoun.
Powers, George, M. E., Parkersburg, Butler.
Pullen, M. W., M. E., Muscatine, Muscatine.
Quigley, J. H., A. H., Corydon, Wayne.
Rail, Ellis, C. E., Storm Lake, Buena Vista.
Randall, W. W., C. E., Council Bluffs, Pottawattamie.
Rea, Florence, Mn. E., Sloan, Woodbury.
Powers, George, C. E., Des Moines, Polk.
Pullen, M. W., M. E., Williams, Hamilton.
Rail, Ellis, Hort., Eagle Grove, Wright.
Rea, Florence, A. H., Minden, Pottawattamie.
Powers, George, Sc., Boone, Boone.
Pullen, M. W., C. E., Avoca, Boone.
Quigley, J. H., C. E., Alton, Pottawattamie.
Rail, Ellis, C. E., Nevada, Sioux.
Powers, George, A. H., Mt. Ayr, Emmett.
Quigley, J. H., C. E., Cherokee, Kossuth.
Rail, Ellis, M. E., Grant City, Cherokee.
Randall, W. W., E. E., Carnforth, Sac.
Powers, George, E. E., State Center, Story.
Pullen, M. W., E. E., Ottumwa, Jones.
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Smith, T. W., E. E., Renwick, Humboldt.
Sones, C. M., E. E., Anamosa, Jones.
Soukup, Edw., E. E., Cedar Rapids, Linn.
Sparks, Cliff, G. & D. S., Boone, Jasper.
Sparks, Mary, M. E., Pasedena, Boone.
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Stelle, A. C., E. E., Camanche, California.
Stevens, John E., E. E., Camanche, Boone.
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Trout, Shelley, E. E., Shenandoah, Fayette.
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White, E. L., Sc., Corydon, Wayne.
Wieland, Albert, M. E., Gladbrook, Tama.
Willett, Tom, Mn. E., Decorah, Winneshiek,
Williams, J. R., A. H., Postville, Allamakee,
Williams, P. R., E. E., Clear Lake, Cerro Gordo,
Wilson, Harriett B.,

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Zimmerman, Phoebe, G. & D. S., Ames, Ohio.

Zorn, H. E., M. E., Montezuma, Story.

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Abrahamson, J.,
Ady, James,
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Alexander, Geo. W.,
Alexander, Rolla,
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Allen, Frances,
Alyea, C. W.,
Anderson, F. H.,
Anderson, Gurine,
Bader, Gottllet,
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Bek, Hugh E.,
Benson, Joseph,
Bentley, Con,

COURSE.
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TOWN.
Morning Sun,
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Stanhope,
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Seward,
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Blubacher, R. R., C. E., Storm Falls, Black Hawk.
Buchanan, H. S., C. E., Denver, Buena Vista.
Buckman, A. W., E. E., Calamus, Colorado.
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Clauson, V. C., Mn. E., Forest City, Linn.
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Corneliussen, F. C., Sc., Story City, Tama.
Cort, E. G., A. H., Huron, Wapello.
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Darling, Eugene, E. E., Dubuque, Dubuque.
Davis, Guy, A. H., Fonda, Pocahontas.
Davis, J. S., Agron., Scranton, Greene.
Demary, Lewis, C. E., Corning, Adams.
Dixon, Vera, M. E., Seney, Plymouth.
Doaden, H., Sc., Sac City, Sac.
Dorman, E. D., M. E., George, Lyon.
Dreher, Genevieve, G. & D. S., Scranton, Hardin.
Dunham, Ralph, A. H., Dunlap, Greene.
Wheeler, Delbert, C. E., Ireton, Sioux.
White, E. L., Sc., Corydon, Wayne.
White, J. F., Agron., Perry, Dallas.
Wieland, Albert, M. E., Gladbrook, Tama.
Willet, Tom, Mn. E., Decorah, Winneshiek.
Williams, J. R., A. H., Postville, Allamakee.
Williams, P. R., E. E., Clear Lake, Cerro Gordo.
Wilson, Harriett B., G. & D. S., Hedrick, Keokuk.
Winkelhaus, L. C., C. E., Clinton, Clinton.
Wolfe, Frank, Vet., Shannon City, Union.
Wood, Asa, C. E., Garner, Hancock.
Wood, C. R., C. E., Corwith, Hancock.
Woodruff, J. D., Sc., Storm Lake, Buena Vista.
Wright, John, C. E., Eagle Grove, Wright.
Wuestenberg, O. R., M. E., Eldridge, Scott.
Zentmire, Frank, A. H., Oakland, Pottawattamie.
Zimmerman, Phoebe, G. & D. S., Ames, Story.
Zorn, H. E., M. E., Montezuma, Poweshiek.
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Gethmann, Charles, M. E., Gladbrook.
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Hills, Mamie, G. & D. S., Stuart.
Hitchcock, Rex B., M. E., Greenfield.
Hofmann, George, M. E., Ottumwa.
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STUDENTS OF THE COLLEGE

Hollister, Olivia, D. S., Des Moines.
Holt, Ed., M. E., Story City,
Homeman, Herman, A. H., Des Moines,
Hopkins, K. M., E. E., Villisca,
Horn, M. R., A. H., Douds-Leando,
Hummel, F. L., M. E., Newton,
Huxtable, E. C., M. E., Newell,
Igo, Roy, A. H., Indianola,
Ines, Leon, C. E., Sinaite, Ilocos,
Jamison, F. H., E. E., Oelwein,
Jepson, A. O., A. H., Des Moines,
Johnson, W. E., M. E., Story City,
Jones, Charles H., Story,
Jones, Frank, Polk.
Jones, Gertrude, Montgomery,
Jones, H. B., Van Buren.
Ka Del, Orpha, Jasper.
Kemp, Ward, Buena Vista.
King, J. N., Warren.
Kirkpatrick, K. A., Polk.
Knoche, A., Story.
Knowles, Frank, Scott.
Knox, R. B., Polk.
Knudson, M. N., Montgomery.
Koester, C. H., Madison.
Kruel, A. H., Pocahontas.
Kruise, J. H., Crawford.
Kuebler, L. J., Clinton.
Kyhl, Louis, Jackson.
Lackey, A. J., Floyd.
Langwill, Wm., Story.
Lau, Oscar M., Scott.
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Lieberknecht, Arthur, Louisa.
Lieberknecht, Ernest, Louisa.
Long, George, Story.
Long, Robert J., Plymouth.
Loring, David M., Johnson.
Loudermilk, H., Polk.
Lynch, Joe, Plymouth.
Magsaysay, Ambrosia, Philippine IIds.
Maine, Kenneth, Polk.
Martin, Helen, G. & D. S., Jasper.
Marshall, C., Pocahontas.
Mason, L. N., Hamilton.
Matter, Otto, Polk.
Maynard, R. N., Cherokee.
McBurney, Eva L., Story.
McCord, Bradley, M. E.
McCulloch, D. E., E. E.
McDonald, R. G., A. H.
McElhinney, Ralph, E. E.
McEwen, Philip H., M. E.
McKibben, Guy, Sc.
McKim, F. A., A. H.
McMillan, Leslie E., Agron.
McNeal, Will, E. E.
McSweeney, Henry, C. E.
Meinhardt, Hugh, E. E.
Merrill, J. W., A. H.
Metcalf, J. F., A. H.
Michaelson, Walter M., C. E.
Miller, Philip W., C. E.
Milligan, F. R., E. E.
Mills, A. D., M. E.
Milton, I. W., E. E.
Mollyneaux, Guy, Mn. E.
Mondroenedo, Marino M.,
Morado, Ciriacas, A. H.
Monroe, C. R., A. H.
Moody, J. G., E. E.
Moore, L. J., E. E.
Morrison, G. W., M. E.
Naiden, Fred, Sc.
Nelson, Lawrence A., A. H.
Nichols, C. S., E. E.
Nichols, T. C., C. E.
Nicholson, Edith, M. E.
Nicholson, N. J., Sc.
Ogle, Margaret, C. E.
Okey, C. W., M. E.
Oliver, Florentine, E. E.
O'Reilly, D. O., C. E.
Orr, Robert, C. E.
Overbaugh, Tom, E. E.
Packer, E. E., E. E.
Packman, M. E., E. E.
Payne, Rodney, A. H.
Paine, Roger, Sc.
Palmer, Maude L., C. E.
Parsons, F. W., E. E.
Phillips, J. T., C. E.
Pickworth, E. A., A. H.
Pieper, Fred, A. H.
Platner, C. R., M. E.
Pollock, Ivan, C. E.
Polzler, Elmer H., M. E.
McCord, Bradley, Harlan.
McCulloch, D. E., Donaldson.
McDonald, R. G., Florence.
McElhinney, Ralph, Dysart.
McEwen, Philip H., Plover.
McKibben, Guy, Storm Lake.
McKim, F. A., Ames.
McNeal, Will, Cherokee.
McSweeney, Henry, Westgate.
Meinhardt, Hugh, Donaldson.
Merrill, J. W., Ames.
Metcalf, J. F., Paulina.
Michaelson, Walter M., Gilbert.
Miller, Philip W., Ames.
Milligan, F. R., Hiteman.
Mills, A. D., Central City.
Milton, I. W., Stanwood.
Mollyneaux, Guy, Correctionville.
Mondroenedo, Marino M.,
Morado, Ciriacas, Nipabatanga.
Monroe, C. R., Garden Grove.
Moody, J. G., Cedar.
Moore, L. J., Newton.
Morrison, G. W., Altoona.
Naiden, Fred, Woodward.
Nelson, Lawrence A., Harlan.
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Nichols, T. C., Marshalltown.
Nicholson, Edith, Ralston.
Ogle, Margaret, Ames.
Okey, C. W., Prescott.
Oliver, Florentine, Nuera, Caceres.
O'Reilly, D. O., Vail.
Orr, Robert, St. Francisville.
Overbaugh, Tom, Cedar Rapids.
Packer, E. E., Marshalltown.
Packman, M. E., Eagle Grove.
Payne, Rodney, Movile.
Paine, Roger, Eagle Grove.
Palmer, Maude L., Deep River.
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Phillips, J. T., Hiteman.
Pickworth, E. A., Minden.
Pieper, Fred, Council Bluffs.
Platner, C. R., Libertyville.
Pollock, Ivan, Anamosa.
Polzler, Elmer H., Ames.
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Relgard, Fay O., Sc., Spirit Lake, Dickinson.
Remington, Harry, Sc., Mt. Auburn, Benton.
Rice, Dora, Sc., Ames, Story.
Riedesel, R. C., M. E., Charter Oak, Crawford.
Rogers, J. H., C. E., Council Bluffs, Pottawattamie.
Rogers, R. D., C. E., Cedar Falls, Black Hawk.
Rolph, James M., E. E., Little Sioux, Harrison.
Roman, E. G., M. E., Clinton, Clinton.
Rounds, C. E., M. E., Hiteman, Monroe.
Rust, W. D., A. H., Newell, Buena Vista.
Sanborn, H. G., C. E., Belle Plaine, Benton.
Sanders, J. S., A. H., Ames, Story.
Sauerberg, C. G., M. E., Mason City, Cerro Gordo.
Saul, W. I., E. E., Carroll, Carroll.
Schelm, Mattie, Sc., Charter Oak, Crawford.
Schnaft, Wm. F., A. H., Baxter, Jasper.
Schregardus, Dirk, E. E., Prairie City, Jasper.
Sexton, Perlee, E. E., West Liberty, Muscatine.
Sharp, Omer, Sc., Dows City, Crawford.
Shinkle, Martha, G. & D. S., C. E., Ame.
Shirley, Will, C. E., Minburn, Dallas.
Shoals, J. W., A. H., Valiant, Indian Terri.
Schultz, Chester, C. E., Des Moines, Polk.
Simmons, Clark, E. E., Macksburg, Madison.
Smith, F. S., Sc., Riverton, Fremont.
Starr, M. B., E. E., Pocahontas, Pocahontas.
St. Clair, Fred, Sc., Mt. Auburn, Benton.
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Strickler, Paul, A. H., Centerville, Appanoose.
Swanson, C. A., M. E., Fremont, Mahaska.
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Tiara, Bessie, Sc., Ankeny, Polk.
Trullinger, S. B., C. E., Farragut, Fremont.
Upham, Glenn O., C. E., Des Moines, Polk.
Vanglist, Peter, M. E., Kilduff, Jasper.
Velander, Verne, M. E., Stanton, Montgomery.
Walston, Luverna, D. S., Wyoming, Jones.
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Wike, Ed.,
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### ENROLLMENT FOR SPECIAL COURSES IN STOCK AND GRAIN JUDGING, JANUARY, 1905.

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Maxwell,
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Auburn,
Langdon,
Volga,
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Indianola,
webster City,
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Clermont,
Tipton,
Diagonal,
Diagonal,
Luverne,
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Belle Plaine,
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Protivin,
New York,
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Corning,
Brich, P. H., Ames, Story.
Brick, C. A., Red Oak, Montgomery.
Brindle, J. P., Union, Hardin.
Brockway, A. H., Grundy Center, Cedar.
Brockway, J. M., Letts, Tama.
Brooks, F. H., Hampton, Louisa.
Brownlie, R. A., Fairfax, Franklin.
Brooks, C. V., Hillsdale, Benton.
Brown, H. E., Salix, Mills.
Brown, L. D., Benson, Woodbury.
Brunner, W., Rolfe, Black Hawk.
Burns, Clifford, Sioux Rapids, Pocahontas.
Burns, S. J., Orion, Illinois.
Byam, Perry, Marshall.
Cabrera, B. B., Buenos Ayres, Cerro Gordo.
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Cain, E. B., Delmar, Clinton.
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Callahan, P. J., Welton, Clinton.
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Hoover, E.,
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Hutchison, B.,
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Ineck, E. W.,
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Miller, W.,
Mills, J. W.,
Montgomery, F. B.,
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Morris, J. N.,
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Nelson, Chas.,
Nelson, Nels,
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Nienaber, E. C.,
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Olson, O.,
Orr, J. W.,
Palmer, F. A.,
Palmer, J. C.,
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Parkinson, John,
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Pederson, W.,
Peterson, O.,
Perkins, W.,
Person, L. C.,
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Powers, H. O.,
Powers, J. F.,
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Redfern, F.,
Redfern, R.,
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Reichenbach, F. A.,
Reno, M.,
Renshaw, F.,
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Mt. Vernon,
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Shieldahl,
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Williams, J. A.,
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Wingert, P. E.,
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Winslow, T. H.,
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*T. L. Thompson, B. S.
C. H. Tillotson, B. S., Ormund, Nebraska.
*C. P. Wellman, B. S.
John M. Wells, B. S., Nevada, Iowa.

GRADUATES OF 1873.

Edward L. Beard, B. S., R. F. D., 5, Decorah, Iowa.
Rowena (Edson) Stevens, B. S., 728 Linn Street, Boone, Iowa.
*G. R. Flower, B. S.,
W. Green, B. S., Hort. Dept., Capitol Bldg., Des Moines, Iowa.
*G. W. Harvey, B. S.,
Kate (Krater) Starr, B. S., Algona, Iowa.
*J. S. Lee, B. S.
Chas. B. Maben, B. S., Wealthwood, Minnesota.
M. F. Marshall, B. S., Atwood, Kansas.*

GRADUATES OF 1874.

Estella (Bebout) Morse, B. S., Main St., Sevastapol, Des Moines, Iowa.

C. D. Boardman, B. S., Okeene, Oklahoma.

Chas. S. Chase, B. S., 517 Franklin Street, Waterloo, Iowa.

Chas. E. Clingan, B. S., 814 Sixth Street, Sioux City, Iowa.

E. R. Clingan, B. S., Belt, Montana.

*C. P. Hastings, B. S.

George W. Kiesel, B. S., 57 Highland Place, Dubuque, Iowa.

M. C. Litteer, B. S., Yukon, Oklahoma.

G. E. Marsh, B. S., Osage, Iowa.

O. P. McCray, B. S., 620 Fourth Street, Sioux City, Iowa.*

Mary (Palmer) Snell, B. S., 711 Crawford Street, Boone, Iowa.

A. A. Parsons, B. S., 326 Nevada Ave., Colorado Springs, Colorado.

Eva (Paull) Vanslyke, B. S., 1406 Tenth Street, Des Moines, Iowa.*

E. A. Pyne, B. S., Waverly, Iowa.

Ida (Smith) Noyes, B. S., 234 Lincoln Park Blvd., Chicago, Ill.


Kate (Tupper) Galpin, B. S., 520 N. Ave., 64 Los Angeles, Calif.

J. R. Whitaker, B. S., 703 Carroll Street, Boone, Iowa.

*S. Y. Yates, B. S.

GRADUATES OF 1875.

E. P. Cadwell, B. S., Manila, P. I.*

Millah (Cherrie) Whiting, B. S., 636 Thirtieh Ave., Denver, Colo. Alice (Cunningham) Culver, B. S., Knoxville, Iowa.*

Lizzie (Curtis) Foster, B. S., Masilla Park, Las Cruces, N. M.*

R. P. Kelley, B. S., Helena, Montana.*

C. H. Lee, B. S., 411 McPhee Block, Denver, Colorado.*

W. R. L amoreaux, B. S., Los Angeles, California.*

Hannah (Lyman) Cadwell, B. S., Helena, Montana.*

Frank J. Macomber, B. S., Lewis, Iowa.

Celestia (Neal) Gearhart, B. S., 359 Grand Ave., Astoria, Oregon.

T. L. Palmer, B. S., 614 Kirby Street, Lake Charles, Louisiana.


C. E. Peterson, B. S., Panora, Iowa.

*Ida (Ross) Boardman, B. S.

M. E. Rudolph, B. S., Canton, So. Dakota.

Ida (Sherman) Caulkins, B. S., Storm Lake, Iowa.

L. C. Thornton, B. S., Pocahontas, Iowa.*

Nancy (Wills) Roundy, B. S., Hawarden, Iowa.*

Lizzie (Wilson) Edwards, B. S., Waterloo, Iowa.*

J. M. Whitaker, B. S., 12 East Main Street, Marshalltown, Iowa.
GRADUATES OF 1876.

Martin I. Aitken, B. S., 1812 F. Street, Lincoln, Nebraska.
Arthur P. Barker, B. S., 318 Eighth Street, Clinton, Iowa.
L. W. Beard, B. S., Decorah, Iowa.*
A. M. Blodgett, B. S., 405 Thayer Building, Kansas City, Missouri.
Julia (Blodgett) Hainer, B. S., Aurora, Nebraska.
*L. A. Clausen, B. S.
J. E. Cobbey, B. S., 1505 South Third Street, Beatrice, Nebraska.
W. S. Collins, B. S., Basin, Wyoming.*
Winifred (Dudley) Shaw, B. S., 1700 4th St., Des Moines, Iowa.
J. J. Feggley, B. S., 211 South Main Street, Wichita, Kansas.
William T. Gilmore, B. S., 620 Fifth Street, Tipton, Iowa.
James F. Hardin, B. S., Eldora, Iowa.
Ella (Harlow) McKinzie, B. S., Cor. Elm and Twenty-third Street, Spokane, Washington.
A. E. Hitchcock, B. S., Mitchell, So. Dakota.
W. M. James, B. S., Meridan, Yucutan.*
Ella (Mead) Dissmore, B. S., Dissmore, No. Dakota.
G. A. Gerard, B. S., Denver, Colorado.*
H. N. Scott, B. S., 489 Jefferson Street, Portland, Oregon.
A. B. Shaw, B. S., 1700 Fourth Street, Des Moines, Iowa.
L. E. Spencer, B. S., 5725 Monroe Avenue, Chicago, Illinois.
W. W. Woodward, B. S., Lincoln, Nebraska.*

GRADUATES OF 1877.

F. W. Booth, B. S., 7342 Rural Lane, Mt. Airy, Philadelphia, Pa.
Alfa (Campbell) Fassett, B. S., 118 South Scoville Ave, Oak Park, Chicago, Illinois.
Mary (Carpenter) Hardin, B. S., Eldora, Iowa.
C. C. Colclo, B. S., Carroll, Iowa.
Kate (Curtis) Mirick, B. S., Monticello, Iowa.
J. W. Doxsee, B. S., Monticello, Iowa.
Mary (Farwell) Carpenter, B. S., Monticello, Iowa.
A. P. Hargrave, B. S., Armstrong, Iowa.
W. A. Helsell, B. S., Odebolt, Iowa.
J. B. Hungerford, B. S., Carroll, Iowa.
W. N. Hunt, B. S., Central City, Iowa.*
*R. F. Jordan, B. S.
*Cora B. (Keith) Pierce, B. S.
Edwin L. King, B. S., Osceola, Nebraska.
George I. Miller, B. S., 427 Story Street, Boone, Iowa.
Alice (Neal) Gregg, B. S., Traer, Iowa.
J. C. Milnes, B. S., 3546 Forest Avenue, Chicago, Illinois.
Cora (Patty) Payne, B. S., Linden, Iowa.
L. B. Robinson, B. S., 1010 Baldwin Street, Harlan, Iowa.
T. L. Smith, B. S., 134 Tenth Street, Milwaukee, Wisconsin.
F. L. Stratton, B. S., Osceola, So. Dakota.*
*H. M. White, B. S.
LIST OF GRADUATES

GRADUATES OF 1878.

*Florence (Brown) Martin, B. S.
Richard Burke, B. S., 221-223 First Ave., East, Oskaloosa, Iowa.
H. L. Glenn, B. S., 924 Eleventh Avenue, Helena, Montana.
A. E. Griffith, B. S., M. S., 703 Madison Ave., Council Bluffs, Iowa.
J. C. Hainer, B. S., M. S., 309 Security Bldg., St. Louis, Missouri.
Thomas F. Lee, B. S., Box 98, Lakeport, California.
C. E. Martin, B. C. E., San Antonio, Texas.*
J. C. Meridith, B. C. E., Kansas City, Missouri.*
C. F. Mount, B. C. E., C. E., Homewood, Penn.
J. N. Muncey, B. S., Jesup, Iowa.
Emma (McHenry) Glenn, B. S., 924 Eleventh Ave., Helena Mont.
David McKinnon, B. S., California, Iowa.
Ellen (Rice) Robbins, B. S., 290 McGregor St., Manchester, N. H.
Wm. K. Robbins, B. S., 290 McGregor St., Manchester, N. H.
L. (Shepherd) Beckwith, B. S., Garey, California.
Ida (Twitchell) Blockman, B. S., Santa Maria, California.
E. G. Tyler, B. C. E., Logan, Iowa.
G. W. Wilson, B. C. E., Rockwell, Iowa.*
J. W. Whitney, B. S., Prairieburg, Iowa.*
Belle Woods, B. S., Pueblo, Colorado.

GRADUATES OF 1879.

Malinda (Cleaver) Faville, B. S., 428 Pool St., Norfolk, Virginia.
*Carrrie (Carter) Hanson, B. S.
Lillie (Croy) Lee, B. S., 118 Oak Park, Chicago, Illinois.*
Frank N. Field, B. C. E., 715 Foster Street, Burlington, Iowa.
F. H. Friend. B. C. E., 897 Ashland Avenue, St. Paul, Minnesota.
Albert L. Hanson, B. C. E., Ada, Minnesota.
T. V. Hogatt, B. S., 308 Bush St., San Francisco, California.
L. L. Manwaring, B. S., 303 West Olive St., Stillwater, Minnesota.
W. G. McConnon, B. M. E., 1024 South Avenue, Wilkinsburg, Pa.
Jennie (McElyea) Beyer, B. S., 901 Kellogg Street, Ames, Iowa.
*J. C. Noble, B. S.
Herbert Osborne, B. S., M. S., 485 King Avenue, Columbus, Ohio.
James D. Shearer, B. S., 517 First Ave., So., Minneapolis, Minn.
Fremont Turner, B. M. E., 902 Sixteenth St., Des Moines, Iowa.
*Genevieve (Welch) Barstow, B. S.
Willis Whited, B. M. E., M. E., 286 Main Street, Pittsburg, Pa.
Alice (Whited) Burling, B. S., Eldora, Iowa.
GRADUATES OF 1880.

M. J. Bailey, B. S., Custer City, So. Dakota.*
D. D. Briggs, B. S., Nevada, Iowa.*
*F. Boddy, B. S.
O. S. Brown, B. S., Meservey, Iowa.
M. Hakes, B. S., Laurens, Iowa.
D. S. Hardin, B. S., Alma, Nebraska.
*E. D. Harvey, B. S.
J. Hassett, B. S., Papillion, Nebraska.*
Carrie (Lane Chapman) Catt, B. S., Park Row Bldg, New York, New York.

*C. H. McGrew, B. S.
*R. M. Nicholson, B. S.
*G. E. Reed, B. S.
J. L. Simcock, B. S., Adel, Iowa.*
W. A. Thomas, D. V. M., 645 North 13th Street, Lincoln, Nebraska.
J. Vincent, D. V. M., Shenandoah, Iowa.*
W. B. Welch, B. S., D. V. M., Marshall, Missouri.*

GRADUATES OF 1881.

W. C. Armstrong, B. C. E., C. E., 225 Central Ave., Wilmette, Ill.
Nellie (Bell) McGavern, B. S., Mo. Valley, Iowa.
A. M. Beresford, B. S., Orleans, Nebraska.
Thomas Burke, B. S., Baker City, Oregon.
Chas. M. Coe, B. S., Cor. 11th and Broadway, Kansas City, Mo.
Frank E. Colby, B. C. E., Onawa, Iowa.
*Marilla J. Crossman, B. S.
James S. Dewell, B. S., Mo. Valley, Iowa.
C. A. Dodge, B. C. E., Orange City, Iowa.
F. E. Furry, B. S., Alden, Iowa.
Mark J. Furry, B. S., Alden, Iowa.
Julia M. Hanford, B. S., 811 South Eleventh St., Tacoma, Wash.
*R. J. Hopkins, B. S.
W. O. McElroy, B. C. E., Newton, Iowa.
Jno. S. McGavern, B. S., Mo. Valley, Iowa.
Wm. H. McHenry, B. S., 2820 Cottage Grove Ave., Des Moines, IA.
Jennie (Perrett) Gault, B. S., Whitworth College, Tacoma, Wash.
Alice (Sayles) Osborn, B. S., 485 King Avenue, Columbus, Ohio
Thos. W. Shearer, B. S., M. S., Wallisville, Texas.

GRADUATES OF 1882.

W. D. Atkinson, B. S., 1605 Forrest Avenue, Parsons, Kansas.
*J. A. Blaine, B. S.
Etta M. Budd, B. S., Kellogg St., Ames, Iowa.
Geo. M. Catt, B. C. E., C. E., Park Row Bldg, New York, N. Y.
Mary (Coe) Lorbeer, B. S., 781 Holt Avenue, Pomona, California.
W. V. A. Dodds, B. S. 1207 North 7th Street, Beatrice, Nebraska.
W. M. Dudley, B. S., 300 Church Street, Shenandoah, Iowa.
H. J. Gable, B. S.
C. I. Lorbeer, B. S., 781 West Holt Avenue, Pomona, California.
J. B. Marsh, B. M. E., 1700 Ninth Street, Des Moines, Iowa.
E. A. McDonald, B. S., Box 2165, Mexico City, Mexico.
J. R. McKim, B. S., 304 Maple Avenue, Kansas City, Missouri.
Nellie (Merrill) Wheeler, B. S., 1715 Ninth St., Des Moines, Iowa.
Della A. Neal, B. S., 16 Augusta Avenue, Atlanta, Georgia.
J. H. Patten, B. S., Denver, Colorado.*
Hattie A. Perrett, B. S., Rock Falls, Iowa.
Lizzie Perrett, B. S., Rock Falls, Iowa.
O. C. Peterson, B. S., 7405 Princeton Avenue, Chicago, Illinois.
*Kitty E. Reeve, B. S.
C. F. Saylor, B. S., 1082 Twenty-first Street, Des Moines, Iowa.*
Sarah (Smith) McDonald, B. S., Box 2165, Mexico City, Mexico.
D. T. Stockman, B. S., Sigourney, Iowa.
W. S. Summers, B. S., Omaha, Nebraska.
W. W. Wheeler, B. S., 1715 Ninth Street, Des Moines, Iowa.

GRADUATES OF 1883.

A. M. Allen, B. S., 2116 Kenwood Boulevard, Minneapolis, Minn.*
A. G. Andrews, B. C. E., U. S. Surveyor General's Office,
Salt Lake City, Utah.
G. M. Burnham, B. S., Ashland, Wisconsin.
Luberta (Carson) Cleave, B. S., 224 Catherine St., Ottawa, Illinois.
George Caven, B. C. E., 45-154 Lake Street, Chicago, Illinois.
Virginia (Colclo) Quint, B. S., 1715 W. Ninth St., Des Moines, Ia.
George W. Curtis, B. S. A., M. S. A., Fort Worth, Texas.
C. M. Doxsee, B. S., Aligona, Iowa.*
*Lottie Estes, B. S.
*Jessie (Frater) Muncey, B. S.
H. M. Hunter, B. S., Sibley, Iowa.
Chas. H. Kegley, B. S. A., 970 Eighteenth Street, Oakland, Calif.
Minnie (Knapp) Mayo, B. S., 519 Pujo Street, Lake Charles, La.
Herman Knapp, B. S. A., Station A, Ames, Iowa.
Mary (McDonald) Knapp, B. S., Station A., Ames, Iowa.
Kate (McNeil) Wells, B. S., 1801 R. Street, Lincoln, Nebraska.
Elwood Mead, B. S., B. C. E., 1513 Rhode Island Avenue,
Washington, D. C.
A. M. Miller, B. S., 1314 E. Thirteenth Street, Des Moines, Iowa.*
Emily A. Reeve, B. S., 1909 Ninth Street, Des Moines, Iowa.
M. J. Riggs, B. C. E., 3136 Collingwood Avenue, Toledo, Ohio.
S. C. Scott, B. S., Lyons, Iowa.*
*Effie G. Slater, B. S.
F. J. Smith, B. S., 2311 Carpenter Avenue, Des Moines, Iowa.
M. E. Wells, B. S., 1801 R. Street, Lincoln, Nebraska.
W. D. Wells, B. S., 1716 Park Avenue, Davenport, Iowa.
Agatha (West) Ramsey, B. S., Rock Rapids, Iowa.
Mabel A. (Young) Alexander, B. S., Clarion, Iowa.

GRADUATES OF 1884.

J. F. Armstrong, B. S., Faulkton, So. Dakota.
Edna (Bell) Anderson, B. S., Mo. Valley, Iowa.
T. F. Bevington, B. S., Iowa Building, Sioux City, Iowa.*
Geo. R. Chatburn, B. C. E., 2850 P. St., Lincoln, Nebraska.
C. J. Clark, B. C. E., Denver, Colorado.*
J. E. Daugherty, B. C. E., 1420 W. Seventh St., Texarkana, Texas.
*W. P. Dickey, B. S.
L. M. Garrett, B. S., 703 West Seventh Street, Des Moines, Iowa.
J. W. Gill, B. C. E.
B. T. Hainer, B. S., 1002 E. Street, Perry, Oklahoma.
Hermine (Hainer) Gabel, B. S., 446 Hamilton Avenue, Palo Alto, California.
*A. E. (Henry) Quint, B. S., M. Ph.
G. B. Hibbs, B. S., Mitchellville, Iowa.
A. S. Hitchcock, B. S. A., M. S., 3363 Sixteenth Street, N. W., Washington, D. C.
E. J. Nichols, B. C. E., 407 Juan Linn Avenue, Victoria, Texas.
G. M. Osborn, D. V. M., 126 A. Avenue, East, Cedar Rapids, Iowa.
F. L. Pitman, B. C. E., Port Norfolk, Virginia.*
Addie (Rice) Hainer, B. S., Webster Groves, St. Louis, Missouri.
G. W. Thompson, B. C. E., Casey, Iowa.*
C. Vincent, B. S., 1812 Chicago Street, Omaha, Nebraska.
M. Vincent, B. S. A., Lake Charles, Louisiana.
Ione (Weatherby) Marsh, B. S., 1700 Ninth St., Des Moines, Ia.*
*W. J. Hicks, B. S.
W. H. Wier, B. S., Swan, Iowa.
Alfred Williams, B. C. E., Treadwell, Alaska.
Fannie R. Wilson, B. S., Charles City, Iowa.
G. W. Wormley, B. C. E., Newton, Iowa.

GRADUATES OF 1885.

C. S. Bowie, B. M. E., 105 South 10th Street, Tacoma, Washington.
Chas. A. Carey, B. S., D. V. M., Auburn, Alabama.
D. B. Collier, B. S. A., Durant, Iowa.
D. E. Collins, D. V. M., Beatrice, Nebraska.*
Geo. F. Goodnow, B. S., M. S., 220 Genesee St., Waukegan, Illinois.
W. A. Grow, B. S., Grantsville, Montana.
Willet M. Hays, B. S. A., University Farm, St. Anthony Park, Minnesota.

*E. N. Hill, B. M. E.

D. L. Hutchinson, B. C. E., 2245 Irving Street, Denver, Colorado.*
Hannah (Hutton) Shearer, B. S., Wallisville, Texas.
L. D. Jackson, B. M. E.
Mark E. Johnson, D. V. M., Corning, Iowa.
G. W. Knorr, B. S. A., Clarks Station, Kentucky.
*C. J. Lee, B. S.

Frank Leverett, B. S., 312 North Thayer St., Ann Arbor, Michigan.
J. C. Lipes, B. S., 815 Bedford Avenue, Brooklyn, New York.
J. B. C. Lockwood, B. C. E., 70 Dexter Horton Blvd., Seattle, Wash.
*Anna (McConnon) Bevington, B. S.

L. F. McCoy, B. C. E., 1202 Fourth Avenue, Spokane, Washington.
Anna (Nichols) Goodnow, B. S., 537 Genesee St., Waukegan, Ill.
Oak G. Norton, B. S. A.

J. G. Pope, B. M. E., 857 Nineteenth St., Oakland, California.
Emma (Porter) Sloan, B. S., Geneva, Nebraska.
A. U. Quint, B. S., 1715 West Ninth Street, Des Moines, Iowa.

I. B. Schreckengast, B. S., Washington, Iowa.
Lydia (Schreckengast) Collier, B. S., Durant, Iowa.
S. Stewart, D. V. M., Kansas City, Kansas.*
C. E. Underhill, B. S., Onawa, Iowa.

GRADUATES OF 1886.

J. W. Bradford, B. C. E., 10255, Elizabeth Street, Chicago, Illinois.
H. L. Chatterton, D. V. M., Peterson, Iowa.
S. D. Clough, B. S., Pine Bluffs, Arkansas.*
M. Z. Farwell, B. S., La Junta, Colorado.
*V. C. Gambell, B. S.

W. E. Gamble, B. S., 100 State Street, Chicago, Illinois.
G. W. Greene, B. S. A., 1702 North 26th St., South Omaha, Neb.
W. B. Hunter, B. S., Buffalo, New York.*
A. P. Johnson, B. C. E., Sigourney, Iowa.
E. S. Johnson, D. V. M., Morning Sun, Iowa.
<table>
<thead>
<tr>
<th>Name</th>
<th>Address/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lizzie Langfitt</td>
<td>2650 Cottage Grove Ave., Des Moines, Iowa.</td>
</tr>
<tr>
<td>H. J. Langfitt</td>
<td>Hutchinson, Minnesota.</td>
</tr>
<tr>
<td>E. P. Niles</td>
<td>2109 North Tenth St., Kansas City, Kansas</td>
</tr>
<tr>
<td>M. H. Reynolds</td>
<td>St. Anthony Park, Minnesota.</td>
</tr>
<tr>
<td>E. S. Richman</td>
<td>Fullerton, California.</td>
</tr>
<tr>
<td>H. S. Stewart</td>
<td>Texarkana, Texas.*</td>
</tr>
<tr>
<td>J. J. Streets</td>
<td>Los Angeles, California.*</td>
</tr>
<tr>
<td>Cora (Wagner) Hunter</td>
<td>Des Moines, Iowa.*</td>
</tr>
</tbody>
</table>

### GRADUATES OF 1887.

<table>
<thead>
<tr>
<th>Name</th>
<th>Address/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. Z. Barnes</td>
<td>315-319 Elizabeth Street, Pekin, Illinois.</td>
</tr>
<tr>
<td>S. A. Beach</td>
<td>Geneva, New York.</td>
</tr>
<tr>
<td>*R. C. Bennett</td>
<td>D. V. M.</td>
</tr>
<tr>
<td>Emil Besser</td>
<td>Remington, Indiana.</td>
</tr>
<tr>
<td>C. M. Canady</td>
<td>Ambridge, Penn.</td>
</tr>
<tr>
<td>Emma (Casey) Scofield</td>
<td>Glendora, California.</td>
</tr>
<tr>
<td>E. J. Christie</td>
<td>Cedar Rapids, Iowa.</td>
</tr>
<tr>
<td>*S. B. Clark</td>
<td>D. V. M.</td>
</tr>
<tr>
<td>*C. J. Cotey</td>
<td>B. S.</td>
</tr>
<tr>
<td>G. H. Colton</td>
<td>416 18th Ave, North, Seattle, Washington</td>
</tr>
<tr>
<td>Esther Crawford</td>
<td>855 Fairmont Street, Cleveland, Ohio.</td>
</tr>
<tr>
<td>C. F. Curtiss</td>
<td>Station A, Ames, Iowa.</td>
</tr>
<tr>
<td>A. C. Felt</td>
<td>Superior, Nebraska.</td>
</tr>
<tr>
<td>C. W. Ferguson</td>
<td>Chappell, Nebraska.</td>
</tr>
<tr>
<td>*W. H. Frater</td>
<td>D. V. M.</td>
</tr>
<tr>
<td>G. S. Govier</td>
<td>Argentine, Kansas.</td>
</tr>
<tr>
<td>F. H. Graves</td>
<td>Madrid, Iowa.</td>
</tr>
<tr>
<td>Norma (Hainer) Beach</td>
<td>Geneva, New York.</td>
</tr>
<tr>
<td>N. E. Hansen</td>
<td>Brookings, D. Dakota.</td>
</tr>
<tr>
<td>L. V. Harpel</td>
<td>Boone, Iowa.</td>
</tr>
<tr>
<td>F. W. Hoskins</td>
<td>Beresford, So. Dakota.</td>
</tr>
<tr>
<td>*W. S. Igo</td>
<td>D. V. M.</td>
</tr>
<tr>
<td>E. A. Kirkpatrick</td>
<td>Fitchburg, Mass.</td>
</tr>
<tr>
<td>F. W. Malley</td>
<td>Garrison, Texas.</td>
</tr>
<tr>
<td>O. E. McCarthy</td>
<td>La Porte City, Iowa.</td>
</tr>
<tr>
<td>A. E. Osborne</td>
<td>B. S., M. Ph., Peterboro, No. Carolina.*</td>
</tr>
<tr>
<td>L. G. Patty</td>
<td>D. V. M., 120 East Fifth Street, Carroll, Iowa.</td>
</tr>
<tr>
<td>Joseph Paxton</td>
<td>203 West Hallam Street, Aspen, Colorado.</td>
</tr>
<tr>
<td>J. A. Perley</td>
<td>Peterboro, No. Carolina.*</td>
</tr>
<tr>
<td>W. A. Peterson</td>
<td>3046 Wentworth Avenue, Chicago, Illinois.</td>
</tr>
<tr>
<td>C. L. Spencer</td>
<td>Jacksonville, Florida.</td>
</tr>
<tr>
<td>G. W. Sturtz</td>
<td>Plainview, Nebraska.</td>
</tr>
<tr>
<td>R. P. Thurtle</td>
<td>Ashawa, Iowa.</td>
</tr>
<tr>
<td>John Tillie</td>
<td>Muscatine, Iowa.</td>
</tr>
</tbody>
</table>
Olive (Wilson) Curtiss, B. L., Station A Ames, Iowa.
J. W. Wilson, D. V. M., Traer, Iowa.

GRADUATES OF 1888.

J. G. Abraham, B. S., R. F. D. No. 1, Mt, Pleasant, Iowa.
J. B. Allen, B. S., R. F. D. No. 4, Codaz, Nebraska.
Clarence Baker, B. C. E., 415 East State Street, Centerville, Iowa.
Ethel Bartholomew, B. L., Charlton, Iowa.
Chas. L. Bartholomew, B. S., 622 E. 18th St., Minneapolis, Minn.
Scott, Bradford, B. S., Storm Lake, Iowa.
A. Brandvig, B. S., 331 North Wapello Street, Ottumwa, Iowa.
G. L. Buffington, D. V. M., Brooklyn, Iowa.
J. G. Davidson, B. M. E., 529 West 60th Street, Chicago, Illinois.
F. L. Dobbin, B. S., State Center, Iowa.
*C. A. Finnegan, B. C. E.
Grant Flora, B. C. E., 120 E. Lincoln Street, Estherville, Iowa.
W. N. Gladson, B. M. E., 820 W. Maple St., Fayetteville, Arkansas.
K. H. Granger, B. S., 129 Pleasant Street, South Weymouth, Mass.
James E. Gyde, B. S., Wardner, Idaho.
Ella (Henderson) Bartholomew, B. L., 622 E. Eighteenth Street, Minneapolis, Minnesota.
Chas. W. Hunt, B. S., Logan, Iowa.
F. L. Lightner, B. S., Louisiana.
Elizabeth (McClusky) Morrison, B. L., 619 First Avenue, Council Bluffs, Iowa.
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W. L. Thompson, B. S., Bayard, Iowa.
L. C. Tilden, B. S., Kellogg St., Ames, Iowa.
W. E. Warwick, B. M. E., Whiting, Indiana.
Nannie E. Waugh, B. L., Manchester, Iowa.
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Julia (Wentch) Stanton, B. L., Station A, Ames, Iowa.
W. H. Wright, B. S.
Sherman Yates, B. S., Tipton, Iowa.

GRADUATES OF 1889.

C. A. Ashworth, D. V. M., Valley Junct., Iowa.
James A. Baker, B. S., Muskogee, Indian Ter.
J. E. Banks, B. C. E., 271 Fisk Street, Pittsburg, Pennsylvania.
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*A. E. D. Bosquet, D. V. M.
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*H. W. Chamberlain, B. S.
*F. H. Cooley, B. C. E.
Harry B. Day, B. M. E., New Madrid, Missouri.
J. E. Durkee, B. S., Sioux Rapids, Iowa.
H. A. Gossard, B. S., Wooster, Ohio.
B. T. Green, B. S., Brookings, S. Dakota.
Wm. R. Hensen, B. S., Chinoook, Montana.
Nellie Johnson, B. L., Edmonds, Oklahoma.
James A. Kelsey, B. S., M. S., Dunlap, Iowa.
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S. W. Morris, B. S., Corning, Iowa.
John Mcbirney, D. V. M., Clarinda, Iowa.
Albert McClelland, B. S., Runnells, Iowa.
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Belle Newell, B. L., Woodward, Iowa.
I. A. Nichols, B. S., Iowa Falls, Iowa.
W. H. Rickard, B. C. E., Texarkana, Arkansas.*
P. H. Rolfs, B. S., M. S., Miami, Florida.
*John Schoenleber, B. M. E.
W. U. Scott, B. S., Clarinda, Iowa.
John A. Shelton, B. S., 34-35 Hirbour Building, Butte, Montana.
Wm. R. Shoemaker, B. S., Menomonee, Michigan.
J. O. Simcoke, D. V. M., Stuart, Iowa.
Virgil Snyder, B. S., 214 University Avenue, Ithaca, New York.
*Palmer W. Starr, B. C. E.
C. H. Stearns, B. S., Santa Rosa, New Mexico.
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M. W. Thornburg, B. S., Redfield, Iowa.
Rosalia Thurlimann, B. L., Carroll, Iowa.
Chas. M. Wade, B. S., 1010 Tenth Street, Sioux City, Iowa.
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GRADUATES OF 1890.

Nettie Bannister, B. L., Cherokee, Iowa.
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Chas. D. Davidson, B. M. E., Whiting, Indiana.
W. C. Dewell, B. S., Magnolia, Iowa.
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Q. C. Fuller, D. V. M., Milford, Iowa.
*Belle (Gaston) James, B. L.
J. M. Graham, B. S., Audubon, Iowa.
*May Hardy, B. L.
Spencer Haven, B. S., Hudson, Wisconsin.
Eugene Henley, B. S., Brooklyn, Iowa.
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Alice Mann, B. S., Algona, Iowa.
Bertha Mann, B. S., Algona, Iowa.
James J. McLaughlin, D. V. M., Blue Earth, Minnesota.
Ada (Mills) Dewell, B. L., Magnolia, Iowa.
*Violet U. Quint, B. L.
Marla, M. Roberts, B. L., Station A., Ames, Iowa.
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GRADUATES OF 1891.

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Wm. H. Heileman, B. S., M. S., Dept. of Agriculture, Washington, D. C. 
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Peter M. Wilson, D. V. M., Traer, Iowa. 

GRADUATES OF 1892. 

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Eugene G. Brown, B. S., Mason City, Iowa.* 
Geo. W. Brown, B. C. E., Boone, Iowa.* 
Inez, J. Christie, B. L., E. St. Louis, Illinois.* 
E. E. Clinton, B. C. E., Lents, Portland, Oregon. 
W. Ross Cooper, D. V. M., Kansas City, Missouri. 
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Elmer E. Kaufmann, B. Ag., Bismarck, No. Dakota.
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F. A. Littell, B. C. E., Audubon, Iowa.
C. W. Mally, B. S., M. S., Currie Street, Graham's Town, Cape Colony, South Africa.
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Gordon P. Miller, B. S., Des Moines, Iowa.
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Kate (Porter) Gess, B. S., St. Anthony, Idaho.*
*Henry Replogle, D. V. M.
J. A. Replogle, D. V. M., Udell, Iowa.
John A. Rolfs, B. S., Eldridge, Iowa.
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Flora H. Wilson, B. L., Washington, D. C.
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Earl Douglass, B. S., Missouri, Montana.*
Jennie Downing, B. L., Brookings, So. Dakota.
Edwin M. Duroe, B. S., Sioux Rapids, Iowa.
R. H. Fairfield, B. Ag., Creston, Iowa.*
Kate M. Farr, B. L., 316 South Grand Street, Bozeman, Montana.
E. E. Faville, B. Ag., M. S. A., Sioux City, Iowa.
James H. Gasson, D. V. M., 309 Erie St., Missouri Valley, Iowa.
Margaret (Gifford) Hodson, B. L., Ames, Iowa.
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C. E. Hart, B. M. E., Davenport, Iowa.*
W. E. Herring, B. C. E., 224 Bowen Street, St. Louis, Missouri.*
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James F. Jones, B. S., Wickenburg, Arizona.
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Charles L. Miles, B. S., Charles City, Iowa.
Grace (Mills) Hangeberg, B. L., Clinton, Missouri.
Ella (Morton) Kearney, B. L., Wauwatosa, Wisconsin.
C. A. McCall, D. V. M., Dodge City, Kansas.
*F. B. McCall, D. V. M.
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Lavenia Price, B. S., 1602 Locust Street, Des Moines, Iowa.
Helen Radnich, B. L., Davis City, Iowa.*
Mary C. Roifs, B. L., Fairfield, Illinois.*
LIST OF GRADUATES

E. E. Smith, B. S., Sioux Rapids, Iowa.
*Evelyn E. Starr, B. S., B. L.
Belle (Wentch) Wood, B. S., Traer, Iowa.
B. F. White, D. V. M., Hampton, Iowa.
Vinnie (Williams) Grattan, B. L., Barr, Colorado.

GRADUATES OF 1894.

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Harry S. Bowen, B. M. E., 65th Street, Chicago, Illinois.*
S. D. Bowle, B. Ag., Chelan, Washington.*
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Wm. J. Burdess, B. M. E., R. F. D. No. 1, Oskaaloosa, Iowa.
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Iowa Campbell, B. L., Newton, Iowa.
W. Lee Campbell, B. C. E., Van Buren and Morgan Street,

W. G. Carlson, B. S., Willlow Lake, So. Dakota.*
G. W. Carver, B. Ag., Tuskegee, Alabama.
Ida (Clark) Campbell, B. L., Clear Lake, Iowa.*
W. R. Cooper, B. S., Newton, Iowa.
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Ella (Curtis) Derr, B. L., Independence, Iowa.
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Annie W. Fleming, B. S., Station A., Ames, Iowa.
W. H. Gemmill, B. S., Dallas Center, Iowa.
Anna Georgen, B. L., Worthington, Iowa.
Emil, Hansen, B. M. E., Great Falls, Montana.*
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Scott W. Linn, B. M. E., Cleveland, Ohio.*
W. L. Melnzer, B. S., Clark, So. Dakota.
John Meissner, B. S., Rugby, No. Dakota.
J. C. Miller, B. C. E., Galesburg, No. Dakota.*

Bertha (Mosler) Hays, B. L., Armstrong, Iowa.
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Nora (Person) Sanborn, B. L., Hood River, Oregon.
Alex McKinnon, B. C. E., Yalesville, Connecticut.
E. M. McLaughlin, B. E. E., Newton, Iowa.
A. A. Peters, D. V. M., Winterset, Iowa.*
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Harry Shanks, D. V. M., Millersburg, Iowa.*
Hala (Silliman) Munns, B. L., Corning, Iowa.
Emma F. Surrine, B. S., M. S., Dysart, Iowa.
H. J. Stevens, D. V. M.
A. W. Stuntz, B. E. E., Owensboro, Kentucky.
Clarence Van Epps, B. S., Clinton, Iowa.*
Arthur R. Wake, D. V. M., Omaha, Nebraska.*
Carter B. Weaver, B. S., Ames, Iowa.*
C. O. Williamson, B. E. E., Knoxville, Iowa.
Alda H. Wilson, B. C. E., 19 West 106th St., New York, New York.
Elsworth Wilson, D. V. M., Alva, Oklahoma.
Elvin J. Wilson, D. V. M., No. English, Iowa.*
J. T. Young, B. M. E., Hydro, Oklahoma.

GRADUATES OF 1895.

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J. W. Crawford, B. S., Fort Morgan, Colorado.
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J. R. Davidson, B. S., Louisvile, Kentucky.*
E. T. Davison, D. V. M.

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C. R. Duroe, B. M. E., Jeffers, Minnesota.
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C. H. Eckles, B. Ag., M. S. A., Columbia, Missouri.
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Burt German, B. M. E., Actual Business Univ., Fremont, Ohio.
Clarence Goddard, B. C. E.,
W. E. Gossard, B. S., Webster City, Iowa.
Geo. W. Harden, B. S., White Sulphur Springs, Montana.
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H. T. Lewis, B. M. E., Pony, Montana.*
John W. Lewis, B. C. E., Carlsbad, N. Mexico.
L. L. Lewis, D. V. M., Stillwater, Oklahoma.
G. W. Louthan, B. Ag., M. S. A., Cornell, Iowa.
F. R. Lyford, B. C. E., Manly, Iowa.

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Mary (McNeil) Aten, B. L., Garden Grove, Iowa.

Hulda M. Nelson, B. S.

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Mabel Ruth (Owen) Wilcox, B. L., Washington, D. C.*

John M. Preston, B. Ag.

Erwin E. Reed, B. S., Monticello, Iowa.
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Ethel B. Rundall, B. S., Emmetsburg, Iowa.

Geo. D. Sabin, B. M. E.

J. C. Sample, B. C. E., Lebanon, Iowa.*
Roger S. Sanborn, B. S., Hood River, Oregon.
Frank H. Schleiter, B. M. E., Galva, Iowa.
J. I. Schulte, B. Ag., 1921 13th St., N. W., Washington, D. C.
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GRADUATES OF 1896.

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Maud Hursey, B. L., Moravia, Iowa.*

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*Watson Mason, B. M. E.

Fred W. Matthews, B. S., Jefferson, Iowa.*
Ira J. Meade, B. Ag., M. Ag., R. F. D. No. 1, Indianola, Iowa.

C. C. Mills, B. S., Linden, Iowa.*
C. O. Pool, B. S., Bedford, Iowa.*

Lillian Porterfield, B. S., Dundee, Illinois.
Herbert L. Preston, B. S., Brocksburg, Nebraska.

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C. H. Speers, B. M. E., Pleasant Hill, Missouri.

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W. W. Wentch, B. M. E., Kansas City, General Delivery, Missouri.
LIST OF GRADUATES

B. W. Wilson, B. Ag., Butte, Montana.*
James W. Wilson, B. Ag., M. S. A., Brookings, South Dakota.
A. L. Zinser, B. S., Sioux Rapids, Iowa.
G. W. Zorn, B. C. E., Cody, Wyoming.

GRADUATES OF 1897.

Mary Barger, B. S., Ontario, Iowa.*
C. A. Bergeman, B. M. E., Grant Works, Illinois.*
F. W. Bouska, B. Ag., M. S. A., Station A., Ames, Iowa.
Guy S. Brewer, B. S., 2925 Rutland Ave., Des Moines, Iowa.
Andrew Brown, B. S., Whitaker Building, Davenport, Iowa.*
Jas. R. Burnip, B. S., Montevideo, Minnesota.
Philip E. Damon, B. Ag., Harrison, Arkansas.
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Gwendolen (Doxsee) Reed, B. L., Monticello, Iowa.
L. A. Duroe, B. S., Jeffers, Minnesota.
L. Mae (Fellows) Banks, B. L., Montour, Iowa.
W. C. Garberson, B. S., Sibley, Iowa.
Blanche (Greeley) Wilson, B. L., Chicago, Illinois.
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Joseph Morrison, B. C. E., Boone, Iowa.
Frank McConnon, B. S., Monticello, Iowa.*
Geo. B. McWilliams, B. C. E., Waterloo, Iowa.
Wilmon Newell, B. S., M. S., State Entomologist, Atlanta, Georgia.
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Ambrose C. Rice, B. S., Baptist College, Rangoon, Burma, India.
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Lawrence Winnie, B. S., Humboldt, Iowa.

GRADUATES OF 1898.

M. C. Adamson, B. S.,  *  Dana, Iowa.*
Ralph W. Barclay, B. Ag., Mason City, Iowa.*
Amanda J. Barger, B. L., Ontario, Iowa.*
Esther (Beatty) Ketchum, B. L., 1121 11th St., Boulder, Colorado.
Leora May Bonwell, B. S., Ross, R. F. D. 1, Iowa.
Otis Boyd, B. S., Roland, Iowa.
Harvey Bozarth, B. M. E., E. Pittsburg, Penn.
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Harry E. Dyer, B. S., St. Louis, Missouri.*
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Ewing M. Johnson, B. S., Charles City, Iowa.
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Fred N. Lewis, B. C. E., Y. M. C. A. Bldg., Minneapolis, Minn.*
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Royal Meeker, B. S., Collegeville, Penn.
Roger C. Mills, B. Ag., Fort Wright, Spokane, Washington.
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W. J. Kennedy, B. S. A., Station A, Ames, Iowa.
Wm. H. Leathers, B. S. in E. E., Mapleton, Iowa.
C. P. Liegrot, D. V. M., Greenfield, Iowa.
John P. Lund, B. S., Saint Ansgar, Iowa.
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LIST OF GRADUATES

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Chas. Rhinehart, B. S. A.,
   Dallas Center, Iowa.
Fordyce W. Rhodes, B. S.,
   Whatcom, Washington.*
Guy Roberts, B. S.,
   Webb, Iowa.
Burton R. Rogers, D. V. M.,
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   Washington, D. C.

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   Anthon, Iowa.
James M. Stimson, B. S.,
   Republican C'y, Nebraska.
F. V. Stout, B. S. A.,
   Stout, Iowa.
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   Minburn, Iowa.
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Jeannette (Younie) Prusia, B. S., Odebolt, Iowa.

GRADUATES OF 1900.

Linton P. Bennett, B. S.,
   Ferndale, Washington.
Frank S. Bone, B. S., R. F. D. No. 2, Grand River, Iowa.
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Paul Hensen, B. S., Chinook, Montana.

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E. G. LeClere, B. S., Quanah, Texas.


Martin Lewis, B. M. E., Oelwein, Iowa.

John L. Lowe, D. V. M., Still School of Osteopathy, Des Moines, Iowa.*

F. R. Marshall, B. S. A., College Station, Texas.*

Wm. H. Mast, B. S. A., Yale Forest School, New Haven, Conn.


Wilson F. McDill, B. S. A., Creston, Iowa.*

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Ira J. Scott, B. S., Roland, Iowa.


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Chas. S. White, B. S., Audubon, Iowa.

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GRADUATES OF 1901.


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Ernest D. Stivers, B. S., Parker, So. Dakota.
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GRADUATES OF 1902.

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Franklin Brown, B. S. A., Boone, Iowa.
Grace Campbell, B. S., Newton, Iowa.
Jos. R. Campbell, D. V. M., St. Louis, Missouri.*
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GRADUATES OF 1903.

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Elva Barton, B. S., Lu Verne, Iowa.
W. R. Battey, B. M. E., Dexter, Iowa.
Percy Bissell, B. M. E., 144 N. Main St., Waterbury, Connecticut.
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Mae Bower, B. S., West Union, Iowa.
LIST OF GRADUATES

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Oscar Royce, B. S. A., Ames, Iowa.*
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B. Arthur Whisler, B. S. in E. E., 13 Eagle St., Schenectady, N. Y.
W. J. Wilson, B. S. A., Earlam, Iowa.*

GRADUATES OF 1904.

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