Bulletin of Iowa State College of Agriculture and Mechanic Arts
General Catalogue

Iowa State University

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General Catalogue

1913-1914

Ames, Iowa
The Iowa State College of Agriculture and Mechanic Arts issues the following publications:

General Catalogue of all courses.
Agricultural Division Catalogue, including Home Economics.
Engineering Division Catalogue.
Veterinary Division Catalogue.

Announcement of Summer School, covering General Agriculture, Home Economics, and College Credit Courses, June 16 to July 25, 1913.

Announcement of Winter Short Courses, including Stock and Grain Judging, Poultry Husbandry, Home Economics, Buttermaking, Farm Dairying and other Agricultural Subjects.

Book of College Views.

In sending requests, please specify the special bulletin desired. Address requests to The Registrar, Room 122, Central Building, Station A, Ames, Iowa.

Under authority of the last Legislature new courses are being organized as below, and announcements will be sent upon application as soon as ready for distribution:

Two Year Trade School Work in Engineering.
Two Year Homemakers' Course.
Engineering Extension Work.

Supplementary announcement of courses will be issued later. It will show certain new studies and minor rearrangement of courses, which will become possible on account of the increased support provided by the last General Assembly.
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<th>JANUARY</th>
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<th>FEBRUARY</th>
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<th>MARCH</th>
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<th>APRIL</th>
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<th>JUNE</th>
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### Calendar

* The General College Faculty meets on the first Monday of each month at 4 P. M. in the faculty room in Central Building. The faculties of the different divisions meet during the previous week, as follows:

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Meeting Time</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Veterinary Medicine</td>
<td>Tuesday, 4 P. M.</td>
<td>Central Building</td>
</tr>
<tr>
<td>Engineering</td>
<td>Wednesday, 4 P. M.</td>
<td>Central Building</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Thursday, 4 P. M.</td>
<td>Central Building</td>
</tr>
<tr>
<td>Science</td>
<td>Friday, 4 P. M.</td>
<td>Central Building</td>
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#### First Semester

<table>
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<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>September 9-10</td>
<td>Entrance Examinations. Registration-Classification Days.</td>
</tr>
<tr>
<td>September 12-13</td>
<td>College Work begins.</td>
</tr>
<tr>
<td>September 15</td>
<td>Last Date of Presentation of Subjects for Bachelor's Degree.</td>
</tr>
<tr>
<td>September 20</td>
<td>Junior Trot.</td>
</tr>
<tr>
<td>October 6</td>
<td>Sophomore-Freshman Annual. Thanksgiving Vacation.</td>
</tr>
<tr>
<td>October 11</td>
<td>Christmas Vacation begins. Special Short Courses in Agriculture and Home Economics and Engineering.</td>
</tr>
<tr>
<td>October 25</td>
<td>Vacation closes.</td>
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<tr>
<td>November 27-29</td>
<td>College Work closes.</td>
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#### Second Semester

<table>
<thead>
<tr>
<th>Date</th>
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<tr>
<td>February 3-4</td>
<td>Entrance Examinations. Registration-Classification Days.</td>
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<tr>
<td>February 6-7</td>
<td>College Work begins.</td>
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<tr>
<td>February 14</td>
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</table>
March 2, Monday.

March 21, Saturday, 8:00 P. M.
March 25, Wednesday, 5:00 P. M.
March 30, Monday, 7:00 P. M.
April 3, Friday, 8:00 P. M.
May 4, Monday.

May 15, Friday

May 30, Saturday
June 1, Monday

June 5, Friday

June 6, Saturday, 8:00 P. M.
June 7, Sunday, 10:30 A. M.
June 7, Sunday, 8:00 P. M.

June 8, Monday, 2:30 P. M.

June 8, Monday, 8:00 P. M.
June 9, Tuesday, 2:30 P. M.
June 9, Tuesday, 8:00 P. M.
June 10, Wednesday, 7:30 A. M.
June 10, Wednesday
June 11, Thursday, 10:30 A. M.

June 11, Thursday, 1:00 P. M.
June 12, Friday

Selection of Senior Honor Students.
Freshman-Sophomore Annual.
Spring Vacation begins.
Spring Vacation closes.
Inter-society Declamatory Contest.
Recommendation of Candidates for Graduation
Last Date for Examination of Candidates for Master's Degree.
Memorial Day.
Last Day for Presenting Theses to Thesis Committee.
Civil and Mining Engineers go into Summer Camp.
Semester Musical Recital.
Baccalaureate Sermon.
Address before the Christian Associations.
Graduation Exercises of Literary Societies.
Junior Class Play.
Senior Class Day Exercises.
Grand Concert.
Senior Breakfast.
Alumni Business Meeting.
Commencement Address and Presentation of Diplomas.
Alumni and Faculty Banquet.
Summer Vacation begins.

1914.

FIRST SEMESTER.

September 8-9, Tuesday and Wednesday, 8:00 A. M.
September 11-12, Friday, 8:00 A. M., to Saturday, 5:00 P. M.
September 14, Monday, 7:40 A. M.
February 5, 1915, Friday, 5:00 P. M.

Entrance Examinations.
Registration-Classification Days.
College Work begins.
First Semester closes.
State Board of Education of Iowa

MEMBERS

Hon. J. H. Trewin, President ........................................ Cedar Rapids
Hon. A. B. Funk .......................................................... Spirit Lake
Hon. Geo. T. Baker ...................................................... Davenport
Hon. Roger Leavitt ...................................................... Cedar Falls
Hon. D. D. Murphy ...................................................... Elkader
Hon. Chas. R. Brenton .................................................. Dallas Center
Hon. P. K. Holbrook .................................................... Onawa
Hon. Edw. P. Schoentgen .............................................. Council Bluffs
Hon. H. M. Eicher ....................................................... Washington

FINANCE COMMITTEE

Hon. W. R. Boyd, President ............................................ Cedar Rapids
Hon. Thomas Lambert .................................................. Sabula
Hon. D. A. Emery, Secretary ......................................... Des Moines
Jackson W. Bowdish, Auditor and Accountant .................. Des Moines
P. E. McClanahan, Inspector of Secondary Schools ............ Des Moines
John E. Foster, Assistant Inspector ................................. Des Moines
Officers of Administration

GENERAL OFFICERS

RAYMOND ALLEN PEARSON, M. S. in Agr., LL. D....President
Room 104, Central Building.

EDGAR WILLIAMS STANTON, LL. D....Secretary of the College
Room 117, Central Building.

HERMAN KNAPP, B. S. A..............Treasurer and Registrar
Room 122, Central Building.

ORANGE HOWARD CESSNA, D. D.............Chaplain
Room 212, Central Building.

VINA ELETHE CLARK.................................Librarian
Morrill Hall.

THOMAS SLOSS...............Superintendent of Buildings and Grounds
Superintendent's Office.

CHARLES G. TILDEN, M. D.....College Physician and Sanitary Officer
Hospital Building.

MRS. EMILY CUNNINGHAM ....................Matron
Margaret Hall.

GEORGE PLATT BOWDISH ...........Inventory Clerk
Room 124, Central Building.

CARL HENRY SCHEMANN, B. S. in C. E...Secretary to the President
Room 104, Central Building.

CHARLES SABIN NICHOLS, B. C. E.,.......Secretary to the Dean of Engineering
Room 315, Engineering Hall.

NELLE M. BEACH..........................Secretary to the Dean of Agriculture
Room 124, Hall of Agriculture.

DEANS AND VICE DEANS

EDGAR WILLIAMS STANTON, LL. D....Dean of the Junior College
and Division of Science
Room 117, Central Building.
OFFICERS OF ADMINISTRATION

CHARLES FRANKLIN CURTISS, M. S. A., D. S. Dean of the Division of Agriculture
Room 124, Hall of Agriculture.

ANSON MARSTON, C. E. Dean of the Division of Engineering
Room 315, Engineering Hall.

CHARLES HENRY STANGE, D. V. M. Dean of the Division of Veterinary Medicine

* MRS. MARIAN H. KILBOURNE, B. L. Dean of Women

SPENCER AMBROSE BEACH, B. S. A., M. S. Vice Dean of the Division of Agriculture
Room 201, Hall of Agriculture.

SAMUEL WALKER BEYER, Ph. D. Vice Dean of Division of Engineering
Room 303, Engineering Hall.

MARIA M. ROBERTS, B. L. Vice Dean of the Junior College
Room 218, Central Building.

AGRICULTURAL EXPERIMENT STATION

CHARLES FRANKLIN CURTISS, M. S. A., D. S. Director
Room 124, Hall of Agriculture.

WILLIAM HENRY STEVENSON, A. B., B. S. A. Vice Director
Room 25, Hall of Agriculture.

ENGINEERING EXPERIMENT STATION

ANSON MARSTON, C. E. Director
Room 315, Engineering Hall.

FACULTY COMMITTEE CHAIRMEN

RAYMOND ALLEN PEARSON, M. S. in Agr., LL. D. President Chairman of Grounds and Buildings and Publicity Committees
Room 104, Central Building.

HERMAN KNAPP, B. S. A. Secretary of the Faculty, Chairman of Committee on Entrance Requirements and Secondary School Relations
Room 122, Central Building.

EDGAR WILLIAMS STANTON, LL. D. Chairman of Course of Study and Scholarship Committees
Room 117, Central Building.

* Leave of absence on Carnegie Foundation.
CHARLES FRANKLIN CURTISS, M. S. A., D. S. ... Chairman of Committee on Library
   Room 124; a Hall of Agriculture.

ALFRED ALLEN BENNETT, M. S. ....... Chairman of Committee on
   Advanced Standings and Substitutions
   Chemical Hall.

LOUIS HERMANN PAMMEL, Ph. D. .... Chairman of Committee on
   Room 314, Central Building.
   Theses.

LOUIS BEVIER SPINNEY, M. S. .... Chairman of Committee on Rules
   Room 212, Engineering Hall.

SAMUEL WALKER BEYER, Ph. D. .... Chairman of Committee on
   Athletics
   Room 203, Engineering Hall.

HENRY ELIJAH SUMMERS, B. S. ....... Chairman of Committee on
   Graduate Study
   First Floor, Morrill Hall.

WARREN H. MEEKER, M. E. ......... Chairman of Committee on
   Public Safety
   Room 202, Engineering Hall.

ARTHUR MACMURRAY, B. A., M. O. .... Chairman of Committee on
   Literary Societies (including Forensics).
   Room 311½, Central Building.

CLARE NEWTON ARNETT, B. S. ....... Chairman of Committee on
   Time Table
   Room 107, Hall of Agriculture.

ROBERT EARLE BUCHANAN, M. S., Ph. D. ... Chairman of Commit-
   tee on Fraternities and Social Clubs
   Room 321, Central Building.

WILLIAM HARPER PEW, B. S. A. ............ Chairman of Committee on
   Public Service
   Room 107, Hall of Agriculture.

ORANGE HOWARD CESSNA, D. D., A. M. ... Chairman of Committee on
   Moral Welfare
   Room 212, Central Building.

MRS. EMILY CUNNINGHAM .... Chairman of Committee on Student
   Social Life
   Margaret Hall.

CHARLES G. TILDEN, M. D. ............ Chairman of Committee on
   Public Health
   College Hospital.
Officers of Instruction

*THE FACULTY*

PRESIDENT AND DEANS

RAYMOND ALLEN PEARSON. 1912.....................President
B. S. in Agr., Cornell University, 1894; M. S. in Agr., Cornell univer­
versity, 1899; LL. D., Alfred University, 1909.

EDGAR WILLIAMS STANTON. †1877, 1874..Dean of Junior College,
Dean of Division of Science,
Professor of Mathematics
B. Sc., Iowa State College, 1872; M. Sc., 1887; LL. D., Coe, 1904.

CHARLES FRANKLIN CURTISS. 1897, 1891..Dean of the Division of
Agriculture, Director of Experiment Station
B. S. A., Iowa State College, 1887; M. S. A., Iowa State College,
1892; D. Sc. in Agriculture, Michigan Agricultural College, 1907.

ANSON MARSTON. 1892..Dean of Division of Engineering, Professor
of Civil Engineering
C. E., Cornell University, 1889.

CHARLES HENRY STANGE. 1909, 1907..Dean of the Division of
Veterinary Medicine, Professor of Theory and
Practice and Diagnosis
D. V. M., Iowa State College, 1907.

PROFESSORS

HONORABLE JAMES WILSON. 1913, 1902, 1891..Emeritus Professor
of Agriculture
M. S. A., Iowa State College, 1907.

GENERAL JAMES RUSH LINCOLN. 1884, 1883..Professor of Mili­
tary Science

ALFRED ALLEN BENNETT. 1885............Professor of Chemistry
B. Sc., Michigan, 1877; M. Sc., Iowa State College, 1888.

HERMAN KNAPP. 1887, 1883...............................Registrar
B. S. A., Iowa State College, 1883.

* The President, Dean, Professors and Associate Professors constitute the College
Faculty.
† First date after the name indicates date of appointment to present position, the
second date, when the first fails to do so, indicates the date of first appointment in
the College.
LOUIS HERMANN PAMMEL. 1889. Professor of Botany
B. Agr., Wisconsin, 1885; M. S., 1889; Ph. D., Washington University, St. Louis, 1898.

LOUIS BEVIER SPINNEY. 1897, 1891. Professor of Physics and Illuminating Engineering
B. M. E., Iowa State College, 1892; B. S. (E. E.), 1893.

SAMUEL WALKER BEYER. 1898, 1891. Vice Dean of Division of Engineering, Professor of Geology and Mining Engineering
B. S. Iowa State College, 1889; Ph. D., Johns Hopkins, 1895.

ALVIN BUELL NOBLE. 1898. Professor of Rhetoric and Literature
B. Ph., University of Iowa, 1887.

HENRY ELIJAH SUMMERS. 1898. Professor of Zoology
B. S., Cornell University, 1886.

ORANGE HOWARD CESSNA. 1900. Professor of History and Psychology
B. S., Iowa State College, 1872; B. D., Garrett Biblical Institute, 1885; D. D., 1900; A. M., Cornell College, 1901.

WILLARD JOHN KENNEDY. 1912, 1901. Director of Agricultural Extension Department
B. S. A., Iowa State College, 1899.

WILLIAM HENRY STEVENSON. 1903, 1902. Professor of Agronomy, Vice Dean of Experiment Station

SPENCER AMBROSE BEACH. 1905. Vice Dean of the Division of Agriculture, Professor of Horticulture
B. S. A., Iowa State College, 1887; M. S., Iowa State College, 1892.

*Benjamin Horace Hibbard. 1906, 1902. Professor of Economic and Political Science
B. S. A., Iowa State College, 1898; Ph. D., Wisconsin, 1902.

WARREN H. MEEKER. 1907, 1891. Professor of Mechanical Engineering
M. E., Cornell University, 1891.

FRED ALAN FISH. 1907, 1905. Professor of Electrical Engineering
M. E. in E. E., Ohio State University, 1898.

JAY BROWNLEE DAVIDSON. 1907, 1905. Professor of Agricultural Engineering
B. S. M. E., Nebraska, 1904.

ARTHUR MacMURRAY. 1908. Professor of Public Speaking
A. B., Kansas, 1896; M. O., Ott School of Expression, Chicago, 1904.

* Resigned to take effect February 1, 1913.
OFFICERS OF INSTRUCTION

ROBERT EARLE BUCHANAN. 1909, 1904. Professor of Bacteriology
B. S., Iowa State College, 1904; M. S., Iowa State College, 1906;
Ph. D., Chicago, 1908.

MARTIN MORTENSEN. 1909. Professor of Dairying
B. S. A., Iowa State College, 1909.

FLETCHER BRIGGS. 1909. Professor of Modern Languages
Ph. B., Iowa, 1901; M. A., 1902.

HAROLD DE MOTT HUGHES. 1910. Professor of Farm Crops
B. S., University of Illinois, 1907; M. S. A., University of
Missouri, 1908.

CATHARINE J. MACKAY. 1911, 1910. Professor of Home Economics
Drexel Institute. Diploma in Domestic Science, 1907; Boston Cooking
School, 1909; Teachers' College, Columbia University, 1910.

WILLIAM WALLACE DIMOCK. 1911, 1909. Professor of Comparative Pathology
B. Agr., Connecticut Agricultural College, 1901; D. V. M., Cornell
University; D. V. M., University of Habana, 1907.

FREDERICK WILLIAM BECKMAN. 1911. Professor of Agricultural Journalism
Ph. B., University of Iowa, 1897.

ARTHUR THOMAS ERWIN. 1912, 1904, 1900. Professor of Truck,
Crops and Landscape Gardening
B. S., Arkansas, 1899; M. S. A., Iowa State College, 1902.

WILLIAM HARPER PEW. 1912, 1909. Professor of Animal Husbandry
B. S. A., Iowa State College, 1907.

GEORGE MELVIN TURPIN. 1913. Professor of Poultry Husbandry

GUY MITCHELL WILSON. 1913. Professor of Agricultural Education
A. B., Indiana University, 1900; M. A., Indiana University, 1908.

ASSOCIATE PROFESSORS

MARIA M. ROBERTS. 1904, 1891. Vice Dean of Junior College,
Associate Professor of Mathematics
B. L., Iowa State College, 1890.

LOLA ANN PLACEWAY. 1905, 1896. Associate Professor of Chemistry
B. S., Iowa State College, 1895.

VINA ELETHE CLARK. 1897. Librarian

JOHN PIPER WATSON. 1904. Physical Director
IRA A. WILLIAMS. 1907, 1898. Associate Professor of Geology and Mining Engineering
B. S., Iowa State College, 1898; M. S., Iowa State College, 1903;
A. M., Columbia, 1904.

JOHN EDWARD KIRKHAM. 1907. Associate Professor of Structural Engineering
B. S. in C. E., Missouri, 1895.

WINFRED FORREST COOVER. 1907, 1904. Associate Professor of Chemistry
A. B., Otterbein University; A. M., Ohio State University.

LAURENCE C. HODSON. 1907, 1906. Associate Professor of Mining Engineering

MARK PERKINS CLEGHORN. 1908, 1902. Associate Professor of Mechanical Engineering
B. S. in E. E., 1902, Iowa State College, M. E., 1907.

CHARLES CURTIS MAJOR. 1908. Associate Professor of Mechanical Engineering
M. E., Blomsburg Normal School, Pa., 1891; M. E., Cornell University, 1898.

EDWARD NORRIS WENTWORTH. 1909, 1907. Associate Professor of Animal Husbandry
B. S. A., Iowa State College, 1907; M. S. A., Iowa State College, 1909.

CLARE NEWTON ARNETT. 1910. Associate Professor of Animal Husbandry
B. S., Purdue University, 1907.

LOUIS BERNARD SCHMIDT. 1911, 1906. Associate Professor of History
Ph. B., Cornell College, 1901; A. M., 1906.

ROY A. NORMAN. 1911, 1907. Associate Professor of Mechanical Engineering
B. M. E., Iowa State College, 1903; M. E., Iowa State College, 1909.

HOWARD CARLTON FORD. 1911, 1907. Associate Professor of Surveying and Astronomy
B. S. (C. E.), Colorado, 1904; M. S., 1905; C. E., 1907.

ARTHUR HENRY HOFFMAN. 1911, 1905. Associate Professor of Physics
A. B., Iowa Wesleyan, 1897; A. M., 1905; B. S. in E. E., Iowa State College, 1905.

*One year's leave of absence from September 1, 1912.
<table>
<thead>
<tr>
<th>Name</th>
<th>Years</th>
<th>Position</th>
<th>Details</th>
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<tbody>
<tr>
<td>William Ballantyne Anderson</td>
<td>1911, 1905</td>
<td>Associate Professor of Physics</td>
<td>B. S. Wisconsin, 1901; M. S., 1903; Ph. D., 1906.</td>
</tr>
<tr>
<td>John Edwin Brindley</td>
<td>1913, 1911, 1907</td>
<td>Associate Professor of Economic Science</td>
<td>B. L., Wisconsin, 1902; A. M., 1906; Ph. D., Iowa State University, 1911.</td>
</tr>
<tr>
<td>Harold Edward Bemis</td>
<td>1911, 1908</td>
<td>Associate Professor of Surgery and Obstetrics</td>
<td>D. V. M., Iowa State College, 1908.</td>
</tr>
<tr>
<td>Howard Sylvester Murphey</td>
<td>1911, 1909</td>
<td>Associate Professor of Anatomy and Histology</td>
<td>D. V. M., Ohio, 1908.</td>
</tr>
<tr>
<td>Henry Herbert Kildee</td>
<td>1911, 1910</td>
<td>Associate Professor of Animal Husbandry, in Charge of Dairy Farm</td>
<td>B. S. A., Iowa State College, 1908.</td>
</tr>
<tr>
<td>Gilmour Beyers MacDonald</td>
<td>1911, 1910</td>
<td>Associate Professor of Forestry</td>
<td>B. S. F., University of Nebraska, 1907.</td>
</tr>
<tr>
<td>Grace Elvleda Russell</td>
<td>1911, 1910</td>
<td>Associate Professor of Domestic Art</td>
<td>B. S., Teachers' College, Columbia University, 1908.</td>
</tr>
<tr>
<td>Everett Edgar King</td>
<td>1912, 1911</td>
<td>Associate Professor of Railway Engineering</td>
<td>B. S., Rose Polytechnic Institute, 1901; C. E., 1908; M. S., 1909; A. B. Indiana University, 1910; M. C. E. Cornell University, 1911.</td>
</tr>
<tr>
<td>William Randolph Raymond</td>
<td>1912, 1907</td>
<td>Associate Professor of English</td>
<td>A. B., Grinnell, 1894.</td>
</tr>
<tr>
<td>Percy Edgar Brown</td>
<td>1912, 1910</td>
<td>Associate Professor of Soil Bacteriology</td>
<td>B. Sc. Rutgers, 1906; A. M. Rutgers, 1909; Ph. D. Rutgers, 1912.</td>
</tr>
<tr>
<td>Martin Francis Paul Costelloe</td>
<td>1912, 1911</td>
<td>Associate Professor of Agricultural Engineering</td>
<td>B. S. in C. E., University of Nebraska, 1906.</td>
</tr>
<tr>
<td>John Nathan Martin</td>
<td>1912, 1911</td>
<td>Associate Professor of Botany</td>
<td>A. B., Indiana University, 1907.</td>
</tr>
<tr>
<td>Harold Criswell Bartholomew</td>
<td>1912, 1911</td>
<td>Associate Professor of Electrical Engineering</td>
<td>M. E. in E. E., Ohio State University, 1906.</td>
</tr>
</tbody>
</table>

* Acting Head of Department of Economic Science since January 1, 1913.
ASSISTANT PROFESSORS.

ALEXANDER STEWART THOMPSON. 1907. Director of Music, Piano, Pipe Organ and Voice Royal College, London; Guild Hall School of Music, London.

CLARA DUTTON-THOMPSON. 1907. Vice-Director Voice Cazenovia Seminary; Guild Hall School of Music.

JOSEPH EDWARD GUTHRIE. 1904, 1902. Assistant Professor of Zoology
B. S., Minnesota, 1900; M. S., 1901.

ERNEST ALANSON PATTEN GILL. 1906, 1900. Assistant Professor of Mathematics
B. S., Iowa State College, 1897; B. S., Cornell University, 1899.

JULIA TRUEMAN COLPITTS. 1906, 1900. Assistant Professor of Mathematics
A. B., Mount Allison University, Canada, 1899; A. M., Cornell University, 1900.

ELIZABETH MOORE. 1908, 1904. Assistant Professor of English
Ph. B., Iowa College, 1900; Ph. M., Chicago, 1902.

WINIFRED RICHARDS TILDEN. 1908, 1904. Physical Directress
B. A., Mount Holyoke, 1903.

DORA GILBERT TOMPKINS. 1908, 1905. Assistant Professor of English
A. B., Monmouth College, 1893; A. M., Knox College, 1898.

JULIA RAMSEY VAULX. 1908, 1906. Assistant Professor of English
A. B., Arkansas, 1894; A. M., Cornell University, 1897.

ROY HIRAM PORTER. 1908, 1906. Assistant Professor of Mechanical Engineering
B. M. E., Maine, 1906.

MORRIS IRWIN EVINGER. 1908, 1906. Assistant Professor of Hydraulic and Sanitary Engineering
B. C. E., Iowa State College, 1906.

Č. E. BARTHOLOMEW. 1909, 1904. Assistant Professor of Entomology
B. S., Iowa State College, 1904; M. S., 1907.

ROY WINCHESTER CRUM. 1909, 1907. Assistant Professor of Experimental Engineering
B. C. E., Iowa State College, 1907.

JESSE GREENLEAF HUMMEL. 1910, 1903. Assistant Professor of Mechanical Engineering
B. M. E. Iowa State College, 1902.
OFFICERS OF INSTRUCTION

JOHN THAXTER BATES. 1910, 1907 Assistant Professor of Mechanical Engineering

B. M. E., University of Maine, 1907.

WALTER HENRY COOPER. 1910, 1907 Assistant Professor of Dairying

B. S. A., University of Wisconsin, 1907; M. S., University of Wisconsin, 1909.

WARD MURRAY JONES. 1911, 1902 Assistant Professor of Mathematics

B. C. E., Iowa State College, 1897.

ROY EUGENE SMITH. 1911, 1909 Assistant Professor of Soils.

B. S. A., Iowa State College, 1909; M. S., 1911.

CHESTER CHARLES FOWLER. 1911, 1909 Assistant Professor of Chemistry


JAMES CLOYD BOWMAN. 1911, 1910 Assistant Professor of English


HENRY DALE BERGMAN. 1911, 1910 Assistant Professor of Physiology and Therapeutics

D. V. M., Iowa State College, 1910.

OTTO THEODORE HOKAASEN. 1911 Assistant Professor of History

A. B., Luther College, 1909. A. M., Northwestern University, 1911.

GEORGE ANDREW GABRIEL. 1912, 1911 Assistant Professor of Mining Engineering.—In charge of Industrial Chemistry

B. S., Worcester Polytechnic Institute, 1899.

BERNARD WERNICK HAMMER. 1911 Assistant Professor of Dairy Bacteriology

B. S. A., University of Wisconsin, 1908.

WILLIAM KUNERTH. 1912, 1907 Assistant Professor of Physics and Illuminating Engineering

M. A., University of Wisconsin, 1910.

CHARLES MURRAY. 1912, 1909, 1908 Assistant Professor of Veterinary Bacteriology and Hygiene

Pe. B., Drake University, 1906; B. S., Iowa State College, 1910; D. V. M., Iowa State College, 1912.

FRANK ANSON ROBBINS. 1912, 1910 Assistant Professor of Electrical Engineering

A. B, Yankton College, 1907; B. S., University of Illinois, 1910.
WILLIAM ROY HECKLER. 1912, 1911......Assistant Professor of Farm Crops

B. S. A., University of Missouri, 1911.

RUTH MICHAELS. 1912, 1911..Assistant Professor in Home Economics

EVAN F. FERRIN. 1912, 1911..............Assistant Professor of Animal Husbandry

B. S. in A. H., Iowa State College, 1911.

ARDEN RICHARD JOHNSON. 1912........Assistant Professor of Chemistry

B. S., Chem Engr., University of Wisconsin, 1906; M. S., University of Wisconsin, 1908; Ph. D., University of Wisconsin, 1911.

ERNEST MUCHMORE MERVINE. 1912....Assistant Professor of Agricultural Engineering

M. E., Lehigh University, 1909.

GEORGE CHESTER MORBECK. 1912........Assistant Professor of Forestry

B. S. in Forestry, Michigan Agricultural College, 1904.

AMOS PEA SLEE POTTS. 1912............Assistant Professor of Mining Engineering

Ceramic Engineer, Ohio State University, 1912.

CHARLES BYRON WILLIAMS. 1913......Assistant Professor in Economic Science

A. B., University of Chicago, 1900.

INSTRUCTORS

EZRA CORNELIUS POTTER........Instructor in Pattern Shop, 1898
ANNIE WILSON FLE MING, B. S......Instructor in Mathematics, 1900
GRACE ISABEL NORTON, B. A........Instructor in German, 1901
EDWARD MERRITT SPANGLER........Instructor in Pattern Shop, 1905, 1904

LOLA STEPHENS, B. S..............Instructor in Chemistry, 1906, 1905
CHARLES L. MUNDHENK..............Band Instructor, 1906
LAURA MAY TAGGART, B. S......Instructor in Chemistry, 1907, 1906
INGEBORG G. LOMMEN, M. L...........Instructor in German, 1907
HELEN FLORENCE SMITH, A. B....Instructor in Mathematics, 1907
FREDERICA VON TRICE SHATTUCK, B. A..Instructor in Public Speaking, 1907

JAMES WILLIAM CAMERON........Instructor in Forge Shop, 1907
JOHN A. SAWIN............Instructor in Foundry, 1907
AGNES GINA MOSHER, B. S., M. S..Instructor in Mathematics, 1908
MRS. MARY PETERS FAIRFIEL D, B. A...Instructor in French, 1908
MRS. DAISY ALISON ARVILLE, A. B.......Instructor in Spanish and French, 1908
RUTH BOGARDUS SAFFORD, B. L.....Instructor in English, 1908
CHARLES ALTON BAUGHMAN..Instructor in Civil Engineering, 1909
HERBERT JOHN PLAGGE, B. S., M. A.....Instructor in Physics and
Illuminating Engineering, 1909
JOHN HUG, B. M. E.......Instructor in Mechanical Drawing, 1909
NELLIE M. NAYLOR, B. A...........Instructor in Chemistry, 1909
ARTHUR LAURENCE BAKKE, B. S., M. S..Instructor in Botany, 1910
JESSIE MILDRED MACLEAN, A. B, A. M.....Instructor in English,
1910

ADA HAYDEN, B. S., M. S...............Instructor in Botany, 1910
BRUCE MAGILL HARRISON, B. S., M. S..Instructor in Zoology, 1910
HARRIET EDITH SESSIONS, B. S........Reference Librarian, 1910
BURLEIGH BUREN REED, B. S............Instructor in Chemistry, 1910
FRANK WISDOM ALLEN, JR., B. S. A........Instructor in Horticulture, 1910
ALOIS F. NICKELS........................Instructor in Machine Shop, 1911
WINFRED SARAH GETTEMY....Instructor in Domestic Art, 1911
WILLIAM ALLEN LINTNER, B. S. A..Instructor in Farm Crops, 1911
EDWARD SAWTELLE WELLES........Instructor in Bacteriology, 1911
WILLIAM OTTERBEIN ELLIS, A. B....Instructor in Zoology, 1911
JOHN HALL BUCHANAN, B. S.........Instructor in Chemistry, 1911
HELEN HUNTING, B. A..............Instructor in Chemistry, 1911
ROLLAND SCHANEL WALLIS, B. S. in E. E., B. S. in C. E.....Instructor in Civil Engineering, 1911
ZELMA ZENTMIRE, B. S............Instructor in Chemistry, 1911
CARRIE ADELA RANKIN, A. B..Instructor in Public Speaking, 1911
MILTON FERDINAND BEECHER, B. S. in Cer........Instructor in Ceramics, 1911
CLAUDE CARLYLE COYKENDALL, B. S. in C. E.....Instructor in Civil Engineering, 1911
RICHARD RUBEN CLEM..Instructor in Agricultural Engineering, 1911
LEE W. FORMAN, B. S. A..............Instructor in Soils, 1911
HUGO HANS BECKMANN..........Instructor in Agricultural Engineering, 1911
GEORGE JUDISCH.............Instructor in Pharmacology, 1912, 1901
MILDRED SEMMONS, B. S........Instructor in German, 1912, 1910
IVA L. BRANDT, B. S......Instructor in Home Economics, 1912, 1911
HIRAM S. DOTY, B. S...........Instructor in Botany, 1912, 1911
CLEM J. O'NEILL, B. S. A........Instructor in Dairying, 1912, 1911
NELSON LOUIS NELSON, D. V. M.........Instructor in Veterinary Medicine, 1912
JAMES BYRON KELLEY, B. S. in M. E..Instructor in Agricultural Engineering, 1912
FRANK D. PAINE, B. S. in E. E........Instructor in Electrical Engineering, 1912
MARIE CLIFTON ADSIT, A. B..Instructor in Home Economics, 1912
MABEL ADAMS.............Instructor in Home Economics, 1912
MRS. SELMA M. PLAGGE, Mus. Bac...Instructor in Piano, Music History, and Harmony, 1912

JAMES WADE DRENNAN.................Instructor in Violin, 1912
ANNA MAUD EARHART, B. S............Instructor in English, 1912
REUBEN CHARLES RIEDESEL, B. M. E...Instructor in Machine Shop, 1912

GEORGE HAMILTON MONTILLON, B. S. in M. E..Instructor in Mechanical Drawing, 1912

JOHN CALVIN POMEROY, B. A., M. A...Instructor in Physics, 1912
ROSS MADISON SHERWOOD, B. S. in A. H...Instructor in Poultry Husbandry, 1912

HERMAN AUSTIN SCULLEN, A. B......Instructor in Zoology, 1912
LLOYD E. BOWEN........................Instructor in Zoology, 1912
AVIS TALCOTT, B. A....................Instructor in Chemistry, 1912
PHINEAS S. SHEARER, B. S. in A. H.......Instructor in Animal Husbandry, 1912

NON-RESIDENT LECTURER

OLE JOHN HENDERSON, B. S., B. L. L..Lecturer in Rural Law, 1909

ASSISTANTS

HARRIETTE KELLOGG, A. M.......Curator of the Herbarium, 1903
GEORGE MITCHELL.........................Farm Superintendent, 1906
CAROLINE E. LAIRD...Assistant Librarian, Engineering Library, 1907
ROBINA MARGUERITE RAE...........Assistant Librarian, Agricultural Library, 1909

JOHN REARDON ............................Gardener, 1909
BRUCE A. COLE....Mechanician, Civil and Electrical Engineering, 1909
L. M. KELLEY...........Mechanician, Agricultural Engineering, 1911
KATHRENE HOLDRIDGE, A. B.......Cataloguer, Library, 1912, 1911
BETTY HUSTON PRITCHETT, A. B.......Cataloguer, Library, 1912
AMY WENTWORTH NOLL, B. Ph........Desk Librarian, 1912

STUDENT ASSISTANTS

ANNA WOLFE...................Student Assistant in Bacteriology, 1911
MARIE HANSON...........Student Assistant in Home Economics, 1912
OSCAR NEGAARD ....Student Assistant in Mechanical Engineering, 1912

EARL ELIJAH ....Student Assistant in Agricultural Journalism, 1912
T. S. LEITH....................Student Assistant in Anatomy, 1912
L. A. WHITE...................Student Assistant in Anatomy, 1912
R. G. ROSS....................Student Assistant in Pathology, 1912
C. D. RICE....................Student Assistant in Pathology, 1912
LYNN W. OSBORN..............Student Assistant in Soils, 1912
L. J. VONDRACEK...........Student Assistant in Farm Crops, 1912
JAMES H. SEYMOUR.............Student Assistant in English, 1912
R. L. DICKINSON.............Student Assistant in English, 1912
GEORGE R. HEMENWAY.........Student Assistant in Zoology, 1912
OFFICERS OF INSTRUCTION

RAYMOND ALLEN PEARSON. 1912. President
B. S. in Agr., Cornell University, 1894; M. S. in Agr, Cornell University, 1899; LL. D., Alfred University 1909.

CHARLES FRANKLIN CURTISS. 1897, 1891. Dean of the Division of Agriculture, Director of Experiment Station
B. S. A., Iowa State College, 1887; M. S. A., Iowa State College, 1892; D. Sc. in Agriculture, Michigan Agricultural College, 1907.

ANSON MARSTON. 1892. Dean of Division of Engineering,
Professor of Civil Engineering
C. E., Cornell University, 1889.

PROFESSORS

CATHARINE J. MACKAY. 1911, 1910. Professor of Home Economics
Drexel Institute, Diploma in Domestic Science, 1907; Boston Cooking School, 1909; Teachers’ College, Columbia University.

ELIZABETH MACLEAN. 1908, 1899. Associate Professor of English
B. Di., State Normal, Iowa, 1894; M. Di., 1900; B. Ph., Chicago, 1909.

MARK G. THORNBURG. 1912, 1910. Associate Professor of Animal Husbandry
B. S. A., Iowa State College, 1910.

CLAUDE KEDZIE SHEDD. 1911. Assistant Professor of Agricultural Engineering
B. S. in Agr., University of Nebraska, 1909.

JULES COOL CUNNINGHAM. 1911. Assistant Professor of Horticulture and Botany
B. S., Kansas State College, 1905.

ESTHER LIEPER COOPER. 1912, 1909. Assistant Professor of English
Ph. B., Iowa State University, 1903.

HENRY LOUIS EICHLING. 1912, 1911. Assistant Professor of Agronomy
B. S. in Agr., Iowa State College, 1911.

Assistant Professor of Engineering
Assistant Professor of Home Economics
INSTRUCTORS

MAY CHASE, B. S. Instructor in Mathematics, 1910
MILTON HENRY HOFFMAN, M. Di. Instructor in Agricultural Engineering, 1911
CHARLOTTE DRYDEN Ph. B. Instructor in Public Speaking, 1911
FRED LLOYD OVERLEY, B. S. in Hort. Instructor in Horticulture and Botany, 1912
PAUL REVERE Lisher, B. S. Instructor in Animal Husbandry, 1912
SADIE CLARK, B. S. Instructor in Mathematics, 1912
MABEL ALICE FLEMING, B. S. Instructor in English, 1912
WALTER WILLIAM WOBUS, B. S. A. Instructor in Dairying, 1912
MOGENS RASMUSSEN TOLSTRUP, B. S. in Dairying. Instructor in Dairying, 1912
D. HAROLD ZENTMIRE, B. S. in Agr. Instructor in Agronomy, 1912
EARL BRUNSON BISBEE Instructor in Chemistry, 1912
HARRY COWIE CAMERON Instructor in Agricultural Engineering, 1912
MAX MERWYN ALLENDER Instructor in Manual Training
FRED KOENIG Student Assistant in German, 1912
RUBY LYNCH Student Assistant in Mathematics, 1912
ROSS P. WHITE Student Assistant in Economic Science, 1912
MYRTLE McDONALD Student Assistant in History, 1912
MIRIAM RICHER Student Assistant in History, 1912
HOWARD S. COE, B. S. Student Assistant in Botany, 1912
Agricultural Experiment Station

STATION STAFF

RAYMOND ALLEN PEARSON, M. S. in Agr., LL. D., President
CHARLES FRANKLIN CURTISS, M. S. A., D. S., Director
LOUIS HERMANN PAMMEL, B. Ag., M. S., Ph. D., Chief in Botany
HENRY ELIJAH SUMMERS, B. S., Chief in Entomology
WILLIAM HENRY STEVENSON, A. B., M. S. A., Chief in Agronomy
SPENCER AMBROSE BEACH, B. S. A., M. S., Chief in Horticulture and Forestry

JAY BROWNLEE DAVIDSON, B. S. M. E., Chief in Agricultural Engineering

CHARLES HENRY STANGE, D.V.M., Chief in Veterinary Medicine

ROBERT EARLE BUCHANAN, M. S., Ph. D., Chief in Bacteriology, Associate in Dairy and Soil Bacteriology

MARTIN MORTENSEN, B. S. A., Chief in Dairying
ARTHUR WAYLAND DOX, B. S., A. M., Ph. D., Chief in Chemistry

HAROLD DE MOTT HUGHES, B. S., M. S. A., Chief in Farm Crops
WILLIAM HARPER P EW, B. S. A., Chief in Animal Husbandry

GILMOUR BEYERS MACDONALD, B. S. F., Assistant Chief in Forestry

CHARLOTTE MARIA KING, Assistant Chief in Botany
LYMAN CRANE BURNETT, M. S. A., Assistant Chief in Cereal Breeding

ROBERT LORENZO WEBSTER, A. B., Assistant Chief in Entomology
LAURENZ GREENE, B. S. A., M. S. A., Assistant Chief in Horticulture
HENRY HERBERT KILDEE, B. S. A., Assistant Chief in Dairy Husbandry

*SAMUEL L. JODIDI, B. S., Ph. D., Assistant Chief in Soil Chemistry
PERCY EDGAR BROWN, A. M., Ph. D., Assistant Chief in Soil Bacteriology

JOHN MARCUS EVVARD, M. S., Assistant Chief in Animal Husbandry

BERNARD WERNICK HAMMER, B. S. A., Assistant Chief in Dairy Bacteriology

GEORGE M. TURPIN, B. S., Assistant Chief in Poultry Husbandry
HARRIETTE KELLOGG, A. M., Assistant in Botany
WILLIAM G. GAESSLER, B. S., Assistant in Chemistry
SEYMOUR C. GUERNSEY, M. S., Assistant in Chemistry
RAY E. NEIDIG, M. S., Assistant in Chemistry

* Resigned February 1, 1913.
W. EUGENE RUTH, M. S. .................. Assistant in Chemistry
JOHN C. REESE, B. S. ................. Assistant in Chemistry
THOMAS J. MANEY, .................. Assistant in Horticulture
EDWARD HENRY KELLOGG, B. S. .......... Assistant in Soils
ROBERT SHIRLEY SNYDER ............. Assistant in Soils
JOHN H. ALLISON, JR. ............... Assistant in Plant Introduction
JOHN BUCHANAN, B. S. A........... Superintendent of Co-operative Experiments
FREDERICK WILLIAM BECKMAN, Ph. B. .... Bulletin Editor
FRED ERVING COLBURN ............. Station Photographer
VINA ELETHE CLARK .................. Station Librarian
ROBINA M. RAE .................. Assistant Librarian
CHARLES R. FOREST ................. Field Superintendent
ORSON GUNNELL LLOYD, B. S. A., M. S. Assistant Chief in Farm Management
Iowa State Highway Commission

ANSON MARSTON Chairman, Ames, Iowa, Commissioner.
J. W. HOLDEN, Scranton, Iowa, Commissioner.
H. C. BEARD, Mt. Ayr, Iowa, Commissioner.
THOS. H. MACDONALD, Highway Engineer.
JOHN EDWARD KIRKHAM, Consulting Bridge Engineer.
C. B. MCCULLOUGH, Assistant Engineer (in charge of designing department).
F. R. WHITE, Assistant Engineer (in charge of field engineering).
J. H. AMES, Assistant Engineer (in charge of office engineering).
L. A. WILKINSON, Accountant.
E. F. KELLEY, Assistant Designing Engineer.
C. E. OLSON, Assistant Field Engineer.
J. A. PAULSEN, Draftsman.
L. H. DOUGHTY, Draftsman.
I. E. TROTTNOW, Draftsman.
W. N. ADAMS, Draftsman.
Agricultural Extension

RAYMOND A. PEARSON, M. S. in Agr., LL. D. .......... President
CHARLES FRANKLIN CURTISS, M. S. A., D. Sc. Dean of Agriculture; State Leader of County Work

AGRICULTURAL EXTENSION STAFF

WILLARD JOHN KENNEDY, B. S. A. .................. Director
E. C. BISHOP, B. S., M. A. ......................... Schools and Juniors
R. K. FARRAR, B. S., M S. ........................ Rural Schools
M. H. HOFFMAN, M. Di. .............................. High Schools
ROY F. O’DONNELL, B. S. A. ....................... Animal Husbandry
HOWARD VAUGHN, B. S. in A. H. ................. Animal Husbandry
HOWARD PHILLIPS, B. S. A. ....................... Animal Husbandry
ROY A. CAVE, B. S. A. .............................. Dairy Test Associations
J. D. CLINE, D. V. M. .............................. Veterinary
E. Y. CABLE, B. S. (Agn.) ........................ Agricultural Engineering
JOHN DODDS, B. S. in C. E. ....................... Agricultural Engineering
PAUL C. TAFF, B. S. in Agn. ....................... Farm Crops
GEORGE DUNLOP ................................. Farm Crops
A. M. TEN EYCK, B. S., M. S. ....................... Farm Crops
MATHIAS ALLEN HAUSER .......................... Farm Crops
FRANK C. GRANNIS, B. S., M. S. .................. Soils
EVERETT LLOYD STEWART, B. S. A. ............. Soils
R. S. HERRICK, B. S. ................................. Horticulture
JOHN W. COVERDALE ................. Assistant State Leader, County Work
NEALE S. KNOWLES ............................... Home Economics
MRS. LOUISE HATHAWAY CAMPBELL, B. S. .... Home Economics
MRS. JESSIE AUSTIN BOYS, B. S. ................. Home Economics
MRS. CHARLES B. MCCOY, B. S. .................. Home Economics
IDA A. SUTHERLAND, B. S. ....................... Home Economics
MAMIE CUNNINGHAM, B. S. ....................... Home Economics
FREDERICK W. BECKMAN, Ph. B. ................... Bulletin Editor
The Thirty-fifth General Assembly made an appropriation to provide for engineering extension work. The staff for this work will be announced in a later bulletin.
The laws of the State of Iowa provide for the management and control of the State College of Agriculture and Mechanic Arts by the State Board of Education. This board consists of nine men nominated by the Governor and confirmed by the Senate. This Board appoints a Finance Committee consisting of three men who give their entire time to the management and control of the three state institutions of Iowa, under such rules and regulations as the State Board of Education may prescribe.

The act establishing "A State Agricultural College and Model Farm" to be connected with the entire agricultural interests of the State was passed by the Legislature of Iowa in 1858. This legislature also 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.

In 1862 Congress enacted and President Lincoln signed a bill 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."

Section 4 requires: "That all moneys derived from the sale of land shall constitute a perpetual fund, the capital of which shall remain forever undiminished, 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."

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 Representatives 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 sciences, with special reference to their application in the industries of life, and to facilities for such instruction."

The income of the College from National and State sources is therefore expended in instruction, experimentation, and illustration in agriculture and in the mechanic arts, and in the underlying and related science and literature. All buildings are erected and all repairs thereon are made by the State of Iowa. The college property is valued at $2,772,490.22. The College was formally opened on the 17th day of March, 1869.

SCOPE

The Iowa State College of Agriculture and Mechanic Arts seeks to aid the young men and women in the acquirement of a higher education. Instruction is given in the culture studies and sciences, together with such experimental work as to enable the students successfully to engage in a practical profession. Throughout the several courses, the study of the textbook is supplemented by lectures, discussions, library work, and
the practical experimental work of the laboratory. The instruction is not merely theoretical, but also practical, the student verifying and putting into practice in the laboratory the instruction received.

The Iowa State College offers four five year courses and sixteen four year courses leading to the following degrees:

**FIVE YEAR COURSES**

Five year course in Mechanical Engineering, leading to the degree of Bachelor of Science in Mechanical Engineering, B. S. in M. E.

Five year course in Civil Engineering, leading to the degree of Bachelor of Science in Civil Engineering, B. S. in C. E.

Five year course in Electrical Engineering, leading to the degree of Bachelor of Science in Electrical Engineering, B. S. in E. E.

Five year course in Mining Engineering, leading to the degree of Bachelor of Science in Mining Engineering, B. S. in E. M.

**FOUR YEAR COURSES**

Course in Agronomy, leading to the degree of Bachelor of Science in Agronomy, B. S. in Agn.

Course in Dairying, leading to the degree of Bachelor of Science in Dairying, B. S. in Dairying.

Course in Animal Husbandry, leading to the degree of Bachelor of Science in Animal Husbandry, B. S. in A. H.

Course in Horticulture and Forestry, leading to the degree of Bachelor of Science in Horticulture, B. S. in Hort., or Bachelor of Science in Forestry, B. S. in For.

Course in Agricultural Engineering, leading to the degree of Bachelor of Science in Agricultural Engineering, B. S. in A. E.

Course in Agricultural Education, leading to the degree of Bachelor of Science in Agricultural Education, B. S. in Ag. Ed.

Course in Veterinary Medicine, leading to the degree of Doctor of Veterinary Medicine, D. V. M.

Course in Mechanical Engineering, leading to the degree of Bachelor of Science in Mechanical Engineering, B. S. in M. E.

Course in Civil Engineering, leading to the degree of Bachelor of Science in Civil Engineering, B. S. in C. E.

Course in Electrical Engineering, leading to the degree of Bachelor of Science in Electrical Engineering, B. S. in E. E.

Course in Mining Engineering, leading to the degree of Bachelor of Science in Mining Engineering, B. S. in E. M.

Course in Ceramics, leading to the degree of Bachelor of Science in Ceramics, B. S. in Cer.

Course in Chemical Engineering, leading to the degree of Bachelor of Science in Chemical Engineering, B. S. in Chem. Engr.
Course in Science as related to the Industries, leading to the degree of Bachelor of Science, B. S.
Course in Home Economics, leading to the degree of Bachelor of Science in Home Economics, B. S. in H. E.

NON-COLLEGIATE COURSES

Two Year Course in Agriculture.
Two Year Course for Homemakers.
Two Year Trade School Work in Engineering.
One Year Course in Dairying.
One Year Course in Poultry Husbandry.

SUMMER SCHOOL

Six Weeks Summer School devoted to both collegiate and non-collegiate courses.

WINTER SHORT COURSES

Two Weeks Short Course in Stock Judging.
Two Weeks Short Course in Grain Judging.
Two Weeks Short Course in Horticulture and Forestry.
The following lectures are given in connection with the Short Courses in Stock Judging and Grain Judging: Horticulture, Forestry, Veterinary, Botany and Agricultural Engineering.
Two Weeks Short Course in Dairying.
Two Weeks Short Course for Buttermakers.
Two Weeks Short Course in Home Economics.
Two Weeks Short Course in Engineering.

LOCATION

The College occupies a delightful and healthful location upon high, rolling land in the west part of Ames, Story County. Situated at the junction of the north and south branch and the main double-track line of the Chicago & Northwestern Railroad, and connected with all the trunk lines of Iowa, Ames is easily accessible from all parts of the State. An electric railway connects Ames and the College with efficient service. The Fort Dodge, Des Moines and Southern Railway (electric), with stations on the campus, gives efficient service to the College, and excellent connections with the following trunk lines in Iowa: At Fort Dodge, with the Illinois Central and Chicago Great Western; at Huxley, with the Chicago, Milwaukee & St. Paul; at Des Moines with the Chicago, Rock Island & Pacific, the Chicago Great Western, and the Chicago, Burlington & Quincy.

Ames is a most desirable town for wholesome college influences. Its people are thrifty, enterprising and cordial. The town has an excellent system of public schools, numerous churches, waterworks, and electric lights, and it also has a good city government. It is an inviting community for families who wish to educate their children and to enjoy a good environment at a reasonable expense. Ames and the College are
on very cordial terms, and its citizens seek to promote the efforts of the students and the highest interests of the College.

THE COLLEGE GROUNDS

Of the entire College domain of 1,200 acres, 125 acres are set apart for College grounds. These include the experimental plots, the young forestry plantations, the surroundings of the professors' dwellings, and the central campus with its beautiful winding walks and drives; its trees, shrubbery, and flower gardens; and its large and stately college buildings. 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 the entire campus a large and beautiful park.

BUILDINGS

Thirty-six commodious buildings have been erected by the State for the exclusive use of the various departments of the College, besides the dwelling houses and the buildings for farm stock, machinery, and work. All of these buildings are heated by steam, lighted by electricity, and supplied with pure water.

GENERAL BUILDINGS

Central Building: The New Central Building, which has been erected on the site of the Old Main, accommodates the Executive Offices, and the departments of English, Modern Languages, Economic Science, History, Mathematics, Public Speaking, Botany and General Bacteriology. The building is of buff Bedford stone, built in the Roman Renaissance style, which style has also been adopted for the Engineering and new Agricultural Halls. The building completed and furnished, cost about $375,000.

Morrill Hall: Morrill Hall, one of the oldest of the College buildings, was named in honor of Hon. Justin S. Morrill, the originator of the "Land Grant" for Colleges of Agriculture and Mechanic Arts. It is of deep red brick with stone, brick and terra cotta trimmings. In it are College Chapel, Library, Zoological Museum, lecture rooms, and laboratories.

Home Economics Building: This is a two story fireproof building. The basement contains the lockers, reading room, and class rooms of the Home Economics Department. The first floor is devoted to offices and the laboratories for the Domestic Art work. The second floor contains the laboratories for the Domestic Science classes and the art room.

Margaret Hall: Margaret Hall, the home of the young women of the College, occupies one of the most pleasing locations on the campus. It is built of brick, roofed with slate, provided with steam heat, electric lights, baths, and a large parlor. The hall accommodates about one hundred women, to whom the rooms are assigned in the order of their application. The privilege of rooming in Margaret Hall is reserved for regular students. In connection with the Hall there is a boarding club for the young ladies. Young women residents of Margaret Hall are re-
quired to board in this club. The young women are under the direction of an efficient matron.

The Campanile: A detached tower 110 feet in height is built of buff brick with terra cotta trimmings. This tower stands practically in the center of the campus. It contains a Seth Thomas tower clock with four dials, each seven feet in diameter. The tower also contains the Margaret Chimes presented to the Iowa State College by Dr. Edgar Williams Stanton in memory of his wife, Margaret McDonald-Stanton. The chime was manufactured by John Taylor & Company, Loughborough, England. It has ten bells, the combined weight of which is 15,000 pounds.

Chemical Hall: A three story brick building furnished with steam heat, water, gas, and laboratory equipment, accommodating 600 students in Chemistry. Destroyed by fire, April, 1913.

Sanitary Hall: A two story brick building, containing offices, kitchen and dining room for the hospital patients, and rooms for the sick and convalescent.

Alumni Hall: This is a brick building, 87 by 48 feet, colonial in style, with three large porches. It has three stories and a basement; in the basement there are the cafe and swimming pool; on the first floor, there are reception rooms and reading rooms for the Young Men's and the Young Women's Christian Associations; on the second floor, there are the assembly room and the Bible class rooms; and on the third floor, there are three large parlors and fourteen sleeping rooms. This building was built by private subscriptions.

Gymnasium: This building is one of the largest in America devoted to physical training. It is 297 feet long and 83 feet wide. Each of its two great exercise rooms has an area of nearly one-third of an acre. One has a dirt floor for indoor practice in all outdoor sports. The other, in the second story, has space for basket ball courts, volley ball and squash courts, baseball cage, indoor baseball diamond, complete gymnasium apparatus and 1-12 mile track. In the wings are lockers and special exercise rooms, baths, pool, handball courts, and athletic quarters. This building cost $165,000.

Music Hall: This is a two story brick building, fitted with apparatus and instruments for practice and instruction.

Central Heating Plant: A central heating and power plant furnishes heat and power for all College purposes with very satisfactory results in comfort, economy, and cleanliness.

Custodian's Office: This is a small two story brick building about 40 x 36 feet. It is used for offices for the Custodian and the Military Department.

Book Store and Post-office: This is a small one story brick building about 44 x 55 feet, which contains the College book store and the branch government post-office known as Station "A."

Dwelling Houses: There are also on the campus eighteen comfortable dwelling houses occupied by professors' families, or by foremen and employees.
Hall of Agriculture: The Hall of Agriculture is 234 x 78 feet, and four stories in height. It is fireproof throughout, of the best modern construction, and arranged with suitable conveniences and facilities for thoroughly efficient high-grade work in agricultural instruction and investigation. This building, with its equipment complete, cost about $350,000.

The Annex of the Hall of Agriculture: This contains the assembly room, which is semi-circular in form, the base being ninety-six feet in diameter. The annex is fireproof throughout and of the best modern construction.

Agricultural Engineering Hall: This is a four story building, the lower stories of stone and the upper of brick. It contains offices, recitation rooms and shops of the Department of Agricultural Engineering and also offices and recitation rooms for the two year work in Botany and Horticulture.

Agricultural Engineering Annex: This is a four story, fireproof building, built of steel and pressed brick, costing, when equipped, about $70,000. It accommodates the workshops, tool rooms, blacksmith shop, carpenter shop, drafting room, reading room, rooms for the study and exhibition of various farm implements, offices and class rooms, bulletin rooms, and photographic department.

Dairy Building: This is a three story building built of pressed brick and trimmed with Bedford stone, containing factory, butter, and cheese rooms, bottling room, refrigerators, lunch room, offices, research laboratory, farm dairy room, students' testing laboratory, lecture room, dairy reading room, and bacteriological laboratory for research and investigation.

Horticultural Laboratory: This is a two story brick building connected with the greenhouse. The main floor, accommodating fifty students, is especially fitted for the study of fruits. The building is equipped with two refrigerators, one for experimental work in cold storage and the other for storing fruits for class purposes. The second floor contains the horticultural museum and facilities for photography.

Greenhouses: The present plant contains 11,040 square feet under glass. The houses are of cypress construction, supported by a steel structure. They are heated by steam, operated on the Paul system, with varying temperatures for the propagating house, the growing houses, and the seed testing houses. The houses also include four commodious work rooms used in potting, transplanting, and other necessary work.

Horse Barns and Stock Pavilion: The barn, built of brick, with a slate roof, is for horses, for the storage of grain, and for general farm purposes. The Stock Pavilion, also of brick, is circular in form, and is well heated and lighted, accommodating several hundred students at a time, and affording first-class advantages for stock judging and animal husbandry.
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 veneered with buff pressed brick, has a slate roof, paved brick floors, and is in every respect entirely fireproof. The building is devoted to the housing of beef and dairy cattle and horses and to the storage of vehicles and machinery. It is also used as a storage and grinding room for feed, and as seed rooms for the drying of corn and the storage of grain and feed stuffs used in experimental work.

Judging Pavilion: In connection with the experimental barn, there is a two story octagonal judging pavilion. It is built of buff pressed brick with a slate roof. The lower story is used for stock judging, and the upper for grain judging. This building, thoroughly equipped in every way, is conceded to be the best building of its kind on the continent.

Judging Pavilion Annex: A new Judging Pavilion in type and style the same as the pavilion described above.

Other Buildings: Stables, barns and seed houses sufficient for the requirements of the farm, are conveniently grouped near the College campus.

Veterinary Buildings

Administration Building: In this building are located the Dean’s general and private offices, faculty room, surgeon’s office, and assembly room with seating capacity for two hundred and fifty, museum, library, and librarian’s office. These occupy the first and second floors, while storerooms for department supplies are located in the basement.

Hospital: The hospital is a three story brick building, fitted with well lighted single and box stalls, operating rooms, office and pharmacy, resident surgeon’s room, etc. It is well furnished with all the surgical instruments of modern construction, operating table, and other important conveniences for clinical as well as for general hospital work.

Anatomy and Histology Building: The Department of Anatomy and Histology occupies the northwest building of the Veterinary group. The amphitheatre class room is arranged so that all students have an equal opportunity to observe the class room demonstrations, which are favored by the ample amount of light.

The dissecting room is lighted by windows on three sides as well as sky lights, and equipped with tracks to which animals may be suspended in a normal position. There are individual tables for dissecting parts, and hot and cold water for cleansing and dilating purposes. Skeletons of the horse, ox, pig, sheep, and dog are at all times available to assist the student in his laboratory work. A modern odorless rendering apparatus disposes of all dissected material and offal from the hospital.

The private laboratory adjacent to the dissecting room provides for the preparation of tissues for laboratory work and microscopical sections for histology.

The histology laboratory is a large, well lighted room with thirty-six desks for individual students. Each student is provided with a com-
complete set of apparatus, including a microscope, consequently no student's work is hampered or interfered with by another.

Pathology and Bacteriology Building: The northeast building of the Veterinary group is devoted to the work in Pathology, Bacteriology, and Meat Inspection. It comprises two offices, a private laboratory for individual research work, a class room, accommodating fifty students, with provision for lantern slides and microscopic projection work, and a large general laboratory. The laboratory equipment is complete and modern in every respect, each student being provided with an individual glass topped desk, microscope and accessories. Special attention has been paid to the lighting of the laboratories, windows being on three sides, with electricity and gas available. In connection with the laboratory are pathology preparation rooms for fixing, imbedding, sectioning, staining, and mounting sections of tissue, sterilizing room and incubation room.

In the basement are found rooms for small animals for inoculation and post mortem work. For the preparation and storing of museum specimens and for demonstration work in both general and special pathology. Photographic and dark room are also located here.

Physiology and Pharmacology Building: This building lies just south of the Administration Building, and forms the southeast corner of the Veterinary group. In this building may be found modern laboratories and equipment for carrying on general laboratory or research work in either physiological or pharmaceutical subjects. Aside from a large class room, three well lighted general laboratories for student use, a private laboratory and dark room, preparation room, experimental animal room, and store rooms are located here, each of which is admirably equipped to suit its respective purpose. In general laboratories each student has his own individual equipment for both physiological and pharmaceutical work, and thus being made independent, individual work and self reliance are encouraged.

ENGINEERING BUILDINGS

Engineering Hall: The Engineering Departments occupy Engineering Hall. This is a fireproof building in which all the engineering departments have offices, recitation and lecture rooms, laboratories and engineering museum. It is of Bedford stone, has plate glass windows, and modern conveniences and furnishings throughout. This building, costing $220,000, is the best engineering building west of the Mississippi river.

Engineering Annex: This is a two story fireproof building, 50 x 208 feet, completed in the fall of 1909. The total cost is $41,000. The first story is devoted to the use of the Electrical Engineering Department, the Mining Engineering Department and the surveying Department. In it are located the dynamo engineering laboratory, assaying and clay working rooms for the Mining Engineering Department, and instrument room and class room for the Surveying Department. The second story contains additional rooms for the Mining Engineering Department, the remainder being given up to drafting rooms and class rooms for the Electrical, Civil,
and Mechanical Engineering Departments. A third story is being held in reserve, to provide additional accommodations as the constant growth of the department demands.

The Ceramics Building: The Legislature provided an appropriation of $15,000 for the construction of a new Ceramics building. This was completed in the fall of 1909. It is a three story, fireproof building, 70 x 50 feet, containing clay working rooms, kiln rooms, and other adequate accommodations for the Ceramics work. The chemical part of the Engineering Experiment Station work is done in this building.

Structural and Hydraulic Laboratory: This is a three-story stone and brick building, which has been entirely remodeled and rebuilt into a modern laboratory building, fireproof except for the roof. The Hydraulic laboratory occupies a basement wing lined with enameled brick, and also the floor above it. There are two large structural laboratory rooms, one large cement laboratory room, four computing and research rooms, five instrument rooms, and offices. The Engineering Experiment Station and the Structural Testing Laboratories are also located in this building.

Foundry: This is a one story brick building, 38 x 78 feet, containing the equipment for instruction in foundry practice. The roof trusses are of steel and are calculated to carry traveling cranes for transferring heavy castings and forgings.

Forge Shop: This is a one story brick building, 38 x 78 feet, with a store room at one side in an addition. The building was constructed in 1906. It contains equipment for instruction in forge shop practice. The roof trusses are of steel and the roof is of slate.

Pattern Shop: This is a one story brick building, 38 x 120 feet, devoted to the work of instruction in bench work, wood turning, and pattern work. A fireproof 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.

Machine Shop: This is an entirely new building, 150x45 feet, just erected. It is practically two stories high, and, besides a large machine shop, surrounded by a gallery, it contains laboratory, locker room, office, class room, and tool room. This building is one of the best college engineering shops in the country.

New Mechanical Laboratory: A new and complete Mechanical Laboratory is about to be erected, actual work to be started this year. It is estimated that this building will cost $35,000, and is constructed entirely of brick. It consists of a main building 55x100 feet, and contains materials, testing laboratories, and offices; a wing 55x47, contains boilers, producers, gasoline and steam engines, pumps, etc.; and a balcony, 15 feet wide.
Accredited Schools

High schools and academies are placed on the accredited list upon the recommendation of the Board on Secondary School Relations, and the approval of the Faculties of the three State Educational Institutions of Iowa. The Board on Secondary School Relations was appointed by the Iowa State Board of Education and consists of the following members:

P. E. McClenahan, Inspector of Secondary Schools, Des Moines, Iowa.
Herbert C. Dorcas, State University, Iowa City.
Herman Knapp, Registrar, State College, Ames.
George S. Dick, Registrar, State Teachers College, Cedar Falls.

All questions with regard to the inspection or relation of the schools to the three state institutions should be addressed to P. E. McClenahan, Inspector of Secondary Schools for the State Board of Education, Des Moines, Iowa.
Admission to the College

All communications with regard to the admission of any student to the College should be addressed to the Registrar. Official high school records should be filed with the Registrar at the close of the school year, if possible, and not later than the second Monday in August or the first Monday in January. The Registrar will determine the value of all credentials and will notify the applicant of their acceptance. He will also assign the applicant for admission to his position in the course desired. This assignment will be conditioned upon the the students doing creditable work.

Applicants for admission to the freshman class should be at least sixteen years of age.

A student may enter the College at the beginning of either semester. The regular classes begin with the opening in September and the student is urged to commence at that time. The freshman subjects are, however, taught in both semesters. The Freshman work will be of such grade that a graduate of an accredited school can reasonably be expected to be prepared to carry it creditably. The responsibility of maintaining himself in the Freshman class rests, however, upon the student. The College desires to emphasize the importance of thorough preparation, particularly in subjects that are to be continued in College, as for example, Mathematics and English. In these subjects the College has found it helpful to conduct a review for the first two or three weeks of the freshman year. In English, this review will include a rapid but thorough review of grammar followed by essays on simple subjects designed to test the student's command of fundamental principles. This review will be given with the student's first course in college English. At the end of this review students are assigned to sections covering the work which they are fitted to undertake. As without thorough preparation satisfactory progress in advance work is impossible, students are urged to review carefully before entering the College algebra through quadratics, English composition, and grammar. Students desiring admission should examine the requirements for admission and the methods of obtaining the fifteen units for admission.

REQUIREMENTS FOR ADMISSION TO THE SEVERAL DIVISIONS OF THE COLLEGE

(Requirements for Non-Collegiate Courses, see Index)

The requirements for admission are stated in terms of units. An entrance unit is defined as thirty-six weeks of high school work in one subject of study, with five class periods per week each not less than forty
minutes in length. Each laboratory period should be at least 80 minutes in length. Students desiring admission to the Freshman year must present fifteen units. Of these, certain are required and the balance may be elective.

<table>
<thead>
<tr>
<th>UNITS REQUIRED FOR ADMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division of Agriculture.</td>
</tr>
<tr>
<td>Units.</td>
</tr>
<tr>
<td>Algebra</td>
</tr>
<tr>
<td>Geometry, Plane</td>
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<tr>
<td>Geometry, Solid</td>
</tr>
<tr>
<td>*English</td>
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<tr>
<td>**History</td>
</tr>
<tr>
<td>Foreign Language</td>
</tr>
<tr>
<td>Electives</td>
</tr>
<tr>
<td>From the following list of electives</td>
</tr>
<tr>
<td>Total units for admission</td>
</tr>
</tbody>
</table>

A student may be admitted who is conditioned 1½ units, but the entrance conditions must be removed within one calendar year after his admission, or before he registers for his second year's work; and he is to be registered at once for the work in which he is deficient, as a part of the normal amount of work allowed to students.

In case a student presents 13½ to 15 acceptable entrance units, not including any foreign language, he must be conditioned to the extent of two units in foreign language; for such a student cannot make up the full amount of preparatory foreign language in one year. He should be permitted to complete the deficiency during the first half of his sophomore year. This will ordinarily require, if taken in College, extra work to the extent of five hours a week for three semesters. Such extra work will not be credited as a part of the credit hours required for graduation in the several courses.

Students admitted with conditions are not to be permitted to remove these conditions, within the allotted one year by taking entrance examinations in subjects in which they have been taking college courses for credit.

Students offering Foreign Language for admission units are urged to offer two units in one language, preferably a Modern Language.

In the divisions of Science and Engineering, no Foreign Language course of less than two units will be accepted for required entrance units in language.

* Not less than 3 semesters in literature; and 3 semesters in composition and rhetoric, and grammar, provided that no credit will be given for grammar if taken in the ninth grade.

** May include civics and economics. United States History is not to be accepted unless taken within the latter half of the secondary school course. Not more than one-half unit of the required units is to be allowed for civics.
In the division of Agriculture and Veterinary Medicine it is not necessary that the required units in Foreign Language be in one language.

List of Elective Units

The following is a list of elective subjects for which entrance credit may be allowed as indicated:

1. Foreign language (not more than a total of 4 units in any one foreign language, including the required 2 units).
   - (1) Greek  2 to 4 units
   - (2) Latin  2 to 4 units
   - (3) French 2 to 4 units
   - (4) Spanish 2 to 4 units
   - (5) German 2 to 4 units

2. English (additional to the required 3 units).
   - (1) Not more than 1 unit; or a total of not more than 4 units, including the required 3 units.

3. History, civics and economics (not more than a total of 4 units in this group, including the required unit, and not more than the maximum credit here indicated in each case).
   - (1) Ancient history ½ to 1 unit
   - (2) Mediaeval and modern history ½ to 1 unit
   - (3) English history ½ to 1 unit
   - (4) U. S. history (only if taken within the latter half of the high school course) ½ to 1 unit
   - (5) General history (but not in addition to ancient mediaeval and modern history) 1 unit
   - (6) Civil government ½ to 1 unit
   - (7) Political economy ½ unit

4. Mathematics
   - (1) Solid geometry ½ unit
   - (2) Plane trigonometry ½ unit
   - (3) Advanced algebra ½ unit

5. Science (not more than a total of 4½ units in this group).
   - (1) Physics, not less than 1 unit
   - (2) Chemistry, not less than 1 unit
   - (3) Physical geography or physiography ½ to 1 unit
   - (4) Botany ½ to 1 unit
   - (5) Zoology ½ to 1 unit
   - (6) Physiology ½ unit
   - (7) Geology ½ unit
   - (8) Astronomy ½ unit
   - (9) Agriculture ½ to 1 unit

For the present year any applicant for admission to the Division of Veterinary Medicine may be admitted without Language, provided, he offers all the required units except the two in Foreign Language, together with sufficient elective units to make a total of fifteen units.
6. Commercial subjects (not more than a total of 2 units in this group).

(1) Advanced arithmetic (only if taken after the completion of the required 1½ units in algebra or in the latter half of the high school course) ½ unit

(2) Double entry bookkeeping ½ to 1 unit

(3) Commercial geography ½ unit

(4) Commercial law ½ unit

(5) Industrial history ½ unit

7. Industrial subjects (consisting of subjects in which there should be required for ½ entrance unit either 36 weeks of daily class exercises, each class exercise being not less than 40 minutes in length; or, still better, 18 weeks of daily class exercises, each class exercise being not less than 80 minutes in length).

(1) Freehand or mechanical drawing ½ to 1 unit

(2) Manual training, i.e., shop work ½ to 2 units

(3) Domestic science ½ to 1 unit

(4) Stenography ½ to 1 unit

(Not more than a total of 2 units in this group).

Note: Credit is not given except upon the passing of the regular entrance examinations, for English grammar, and United States history, when these subjects are given in the 9th grade; nor for arithmetic when this subject is given before the completion of the required 3 semesters of work in algebra, or in the latter half of the course.

METHODS FOR OBTAINING THE FIFTEEN UNITS FOR ADMISSION (See General Catalogue)

There are four methods of obtaining the necessary units for admission to the Freshman class:

A. Admission by transfer from other Colleges and Universities.
B. Admission by certificate from a fully accredited High School.
C. Admission by Examination.
D. Admission on other evidences of Proficiency.

A. Admission by Transfer From Other Colleges and Universities

For the acceptance of standings from other Colleges or Universities to apply as college work in this College, see Index for Advanced Standings.

College Entrance Examinations

Certificates of entrance examinations passed for admission to reputable universities and colleges; and certificates of examination passed under the direction of any of the College Entrance Examination Boards and the Regents of the State of New York; may be accepted as certificates from our own accredited schools are accepted.
Academies and Preparatory Schools

Credits certified from private secondary schools such as academies, seminaries, etc.; and from college preparatory schools, shall be estimated in accordance with the definitions of the entrance unit and on the standard of four years of preparation and residence. College academies or preparatory departments conforming in their organization with the organization of the four-year accredited high school shall be treated as accredited schools, if the colleges themselves are regarded as standard colleges.

B. Admission by Certificate From the Fully Accredited High Schools

Graduates of the fully accredited High Schools of Iowa who meet fully the requirements for admission to the Freshman class, will, upon presentation of the proper Uniform Certificate, be admitted to the College without examination.

Graduates of schools fully accredited by the Colleges of other states which have as high a standard of entrance requirements as this institution, will also be admitted as Freshman upon presentation of certificate of graduation, accompanied by Uniform Admission Certificate.

Superintendents and Principals are urged to send to the Registrar immediately upon the close of the school year, the Uniform Admission Certificate of each graduate intending to enter the College at the beginning of the ensuing College year. If, on inspection, the certificate is found satisfactory, the applicant will be forwarded a certificate entitling him to admission without examination. Uniform Admission Certificates may be obtained by teachers and students upon application. Candidates for admission may apply to the Registrar for the Uniform blank. The Certificate must show the grade of work done and text-books used in the subjects required for entrance, with a definite statement of the year of the High School in which the subject was taken, the number of recitations per week, and the number of weeks the subject was pursued during the High School Course; and it must state that the applicant is of good moral character and, in the judgment of the subscriber, able to pursue college studies successfully.

If, however, applicants from accredited four-year secondary schools present the superintendent's or principal's certificate showing deficiencies not exceeding 1½ entrance units, together with that officer's statement that they are in good standing in the school from which they come, and that in the subscriber's judgment they are able to pursue college studies successfully, they may be admitted on condition that they make up enough credits to bring the number up to fifteen units within one year after their admission.

Diplomas of graduation will not be accepted for entrance unless accompanied by a Uniform Certificate as stated above.

All Uniform Certificates should be filed with the Registrar not later than the second Monday in August or the first Monday in January.
C. Admission by Examination (a suggestive list of examination questions may be obtained from the Registrar).

Students desiring to enter by examination will be given such examinations in any subject required for entrance, upon presentation of satisfactory evidence of their having devoted sufficient time to the preparation of such subjects.

Students desiring to enter by examination will be expected to pass examinations in the required and elective subjects, according to work outlined on pages —, — and —.

The subject matter to be covered is according to the material found under the general statement concerning entrance units, page —, which gives a synopsis of the amount and kind of work required for entrance.

-D. Admission on other evidences of Proficiency

Admission from a Non-Accredited School

A student presenting a certificate from an unaccredited school may be admitted to collegiate courses by the following plan:

1) He is to pass entrance examinations in acceptable subjects representing each of the main groups of subjects certified, for half of the number of acceptable credits so certified.

2) The subjects for examination are to be selected by the college examiner at the time of the examination and irrespective of the choice of the student.

3) The total number of credits ultimately allowed on the certificate shall not exceed twice the number earned by examination.

4) The total amount of credit gained in this way, together with additional credit for subjects not indicated in the certificate (or subjects so indicated, but not acceptable), if additional credit is needed, shall be at least 13½ units. In case he presents less than fifteen acceptable entrance units he is to be conditioned to the extent of enough units to bring the total number up to fifteen units.

First Grade Uniform County Certificate

Entrance credit may be allowed for the first grade uniform county certificate in subjects marked 85 or above, as follows:

Arithmetic .................. ½ unit  Civics ..................... ½ unit
U. S. History .................. ½ “  Economics .................. ½ “
Physiology .................. ½ “  Algebra ..................... 1 “
Grammar .................. ½ “

State Certificate

Entrance credit may be allowed without examination for the five-year second and first grade state certificates, and for the life diploma as follows:
**ADMISSION TO COLLEGE**

<table>
<thead>
<tr>
<th>SECOND GRADE</th>
<th>FIRST GRADE</th>
<th>LIFE DIPLOMA</th>
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<tbody>
<tr>
<td>English</td>
<td>1½ units</td>
<td>3 units</td>
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<tr>
<td>History</td>
<td>½ “</td>
<td>1½ “</td>
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<tr>
<td>Civics</td>
<td>½ “</td>
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<td>Economics</td>
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<td>Physics</td>
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<td>1 “</td>
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<td>Botany</td>
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<td>Physiology</td>
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<td>Drawing</td>
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<tr>
<td>&quot;Didactics&quot;</td>
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<td>½ “</td>
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<tr>
<td>Psychology</td>
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<td>½ “</td>
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<tr>
<td>Geometry</td>
<td>1 “</td>
<td>1 “</td>
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<tr>
<td>Trigonometry</td>
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**Totals** 8½ units 12½ units 14½ units

**Entrance Examination Periods**

Examinations for entrance to College will be conducted at the opening of each semester on the Tuesday and Wednesday preceding classification.

**Tuesday.**
- 8 to 10 A. M.—Mathematics. Room 221, Central Building.
- 10 to 12 A. M.—English. Rooms 1 and 3, Central Building.
- 1 to 3 P. M.—Language. Room 119, Central Building.
- 3 to 5 P. M.—Botany. Room 312, Central Building.

**Wednesday.**
- 8 to 10 A. M.—Mathematics. Room 221, Central Building.
- 8 to 10 A. M.—Chemistry. Chemical Hall.
- 10 to 12 A. M.—History. Room 208, Central Building.
- 1 to 3 P. M.—Civics. Room 102, Central Building.
- 3 to 5 P. M.—Physics. Room 212, Engineering Hall.
- 3 to 5 P. M.—Language. Room 119, Central Building.

The Registrar will arrange for the other examinations required by the candidates for admission.

**GENERAL STATEMENT CONCERNING ENTRANCE CREDITS**

Students and others desirous of learning something of the amount and kind of work required for entrance to Freshman classes will find suggestive outlines below for some of the most important subjects.
Foreign Languages

The work in Foreign Language should be a careful preparation which shall enable the student to continue the same work in college with ease. Whether the amount of reading covered is relatively small or great, the training should consist of a thorough knowledge of grammar. Proficiency is of the greatest importance.

Suitable texts may be found in the Report of the Committee of Twelve of the Modern Language Association of America. A representative amount of work in preparation is as follows:

1. Latin. Four units accepted.
   First Year:—Thorough work with an acceptable elementary text, mastery of forms, readiness in writing simple Latin.
   Second Year:—Four books of Caesar or the equivalent; Latin prose, one period each week.
   Third Year:—Six orations of Cicero; Latin prose, one period each week.
   Fourth Year:—Six books of Virgil; prose or mythology, one period each week.

2. German. Four units accepted, but three units outlined.
   First Year:—Careful drill upon pronunciation (pupils should get pronunciation from trained teacher, not from books), rudiments of grammar, conversational and colloquial German, reading of from 60 to 100 pages of graduated texts with constant practice in translating into German easy variations upon sentences selected from the reading lesson.
   Second Year:—Reading from 150 to 200 pages of easy stories and plays, accompanying practice, as in first year, in the translation into German of easy variations, continued drill in rudiments of grammar and conversational use of knowledge.
   Third Year:—Reading of about 300 pages of moderately difficult texts with constant practice in giving in German paraphrases and abstracts of the matter read, grammatical drill with special reference to auxiliaries, tenses, moods and some attention to word formation.

3. French. Four units accepted, but three units outlined.
   First Year:—A full statement of the work to be done and suggestions as to methods and texts may be found in Section X-XII of the Report of the Committee of Twelve of the Modern Language Association of America. The work should comprise the elements of the grammar with exercises and drill in easy conversation and especially pronunciation. The reading should consist of from 150 to 200 pages of easy texts.
   Second Year:—Reading of from 250 to 400 pages of texts. Review of the principles of grammar with exercises and composition. Conversation practice based on texts and grammar.
   Third Year:—Reading from 400 to 600 pages of texts. Free composition. Summaries of texts and conversation drill. Study of a grammar of moderate completeness.
4. Greek. Four units accepted, but two units outlined.

First Year:—The elements of Greek grammar and the reading of easy selections; in the latter part of the year the reading of a portion of Xenophon's Anabasis or of some other Attic prose of the same grade. The regular paradigms should be thoroughly mastered and a considerable vocabulary acquired.

Second Year:—The reading of the remainder of the first four books of the Anabasis or portions of Cyropaedia; in the second half of the year the reading of some other piece of Attic prose, such as Xenophon's Hellerica or the orations of Lysias, or of three or four books of Homer.

While accurate knowledge of the grammar of the language is essential for real progress, and slipshod work is to be avoided, it should be remembered always that this is but a means to an end—the inspiration and culture that comes from the Greek spirit.

English

The six credits required in English include the following subjects, and should provide the training indicated below:

1. English and American Literature, 1½ units:

Reading of Classics. The following books are recommended by the Joint Conference on Uniform Entrance Requirements in English, and the list has been accepted by practically all the colleges in the United States.

For Study and Practice: Shakespeare's *Macbeth*; Milton's *L'Allegro, Il Penseroso* and *Comus*; either Burke's *Speech on Conciliation with America*, or both Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*; either Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For Reading and Practice: Ten units selected from the following list, two from each group; the units are set off by semicolons:

Group I. The *Old Testament* (chief narrative episodes); the *Odyssey* (with omission, if desired, of Books I, II, III, IV, V, XV, XVI, XVII); the *Iliad* (with omission, if desired, of Books XI, XIII, XIV, XV, XVII, XXI); Vergil's *Aeneid*. (For any one of this group one from any other group may be substituted).

Group II. Shakespeare's *Merchant of Venice, Midsummer Night's Dream, As You Like It, Twelfth Night, Henry the Fifth, Julius Caesar*.

Group III. Defoe's *Robinson Crusoe, Part I*; Goldsmith's *The Vicar of Wakefield*; either Scott's *Ivanhoe* or Scott's *Quentin Durward*; Hawthorne's *The House of Seven Gables*; either Dickens's *David Copperfield* or Dickens's *A Tale of Two Cities*; Thackeray's *Henry Esmond*; Mrs. Gaskell's *Cranford*; George Eliot's *Silas Marner*; Stevenson's *Treasure Island*.

Group IV. Bunyan's *Pilgrim's Progress, Part I*; Addison's *The Sir Roger de Coverley Papers* in the Spectator; Franklin's *Autobiography*;
Irving's Sketch Book; Macaulay's Essays on Lord Clive and Warren Hastings; Thackeray's English Humorists; Selections from Lincoln, including at least the two Inaugurals, the Speeches in Independence Hall and at Gettysburg, the Last Public Address, and Letter to Horace Greeley, along with a brief memoir or estimate; Parkman's Oregon Trail; either Thoreau's Walden or Huxley's Autobiography and selections from Lay Sermons; Stevenson's Inland Voyage and Travels with a Donkey.

Group V. Palgrave's Golden Treasury (First Series), Books II and III; Gray's Elegy in a Country Churchyard, and Goldsmith's Deserted Village; Coleridge's Ancient Mariner, and Lowell's Vision of Sir Launfal; Scott's Lady of the Lake; Byron's Child Harold, Canto IV, and Prisoner of Chillon; Palgrave's Golden Treasury (First Series), Book IV; Poe's Raven; Longfellow's Courtship of Miles Standish, and Whittier's Snow-Bound; Macaulay's Lays of Ancient Rome, and Arnold's Sohrab and Rustum; Tennyson's Gareth and Lynette, Lancelot and Elaine, and The Passing of Arthur; Browning's Selected Poems.

In the study of the books prescribed above the constant aim should be to develop the student's power of appreciation. He should be trained to observe for himself, to analyze for himself, to reach judgments of his own. One excellent method is to give with each assignment specific questions directing attention to certain qualities of thought or plan or style. In this way the student may be trained to observe the fundamental qualities and principles of literary expression. The selecting of appropriate epithets and figures of speech, of beautiful, suggestive, or forcible phrases, of qualities that make style now easy or familiar, now ornate, dignified, or forcible, will develop a sense of literary values, and cultivate the power of literary appreciation. Moreover, by such study the student will insensibly strengthen and enrich his power of self-expression. Having been trained to see and to appreciate clearness, force, and beauty, he will strive to develop these qualities in his own writing, and literature will acquire an added interest through a sense of the power it may confer. In other words the student should come to feel the utility of literature as well as its beauty. The teacher who appreciates that development as the end to be sought will guard against giving ready-made judgments which may injure by forestalling investigation. Properly taught, literature calls for observation, analysis, comparison, as truly and as constantly as does botany. The teacher's function is largely to direct this observation. Manuals of literature, however excellent, should be treated as subsidiary. Biographical details may be helpful in stimulating interest, the conditions of the time may supply the setting, but the thing to be studied is the book itself.

2. Composition and Rhetoric and Grammar, 1½ units:

In composition and rhetoric the constant aim should be to acquire the habit of clear and correct expression. To secure this result the fundamental principles of rhetoric should be taught not as an end, but as a means to an end—the development of skill; not as definitions to be memorized, but as rules to be applied in actual composition. Accordingly
the course should require constant practice in writing, followed by careful revision and correction of mistakes. The topics for themes may be drawn in part from other studies, such as literature and history, but in the main they should rest upon experience and observation, in order that the student may be trained to clear, correct, and effective self-expression. In all his writings he should cultivate habits of correct spelling, sentence-structure, punctuation, and paragraphing. Should his first themes prove defective in these respects, the College reserves the right to require him to make up his deficiencies.

In grammar there should be a thorough review occupying one semester, or at least half time for one semester, preferably in the last year of the high school course. Prior to this time in the course the student is not mature enough to master the more difficult relations of the sentence, or to appreciate how necessary a clear knowledge of sentence structure is to real progress in composition. If the student does not understand the structure of the sentence, he cannot reasonably be expected to frame sentences that are correct in structure or to learn to construct better sentences; thus his ignorance of grammatical relations prevents real progress in composition.

The percentage of failures in the first course in college composition would be materially reduced if grammar were more thoroughly reviewed in the last year of the high school course. From this review the student should be helped in the following ways:

a. He should be trained to analyze good modern prose, sentence by sentence, from such authors as Addison, Macaulay, Hawthorne, and Stevenson. He should be trained to observe clearness, emphasis, unity, climax, variety, and other qualities in sentence structure, and to note the effect of different types of sentence—short, long, balanced, loose and periodic.

b. He should also be trained to construct sentences of all types. One very helpful method is for the teacher to give out in analyzed form well-constructed sentences of the various types, and require the student to arrange these elements in the best order for clearness, emphasis, balance, climax, etc. Most students find this constructive work more interesting than the analytical, and also more helpful.

c. He should also be trained to analyze the sentences of his own essays, to note sameness or variety in sentence length and form, also clearness, emphasis, balance, and other qualities essential to effective expression. It is not assumed that his high-school course in English will make him a master sentence-builder, but it should give him sufficient knowledge and practice to make his every sentence clear and correct, and it should start him on the road to mastery of sentence construction.

3. Elective Units in English.

Students who present the required units set forth above, may also receive one elective unit for additional work. This unit will be granted for additional composition, for more extended study of English or Amer-
ican Classics, or for the study of a good History of Literature, supplemented by study of some of the minor authors not previously studied, or by more minute or more extended study of the major authors.

History

It is recommended that emphasis be put on history in the High Schools along the line suggested by the Report on History in Schools by the Committee of Seven of the American Historical Association, and that not less than two years be given to the subject. The following would be a suggestive course: One year in Greek and Roman History; one semester in English History, or Mediaeval and Modern History with special emphasis on English History; one semester in American History, and Civics. If a three-year course be given, a year should be devoted to each of the above. If a four-year course be given, the following is suggested: One year each to the following subjects: Greek and Roman History, to 800 A. D., Mediaeval and Modern from 800 A. D., English History, American History.

In all the above there should be the use of the best modern texts. There should also be outside reading with notes, and some instruction in historical geography.

It is recommended that students contemplating entering this College take Advanced American History in the fourth year of the High School.

Political Economy, if offered, should come late in the course, in the senior year so far as possible. The work must necessarily be largely reading. A text book should be used, with considerable collateral reading, especially on the economic history of England and the United States. One-half year should be devoted to this subject.

Mathematics

1. Algebra, 1½ to 2 units.

One and one-half units, representing at least one and a half years' work with daily recitations, are required. The work should include fundamental operations, factoring, fractions, simple and quadratic equations, graphic work, theory of exponents, ratio and proportion. This may be given in succeeding semesters, or, following the recommendations of the Central Association of Mathematics and Science Teachers, the first year, including, if possible, simple quadratics, may be followed by a year of plane geometry, after which the third semester of algebra may be taken. Many schools have adopted this order with highly gratifying results. In any case, thoroughness is a desired datum, and the third semester, besides covering quadratic equations, should include a review of the more important phases of the entire subject. In addition to the three semesters of algebra required for admission, credit will be given for a fourth semester if the work is distinctly in advance of that which should be accomplished in the year and a half usually allotted to this subject. The work must be done in the fourth year and must include a careful review of at least the third semester's work and the following additional topics:
variations, arithmetical and geometrical progressions, binomial theorem for positive and integral exponents, and such other topics as time and the advancement of the class will permit.

2. Geometry, 1½ units.

An entire year should be devoted to plane geometry, with much attention to problems. The skilled teacher will constantly apply in a concrete way the principles learned and will lose no opportunity to review the algebra of the preceding year. (See Geometric Exercises for Algebraic Solution, The University of Chicago Press.) Provision is made for teaching solid geometry in the colleges and university, but it is required for entrance in all courses in engineering. If completed in the secondary school a full half-year should be devoted to it.

3. Trigonometry, ½ unit.

This subject is not ordinarily found in the high schools, nor should it be encouraged except in the larger city schools. Only plane trigonometry should be given, a half-year should be devoted to it and the work should include the definitions and relations of the six trigonometrical functions as ratios, the theory of logarithms and use of tables, the proof of important formulae, and considerable practice in trigonometric transformations and the solution of the right and oblique triangles.

Science

4½ units accepted.

No more work in this group should be undertaken than can be treated satisfactorily by laboratory methods. It is recommended that, in general, subjects offered be pursued for at least a year.

There should be running water and adequate drainage in all rooms used for laboratory purposes and sufficient apparatus to enable the student to demonstrate or investigate at first hand the phenomena or topics under consideration. In all science work, good light, abundant table space, and dust proof cases for apparatus are absolutely necessary.

1. Physics, 1 unit.

One year should be given to this subject, at least two double periods each week being devoted to the laboratory. In the laboratory, students should work singly, or in small groups.

Each student should perform at least thirty individual experiments, about twenty being quantitative, each illustrating an important physical principle.

While the whole field of physics should be covered during the course, less emphasis should be placed upon the amount of data and disconnected facts than upon the explanation of everyday, physical phenomena and thorough drill in fundamental principles.

Physics should come in the last year of the high school course, or in the last but one.
2. Botany, ½ to 1 unit.

The aim should be to make the pupils familiar with the local flora, and out-door work is to be emphasized, especially in its economic aspects. Students cannot be too familiar with the ordinary facts of their surroundings; and the habit of accurately observing and then carefully recording what is discoverable in the out-door world should be established from the outset. A carefully kept notebook, containing notes of all sorts concerning plants studied, their characteristics, conditions of growth and dispersal, time of flowering and fruiting, is essential in all Natural History work. A herbarium prepared by the student is generally impracticable and is not recommended. The economic phases of botanical science should be particularly heeded and the attention of the student, especially in our more rural communities, should be constantly directed to the relations of plants to each other, whether for advantage or the reverse.

The high school should offer laboratory work along with Leavitt's Lessons, or Bergen & Davis' "Principles of Botany," or Coulter's "Text-Book of Botany," or any other work covering the same general ground.

The minimum amount of work for preparatory credit is the equivalent of five recitations or exercises a week for one-half the year. If the teacher is well prepared and opportunity offers, the work may extend through the entire year. Ordinarily work in botany should come in the first or second year in the high school course.

3. Physical Geography, ½ to 1 unit.

A half-year should be devoted to the subject, and in exceptional cases, in the midst of rich geological areas, a year may be given. In any case there should be much field work, with such use of the laboratory as the skill of the teacher and material available will warrant. The subject should come in the early part of the course, usually the first semester.

4. Physiology, ½ unit.

No one should attempt to teach a subject so vitally related to the welfare of the community unless there has been special preparation in the laboratories of a higher institution. A teacher properly trained, then, is the prime essential for the successful teaching of physiology.

A trained teacher will give due place to the laboratory work of a course in physiology, largely through demonstrations and simple experiments. The compound microscope should be used occasionally, but microscopic studies are more important. A large place in the course should be left for such practical topics as diet, sanitation, and personal hygiene.

The work in physiology may well form the second semester of a year's course in biology, the first semester being devoted to zoology.

5. Zoology, ½ to 1 unit.

A good text is desirable, but it should serve simply to give definiteness and stability to the course. The chief work must be done in the laboratory. Expensive equipment is not necessary, but there should be abundant table room for each pupil, note-books, and a few cheap tools.
It is recommended that a few typical animal groups be made the subject of study, that acquisition of correct habits of observation and definite knowledge of a few animal forms be sought, and that little attention be given to the learning of classifications and to a superficial text-book knowledge of the animal kingdom as a whole.

The work should extend over at least one semester, and may be followed most profitably by a semester in which emphasis is given to human physiology. If but one semester is devoted to zoology, a second semester should be given to physiology or botany, the two forming a coherent course in biological science.

6. Chemistry, 1 unit.

This is a profitable secondary school study if properly taught, but it should not be offered unless laboratory facilities are adequate. As in physics, double laboratory periods are essential to good work.

Chemistry should come in the last year of the high school, or the last but one. An entire year should be devoted to the subject, and no entrance credit will be given for less than one year with effective, individual laboratory work.

7. Agriculture, ½ to 1 unit.

While agriculture as a high school subject is somewhat new in Iowa, several schools have wrought out courses of study and methods of work that entitle the subject to the recognition which it has received in the entrance requirement conditions.

It is most essential that the teacher shall understand agriculture to be a study of things and not simply of books. Practical laboratory work and observations on the farms should be emphasized in every agricultural class and whenever it is possible experimental plots should be maintained.

Under no circumstances should the work be limited to studying a textbook, though it may be well in some cases to have a good text in the hands of the pupil. Generous use should be made of government and state bulletins, the Iowa State Traveling Library, the Iowa Year Book of Agriculture and the Year Books of the U. S. Department of Agriculture.

No general text will be able to devote sufficient time to those topics which constitute Iowa agriculture. When the class reaches such portions, additional material should be used, such as bulletins and special books. The actual material, such as corn, weeds, insects, potatoes, clover, oats, eggs, poultry, milk, etc., should be studied in the fields and laboratory.

General texts will also devote much space to subjects not of economic interest to our agriculture. Such topics should be omitted or considered briefly as a matter of general information.

The best preparation for the teacher is graduation from a good agricultural college but any teacher prepared in the general sciences with practical farm experience and a sympathetic attitude toward the practical teaching of this subject can by conscientious application do a limited amount of this work well enough to place it on a par with the other work of the school.
Commercial Subjects

2 units accepted.

In this group are two subjects, arithmetic and bookkeeping, which have long been recognized as suitable electives for college entrance. The other subjects are not yet well organized, except in the larger schools, and when presented in the smaller schools are often taught by those not specially fitted for this semi-technical work. It has been provided, therefore, that the Inspector shall in June of each year, provide each of the three institutions with a revised special list of accredited schools whose certificates in the commercial branches, in the industrial branches of Group VII, and in Agriculture may be accepted. Not more than two units in each of these groups will be accepted as satisfying entrance requirements.

1. Arithmetic, ½ unit.

In the stronger schools, not only is elementary arithmetic completed in the grammar grades, but some insight is gained in algebra and concrete geometry. Late in the high school course arithmetic may be taken up again, and a half year may be devoted to the subject with great profit. The work should be in the nature of a review of fundamental principles, and it may well include more than passing attention to the principles of algebra and geometry. No credit will be given for arithmetic preceding algebra.

2. Bookkeeping, ½ to 1 unit.

The half-unit course should extend over at least one semester, the double-entry system should be taught, and some attention should be given to practical bookkeeping as exemplified in local business houses. So far as possible, double periods should be provided, requiring all work to be done in the class room under the direction of the teacher.

If credit to the extent of a full unit is sought, the course must extend throughout the year and must be carried forward under very favorable conditions.

3. Commercial Geography, ½ unit.

This should be more than text-book study. Teachers are encouraged to establish, even on a small scale, commercial museums, and to make the work as concrete as possible. One-half year should be devoted to the subject, and it should come as late in the course as possible, preferably in the third or fourth year, but certainly after physical geography.

The introductory work should show the relationship between commerce and physical conditions, such as surface, soil, and climate. The effect of race, education, transportation, etc., should also receive attention in the early weeks of the course. Following this introduction should come a detailed study of the United States by sections, and then as a whole, with reference to physical features, natural resources, population, industries, etc. Then, if time permits, there should be, finally, a survey of the other important countries from the same general viewpoint.

Text-book should be supplemented by map work, illustrations, ma-
terials of commerce, lantern slides, visits to factories, and observation of local industries.

4. Commercial Law, ½ unit.

This work may be made very valuable, especially if taught in connection with some concrete study of business forms. Problems discussed should be illustrated by some study of cases and there should be considerable practice in drawing the more common legal papers.

5. Industrial History, ½ unit.

A half-year following or preceding commercial geography or political economy might well be offered. The work may take the direction determined by the teacher's preparation or by local interest, as History of Commerce, Economic History of England, Economic History of the United States. Courses in these divisions of the subject are outlined by the North Central Association, to which reference has been made.

Manual Training, or Industrial Subjects

2 units accepted.

The limitations already noted in reference to commercial subjects are necessarily laid upon this group also. For most of this work double class periods are particularly desirable, for some of it they are absolutely necessary, if satisfactory results are to be obtained. Space will not permit the outlining of the subjects in this group, but again reference is made to the satisfactory outlines worked out by a representative committee of the North Central Association.

Credit up to two units will be granted for work properly done in the following subjects:
1. Freehand or mechanical drawing, ½ to 1 unit.
2. Manual training, shop work, ½ to 2 units.
3. Domestic science, ½ to 1 units.
4. Stenography, ½ to 1 unit.

Advanced Standing

Students of other colleges will be admitted to advanced standing in this college under the following conditions:

First, they must present a letter of honorable dismissal;

Second, the entrance requirements to the college must be fully satisfied (see admission from other colleges under Entrance Requirements);

Third, 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 and 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 present official records to the Advanced Standing Committee at Registrar's Office to ascertain the credits to be allowed. It will be under-
stood between the applicant and the Committee that the credits are only provisionally accepted and that their final acceptance depends wholly upon the student maintaining a good average standing for one year in Iowa State College.

Fourth, it is required that all credits from other institutions be sent by the proper officers of such institutions, duly certified, to the Recorder of this College, such certificates to include the number of weeks the student has pursued the studies in question and the number of hours' credit received in each term, as well as the portion of the subjects covered;

Fifth, advanced or college credit may be given for extra high school or secondary school work only on the following conditions:

1. The number of units reported and accepted must be in excess of 16.
2. There must be a rigorous examination for college credit.

Special Students

Students taking special work in any of the College courses must be at least twenty-one years of age, must give good and satisfactory reasons for desiring such 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 depends upon the approval of the President of the College and the Dean or Head of the Department in which the student seeks enrollment.

(1) Permission to take a special course will not be granted to students until they have completed the Freshman year of some one of the courses offered, and then only for a period not to exceed two years except on the recommendation of the Faculty of the division in which the student is enrolled and on approval of the President of the College.

(2) All special students shall pay additional fees for special work of ten dollars for each semester.

Special students are subject to the same rules governing conditions on back work as apply to all other students. The standard prerequisites for advanced work are subject to limited modification with the approval of the Dean of the division in which the student is classified. A student wishing to change from a regular to a special or irregular course, either in the same or another department, will not be permitted to change from one course to another if he has a condition or a not pass in a subject not common to the two courses; or if he has more than one condition or not pass in subjects common to the two courses. Special students, as well as regular students, are subject to the conditions given under Requirements for Admission.

It is the theory of special classification that students should be
particulariy strong and well prepared to do thorough work in the studies they elect. A high standard of scholarship will, therefore, be required of all who are thus classified.

Graduates of approved colleges, who are not candidates for a degree, may take special work in this institution under the rules governing special students, without having to complete the Freshman year in any of the college courses. Permission to take such special course and the subjects included therein depends upon the approval of the President of the College and the Dean or Head of the Department in which the student seeks enrollment.

Irregular College Students

Worthy students of good standing, over twenty-one years of age, not prepared to meet the entrance requirements of the Freshman year may be admitted without examination as irregular college students in the Division of Science as related to the Industries, not to exceed two years, provided they give evidence of satisfactory preparation to carry such work successfully. Students will be required, however, to present a certificate covering their preliminary education. Irregular students who have not had previous work of collegiate grade will be required to take the first year of their work from Junior College studies. They will be confined in their choice of studies to one division of the College, and shall be subject in selecting such studies to the regulations governing regular college students in that division. During the second year they may be admitted to the Senior College studies in accordance with the rules governing admission to each study or course. These irregular college students will be registered, classified and dealt with, the same, as a regular college student who has entered college with 13½ units.

Fees and Expenses

The entire expenses of a student need not exceed $350.00 per College year.

Tuition: The Code of Iowa reads as follows: "The tuition in the College herein established shall be forever free to pupils from the state over sixteen years of age, who have been residents of this state six months previous to their admission."

To the non-residents a tuition fee of $25.00 is charged.

Incidental Fee: The regular incidental fee for the semester is $12.00, but all students who classify during the classification period, Friday and Saturday, before College work begins, will be charged only $10.00 per semester.

Laboratory Fees: Laboratory fees at the actual cost of breakage
and usage are charged to the students, the Treasurer's receipt for such fee being required before the students are admitted to laboratories. Some fees represent charges for mimeograph notes which are furnished at cost; usually when these notes are supplied no text book is required and the fee is in lieu of text book purchase. Deposits are required in some departments to cover the value of equipment loaned to students and at the end of the term the amount is returned less deduction for loss and breakage. For the amount of the fee in any course the student should refer to the description of courses, under the department in which the course is taught (see index for descriptive courses of each department).

**Special Student's Fee:** All special students shall pay an additional fee for special work of ten dollars per semester (see rule under Special Students).

**Board and Room:** About one hundred young women can secure rooms in Margaret Hall. Students rooming in this building will be furnished with bed, mattress, rug, chairs, dresser and table. Students will furnish bedding and such other articles as they need. The price for rent, heat and light will be from $8.00 to $14.00 per month according to the size and quality of the room. The room rent will be four months for the fall semester and five months for the spring semester, each payable in advance at the Treasurer's Office. In case of failure to take the room after making the deposit, the student will forfeit $10.00.

In case one student wishes to occupy a room, she must pay the full rent. Two persons will divide the rent. The Matron reserves the right to assign two persons to each room if necessary.

All other students can secure furnished rooms and board in clubs or private families adjacent to the College grounds at from $4.50 to $5.00 per week.

The young women should consult Mrs. Emily Cunningham, Matron of Margaret Hall, and the young men should consult John P. Clyde, Secretary for the Young Men's Christian Association, Alumni Hall, Ames, Iowa, concerning rooms and rooming places, that undesirable rooms and houses may be avoided. For sanitary or other reasons the College authorities reserve the right to forbid students from rooming in any particular house.

No group of young women students may establish a "house" or "home" without the full knowledge and approval of the President and the Matron, nor make any definite plans in such direction. No young woman may become a resident of a sorority house until after she has attended the College for one College year.

The young women residents of Margaret Hall are required to board at the Margaret Hall boarding club.

**Diploma Fee:** A diploma fee of $5.00 is payable before graduation.

**Text Books:** All text books and stationery may be purchased at the College Book Store at about 20 per cent below the average retail price.
Classification and Standings

Junior and Senior College: The students are now classified in "Junior and Senior Colleges." The Junior College is composed of all students in the Freshman, and Sophomore years; the Senior College, of all students in the Junior and Senior years.

Amount of Work: The amount of work in each course is expressed in hours, an hour meaning one recitation or its equivalent per week throughout the semester. It is considered that one hour's recitation or lecture will require as much time in the preparation, and hence is equivalent to a three-hour laboratory and receives the same credit. Any two-hour laboratory period is equivalent to two-thirds of a three-hour laboratory.

Number of Hours: No student shall be allowed to classify in more hours than are specified in the catalogue for the semester of the course taken unless he has an exceptionally high record in his previous college work. The taking of such additional work is subject to the approval by the Dean under whom the student is classified and the Heads of the Departments in which the student is classified.

In general, students failing in any portion of a term's work will not be allowed to take full classification for the next semester.

Classification: No student shall be admitted to any class or dropped from it, except by authority of the Classifying Officer.

Conflicts: Students shall not classify in conflicting studies without the approval of the Classifying Officer and Heads of the Departments in which the student wishes to enroll.

Standing: All the standings are based on the scale of 100. The passing grade is 75. A student receiving from 60 to 74 per cent inclusive in any course is conditioned, and allowed to make up the condition under the direction of the head of the department.

Back Studies: Students shall be classified in back studies in all cases in which such studies are taught, subject to the first rule under Number of Hours. Any exception to this rule must be for good and sufficient reason, approved by the President of the College and the Dean or Head of the Department in which the student is enrolled.

Changing Course: A student will not be permitted to change from one course to another who has a condition or not pass in a subject not common to the two courses; or if he has more than one condition or not pass in subjects common to the two courses.

No student shall be considered a candidate for graduation who has not at the beginning of the second semester of the Senior year completed his work to within the maximum number of hours regularly allowed in his course for that semester. If the uncompleted work is not offered in the second semester, it shall be passed and reported to the Recorder not later than April 1st.
Examinations in Back Work

Examinations for back work for matriculated students will be conducted at the opening of each semester, on the Tuesday and Wednesday preceding classification days.

Tuesday

8-10 A. M. — Farm Crops ................ Farm Crops Lecture Room, 307 Hall of Ag.
8-10 A. M. — Mining Engineering ........ Room 306, Engineering Hall
8-10 A. M. — Zoology ....................... Zoological Lecture Room
10-12 A. M. — English ................... Rooms 1 and 3, Central Building
10-12 A. M. — Civil Engineering ........ Room 312, Engineering Hall
2- 4 P. M. — History ...................... Room 208, Central Building
3- 5 P. M. — Public Speaking ............ Room 308, Central Building
3- 5 P. M. — Electrical Engineering ...... Room 207, Eng. Hall

Wednesday

8-10 A. M. — Horticulture ............... Forestry Room 210, Hall of Ag.
8-10 A. M. — Chemistry ................... Room 29, Chemical Hall
8-10 A. M. — Mathematics ................ Room 221, Central Building
10-12 A. M. — Economics .................. Room 222, Central Building
10-12 A. M. — Dairying ................... Dairy Building
10-12 A. M. — Botany ...................... Room 312, Central Building
1- 3 P. M. — Civics ........................ Room 102, Central Building
1- 3 P. M. — Home Economics ............ Home Economics Building
2- 4 P. M. — Modern Language .......... Room 119, Central Building
3- 5 P. M. — Soils ........................ Soils Lecture Room 8, Hall of Ag.
3- 5 P. M. — Physics ...................... Room 207, Eng. Hall

Departments Maintained

ADMISSION TO COLLEGE

Government

The relation 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. The institution, therefore, offers no inducement to the idler or the self-indulgent. All who are too independent to submit to needful authority, too reckless to accept wholesome restraint, or too careless to take advantage of their opportunities, are advised not to come. The discipline of the College is confined mainly to sending away those who prove, on fair trial, to be of this class. The final decision of all cases of discipline shall rest with the President of the College except when he delegates such power in particular cases to the Deans or to some one of the standing committees of the faculty.

Manual Labor

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

1. The manual labor of students is divided into two kinds: viz., un instructive 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 of the professor in charge, and under his instruction according to the statement made in each of the courses of study.

The compensated labor furnished by the Divisions of Agriculture, of 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 needed chiefly for study. Still, many worthy and industrious students pay a considerable part of their expenses by labor, over $4,000 being paid out by the College thus each year to students and graduate assistants.

The Y. M. C. A. office maintains an employment bureau through which students are put in connection with all of the available jobs in town and about the campus that can be done at such hours as the students can give them.

More than two hundred men found work this year for about all of their spare time. More in detail regarding the opportunities for self help at the College can be had by writing to the General Secretary, J. P. Clyde, Alumni Hall, Station A, Ames, Iowa.

Graduating Thesis

All candidates for graduation in the Engineering and Agricultural courses are expected to present a satisfactory thesis.

The subjects for theses shall be selected under the 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 semester.

The complete thesis shall be submitted to the Thesis Committee on or before May 25th, unless otherwise stated.

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 by the students themselves. In order to control epidemics and properly to 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 the fees paid by students. The privileges of the hospital are extended to all students, provided: 1st, that the physician shall be paid for calls at their residences; and, 2d, that the usual fee shall be paid within the first ten days of the student's arrival. Persons not making the deposit will be admitted to the hospital upon the basis of $10.00 per week, within the discretion of the College physician. All students who pay the regular fees are insured 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.

2d. 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.

3d. The College assumes no responsibility whatever in case of smallpox; nor shall the privileges of the hospital be extended to such cases.

4th. The President and the College physician may 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.

College Library

The College Library, consisting of over 35,000 volumes and of about 41,000 pamphlets, is chiefly a library of reference, containing standard and technical works bearing particularly upon the lines of study pursued in the College. Magazines, periodical literature bearing upon the special work of the students, and daily papers are furnished for the use of the students. The reading room of the library is open eleven and one-half hours daily except Sunday, when it is open three hours. Personal assistance will be given by the librarian and her assistants to any who desire help in reference work.

A few years ago the College received by bequests about 1,500 volumes pertaining to Engineering and Economics from the library of the late George W. Catt. This Engineering Library, with that section of books
from the general collection, has been made a Departmental Library, located in Engineering Hall. An Agricultural Library has been established, also, in the New Hall of Agriculture.

Religious Life at the College

ORANGE HOWARDCESSNA, CHAPLAIN

JOHN P. CLYDE, GENERAL SECRETARY, Y. M. C. A.

EDITH BEATRICE HELMER, GENERAL SECRETARY, Y. W. C. A.

Although we have here a state school, and hence one non-sectarian, the College life is dominated by religious influences.

The Young Men's and Young Women's Christian Associations, Bible Study Classes, and Mission Classes, consisting of members from both faculty and student body, have a helpful influence not only upon the religious but also upon the social life of the College. The members of the Association assist in the reception of the new students and in the maintenance of religious work.

The work of each Association is under the direction of a general secretary. These two Associations are now located in their new home, "Alumni Hall," which was constructed at an expense of $60,000.00, by funds donated by the alumni, students, instructors, citizens, and friends. This home is the center of the religious and social life of the College and as a building for such purposes it is not excelled in the West.

The faculty and students assemble daily in the Chapel at 7:45 A. M. for public worship. On each Sunday morning at 10:45, Chapel exercises are conducted by some prominent clergyman invited for the occasion. In all these services, the object is to emphasize the principles of morality and of Christian religion.

There are ten different denominational churches in Ames, all of which are closely in touch with the students and cordially invite them to take part in all religious services.

Alumni Association

The Alumni Association of the Iowa State College was organized in 1876. Its purpose is to promote the highest interest of the institution and to increase friendship and sympathy among students and alumni.

The present officers of the Association are: Honorary President, E. W. Stanton, '72, Ames, Iowa; President, J. S. McGavern, '81, Missouri Valley, Iowa; Vice-president, J. L. Stevens, '72, Boone, Iowa; Secretary, Henry L. Eichling, '11, Ames, Iowa; Treasurer, Mrs. Julia Wentch Stanton, '88, Ames, Iowa; and Business Manager of Alumnus, Ward M. Jones, '97, Ames, Iowa. The annual meeting and banquet are held on Wednesday and Thursday of Commencement week. A local associa-
tion was organized in April 1903, in order to arrange for the annual meetings and to keep the alumni in close touch with one another. Active associations exist in Des Moines, California, Colorado, Washington, D. C., Pittsburg, Chicago, St. Louis, Seattle, Canada, and Idaho.

Alumni Hall adds much to the Association, as it affords a place where the alumni may meet when visiting their Alma Mater.

Student and Alumni Publications

1. The Student, a semi-weekly paper, published by a staff elected from the student body and devoted to the recording of such matters as pertain to the interest and welfare of the school.
2. The Bomb, an annual published by the Junior Class.
3. Iowa Agriculturist, published monthly by the Agricultural Club of the Iowa State College.
4. Iowa Engineer, published monthly by the Engineering Association.
5. The Alumnus, a monthly publication, devoted to and published by the Alumni Association.

Literary Societies

The work of the eleven literary societies serves not only to supplement the social and literary work of the College, but also to aid the student in securing that training so necessary to enable one to appear before an audience, that training which every student needs and which cannot be secured in the class room alone. It is the purpose of the officers of the College to keep each Friday evening open that the work of these societies may go on without interruption. Every student is invited, even urged, to join one of these societies.

Forensic League

The Forensic League is an organization composed of two representatives from each of the eleven Literary Societies of the College, and three faculty members representing the Public Speaking, English, and Economics Departments respectively. The function of this organization is to manage the Forensic interests of the College. These interests include intersociety and intercollegiate debates, and intersociety and intercollegiate oratorical contests, intersociety declamatory contests, joint public programs and Literary Society graduation exercises. There are intersociety debates each semester calling out four students from each society. During the fall semester a triangular debate is held with the University of South Dakota and Kansas State Agricultural College, calling out six debaters.
The triangular intercollegiate debate with Drake University and Iowa College held during the spring semester also calls out six students to represent the Iowa State College.

Intersociety oratorical contests are held each fall semester and declamatory contests each spring semester, each society having one representative. The winner in the intersociety oratorical contest represents the College in the annual state intercollegiate oratorical contest.

Musical Organizations

The College maintains a Choral Society (membership being open both to students and to citizens of Ames), a College Choir, a Men's Glee Club, and a Ladies' Glee Club, all of which give frequent concerts and recitals. The musical organizations are under the supervision of the Director of Music.

A College Band of thirty-two pieces is maintained under the instruction of Charles L. Mundhenk, a member of the Iowa State Band of 1893. This band furnishes music in connection with the Military Department and also for all athletic and student assemblies.
Graduate Work
Graduate Work

(The administration of all graduate work will be placed, in the near future, in a separate division to be known as the Graduate Division. The new division will be presided over by a Dean. The work will continue to be given in the various departments and under the conditions stated below.)

The Iowa State College offers graduate work, under the conditions stated below, to those holding the baccalaureate degree from institutions of recognized standing. Those who contemplate taking up graduate work here should write in advance to the chairman of the Graduate Committee, stating the courses they wish to pursue and their preparation therefor. Graduate students will be admitted only to such courses as their previous work has qualified them to pursue with success. The approval of the head of the department must be obtained for admission to any course.

FEES

The same semester fees are charged graduate as undergraduate students. See page 53.

Laboratory fees are charged in the laboratory for the material used, the amount being fixed by the head of the department.

MASTER'S DEGREE

The Iowa State College offers the Master's Degree in Agriculture (M. S. in special line in Agriculture) to Bachelors of Science in Agriculture who are graduates of this College or to others offering equivalent courses of study, the degree of Master of Science (M. S.) to Bachelors of Science who are graduates of this College or of other colleges offering equivalent courses of study, the degree of Master of Science in Agricultural Engineering (M. S. in A. E.) to Bachelors of Science in Agricultural Engineering who are graduates of this College or of other Colleges offering equivalent courses of study.

A graduate student who wishes to become a candidate for the Master's Degree must file with the chairman of the Graduate Committee, a statement to that effect, accompanied by an outline of his course of study, approved by the dean of the division in which he intends to take his degree and by the heads of the departments in which his work is taken, at least six months preceding his final examination, which shall be held not later than two weeks preceding the end of any semester. He must file his completed thesis at least five days before this examination.

The candidates shall spend at least one academic year in residence. If only one year is spent in residence, the candidate shall devote his entire time to his graduate studies, except in cases where work pre-
GRADUATE WORK

Previously done in absentia is accepted at the beginning of the student's residence by the professor in charge of the major subject. Such in absentia work shall constitute not more than one-half of the required work. In the case of graduates of this college, temporary leave of absence for special study elsewhere may be granted during the year's residence. In order to be entitled to his degree, the candidate must meet within four years the requirements existing at the time of matriculation, otherwise he must complete any additional requirements which may be in force at the time of his final examination.

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. The major and minor studies shall be so related as to support and strengthen each other and to give breadth to the student's training. No under-graduate study shall be selected as a major study. Under-graduate studies may be taken for part of the minor work only with the approval of the Committee on Graduate Study, and the heads of the departments in which the work is to be done. The candidate shall have a reading knowledge of French or German.

Graduates of other institutions desiring to become candidates for graduate degrees in this institution should be required to show to the heads of departments in which the work is to be taken evidence of under-graduate work equivalent to the corresponding course in this institution, and if any deficiency appears in the subjects elected for graduate work, to make up such deficiency.

Candidates for advanced degrees are expected to appear on the Commencement stage to receive such degrees.

FEE

Diploma fee for Master's Degree or Professional Degree is five dollars ($5.00).

PROFESSIONAL DEGREES IN ENGINEERING

The several departments of the Division of Engineering confer the following professional degrees: 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.).

Applications for professional engineering degrees will be received from graduates of the engineering departments of this College or from other colleges offering equivalent courses of study in engineering.

A graduate of any of the four-year engineering courses, to be entitled to the professional degree, 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.

A graduate of any of the five year engineering courses shall have devoted not less than one year to successful professional work 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 courses of study described elsewhere.

The degree of Agricultural Engineer is conferred in a manner similar to other professional degrees in engineering. The candidates must be recommended, however, by the faculties of both the agricultural and engineering divisions.

**FEE**

The diploma fee for a professional degree is five dollars ($5.00).

**AGRICULTURE**

**AIMS AND METHODS**

It is the aim of the College of Agriculture to furnish facilities for advanced study commensurate with the demand. By means of this advanced work the College seeks to awaken in the minds of capable men and women an appreciation of research and the advancement of learning, to the end that they may effectively aid, not only in the teaching of agriculture, but also in extending the boundaries of agricultural knowledge. Nearly all of the best positions open in agricultural research and instruction work now require graduate training.

The College of Agriculture aims to give advanced instruction of a high character in each of its departments. No set courses of study leading to the Master's Degree are provided, but each candidate for this degree pursues an independent line of special research, original in character, outlined with the advice of the professors, and carried out under their direction. Seminars are largely employed and especial efforts are made to bring the graduate student into contact with the research problems of his department of study. To this end capable students often take a part in the investigation work of their instructors.

**EQUIPMENT**

The College of Agriculture is well equipped for Graduate work. Each of the departments is provided with commodious laboratories which are fitted up with apparatus and equipment of the most approved design. In addition, large herds and flocks, a large number of field plots devoted to soil and crop investigations, and extensive orchards and plant breeding grounds offer the student excellent facilities along Animal Husbandry,
Agronomy and Horticultural lines. The Dairy and Agricultural Engineering departments have buildings and equipment which are unsurpassed for work in their respective fields. A splendid library has recently been installed in the new Hall of Agriculture which provides unusual facilities for graduate students. Within the past few years hundreds of valuable books containing the results of the most noted foreign investigators have been added to this library.

In the following pages will be found grouped together the lines of agricultural work which are offered graduate students.

FARM CROPS

Graduate work in Farm Crops comprises investigation of biological phenomena of growing crops, with a view to recognizing the operation of the laws of plant breeding. It also includes an opportunity for investigation of station methods and for putting them into practice.

Cereal Breeding: An opportunity is given through the records of the Experiment Station, and through actual work in progress on the experimental field, to investigate the operation of the laws of plant breeding as applied to farm crops. This investigation will include an extended study of correlations of characters in growing strains of corn and small grain. A study of the transference of characters in generations of plants of hybrid origin gives an excellent opportunity for tracing Mendelian principles.

Experiment Station Methods: Special opportunity for practice in experiment station methods of conducting scientific tests of farm crops are offered on the extensive experimental grounds of this institution. Besides making a study of the methods in vogue at this station, an opportunity is given for an investigation of the methods in operation at other leading experiment stations of this country.

General Crop Problems: Unsolved problems of growth and the harvesting and storage of the several cereal crops offer inviting lines for valuable research. The commodious laboratories of the Farm Crops Department, equipped with the best apparatus available, enables the investigator in this line to conduct satisfactory, scientific research into the many important unsolved problems.

SOILS

Graduate work is offered in Soils which prepares the student for special work in the United States Bureau of Soils or in Colleges and State Experiment Stations. The work may be a continuation of work taken as an under-graduate in this College or of any line of soil study which has fitted the student to take up advanced work.

The graduate student will find excellent opportunities for investigations in soils along the following lines:

Soil Physics: Research in special subjects bearing on the physical characteristics of soils and their relation to crop production.
Soil Fertility: Special investigation of the factors which control the productive capacity of soils.

Soil Bacteriology: Original investigations of important problems in Soil Bacteriology, the department offering unusual opportunities along this line, especially in connection with the humus investigations which are now in progress.

Research in Soil Management: Investigations of the principles governing successful systems of soil management. Special studies relating to the management of particular soils such as gumbo, peats, sands, and alkali soils.

Seminar: Special investigation bearing on selected lines in Soils. The preparation and presentation of papers for discussion by the class.

Dairying

Graduate work in Dairying can be taken along any one of the following lines:

Buttermaking: The large, well equipped factory offers abundant opportunity for anyone desiring to specialize along this line. It gives facilities for advanced work in cream ripening, pasteurizing, starters, churning, separating, etc.

Creamery Management: Under this head investigational work is done along such lines as cost of manufacture, economical methods of purchasing cream and supplies, disposal of the by-products of the factory, and improved methods of creamery accounting.

Cheese Making: The large, well equipped cheese room and cold storage rooms connected with it make a very complete laboratory in which to carry on investigational work in comparing different methods of making, storing and curing various kinds of cheese.

Testing Dairy Products and Milk Inspection: These subjects offer a great field for research, including comparisons of quick methods of analyzing the various dairy products with the well established method and a study of improved methods of testing for preservatives and adulterations.

Advanced Work in Dairy Bacteriology: This work will consist of a laboratory study of such a problem as the students themselves may select, together with a survey of the literature along this line. If it is so desired, the work can be of a research nature.

Animal Husbandry

Graduate work in Animal Husbandry may be taken along any of the following lines:

Animal Nutrition: Courses in the principles of animal feeding and nutrition; opportunities for doing research work in the nutrition of horses, cattle, sheep and swine are unequaled because experiments along all these lines are being conducted each year.
Animal Breeding: Special courses in the principles of animal breeding, including variation and heredity and the ancestry of domestic animals.

Dairy Husbandry: Courses in milk and butter fat production and advanced work and research along these lines.

Study of Breeds: Advanced under graduate courses in livestock judging; study of the characteristics of all the breeds of domesticated farm animals.

Management of Live Stock: Courses in the management of farm live stock; special study of methods employed on the best live stock farms and breeding establishments of the state of Iowa, United States, Canada, Great Britain and other countries.

POULTRY HUSBANDRY

Because of its present and its rapidly increasing importance as a productive industry and the comparative newness of the field, Poultry Husbandry offers exceptional opportunities for profitable research work. Graduate work along the following lines is offered to those who have had the required preparation.

Breeding: Because of the readiness with which they may be raised in large numbers, the comparative shortness of generations and the large numbers of distinct characters that may readily be identified in the various races, poultry offers exceptional opportunities for both the study and investigation of the underlying principles of heredity and the profitable application of recently discovered laws to the development of superior strains for meat and egg production.

Feeding and Nutrition: Opportunities are offered for the study and investigation of the problems of feeding for the most economical production of eggs and market poultry.

Incubation and Brooding: The branch of the industry is in great need of investigation because of its great importance and the little knowledge we have of its laws.

HORTICULTURE AND FORESTRY

Graduate students find here opportunity for investigation in Horticulture and Forestry in the following subjects. Work in Forestry is offered for minor subjects only:

Plant Breeding: The investigation of principles and methods of plant breeding. The plant breeding work of the Iowa Experiment Station is continually developing an abundant supply of material for the study of heredity, variation, and selection, particularly with the apple.

Plant Propagation: The greenhouses, garden, and orchards are available for investigations concerning the principles and technique of plant propagation.
Pomology: A special study of horticultural species with reference to their original geographical distribution, to their variation under cultivation, and to the development of distinct types and economic importance.

Research: Problems for horticultural investigation other than those suggested above, undertaken in special lines for which the students may be best prepared.

Forest Botany, or Dendrology: Systematic and biologic forest geography.

Silviculture: The methods of producing a forest crop and of influencing its progress.

Wood Technology: The structural and physical characters of woods, with the application of wood in the arts, with its requirements and working properties, and with the use of minor and by-products.

Forest Economics: A study of the relation of forests to climate, soil, water, health, ethics, etc. This is a study of commercial peculiarities and of the positions of forests and forestry in political economy.

Forest Mensuration: Methods of ascertaining volumes and rates of growth of trees and stands of determining yields.

AGRICULTURAL ENGINEERING

Students who are prepared to do so may take up graduate work along any of the several branches of agricultural engineering. This advanced work will be especially helpful to those who expect to teach agricultural engineering in the colleges or secondary schools. It should also be especially helpful to those who expect to engage in practical or commercial agricultural engineering work.

Farm Machinery: The construction, efficiency and utility of farm machines. The Department of Agricultural Engineering has an extensive equipment of agricultural machinery.

Farm Power: A study of the economy and efficiency of steam and internal combustion engines and tractors. Also a study of the horse as a source of power.

Farm Structures: The location, design, construction of farm structures, materials of construction, specifications and contracts.

Drainage: A study of drainage engineering methods and practice.

Irrigation: A study of irrigation practice and irrigation engineering methods.

Road Construction: A study of the construction, cost and maintenance of rural highways.

Farm Sanitation: The lighting, heating, and ventilating of farm buildings, as to water supply and sewage disposal.

AGRICULTURAL EDUCATION

Graduate work in Agricultural Education comprises research work in
some particular educational line which has relation to Industrial Education as a means of general culture, economic efficiency or social advancement. The work is planned for those who expect to become investigators, directors or teachers in the field of Industrial and Agricultural Education.

Some of the lines of work which may be pursued are Rural Education, Secondary Education, School Supervision, School Administration, Agricultural Economics, Industrial Education, Vocational Guidance and Education, Educational provision for special classes, part time and continuation Schools, the development of Home Economics and Trade courses for girls the History of Agricultural and Industrial Education in Germany, France and America.

**SCIENCE**

Graduate courses are offered in the departments of Bacteriology, Botany, Chemistry, Geology, Zoology, and Agricultural Economics. Most of the lines of work here suggested are planned particularly for those students of exceptional ability who expect to become investigators or teachers in the respective subjects.

**BACTERIOLOGY**

Students who have had General, Quantitative, and Organic Chemistry, and a semester or its equivalent of Bacteriology may pursue work along any of the following lines. The work in each instance consists of a study of some definite problem in Bacteriology, the results of original work to be embodied in a thesis.

**General Bacteriology:** A study of systematic, cultural, or physiological characters of an organism or a group of organisms of economic importance.

**Sanitary Bacteriology:** A study of methods of bacteriological water analysis and a solution of some definite problem in the relation of bacteria to sanitation.

**Fermentations or Zymotechnique:** A study of an organism or group of organisms in relation to some fermentative process of economic importance.

**Veterinary and Pathologic Bacteriology:** The completion of the laboratories for veterinary bacteriology insures adequate opportunity for research or advance work in the relationship existing between bacteria and the diseases of animals.

**Soil Bacteriology:** The laboratories in soil bacteriology are open to those who wish to do graduate work in the relationship of bacteria to soils. The original work consists in the solution of some definite problem relating to the presence or function of bacteria in the soil. The equipment of the Department of Soils is at the disposal of those who wish to do work along this line.
Dairy Bacteriology: The extensive equipment of the college creamery and the college dairy farm are at the service of those who wish to work upon problems in dairy bacteriology.

**BOTANY**

The department has as equipment a large and extensive herbarium, containing representative families of the lower and higher plants, besides numerous exsiccati and a large collection of seeds and grasses, also an economic collection containing the more important food and useful plants. The department has a good equipment of microscopes, and various accessories and other apparatus necessary for the pursuit of graduate work. The graduate work may be grouped under the following heads: Physiology, Morphology, Systematic and Economic Botany.

Advanced Ecology: A course in which the various features underlying the distribution of plants are considered, with reference to soil, moisture, and the distribution of plants and the relation to other floras.

General Physiology: An advanced course in general physiology in which the student will take up some specific problem in plant physiology, such as the germination of seeds under different conditions.

The student will take up some specific problem along any one of the following lines: Plant Chemistry; Plant Physics; Growth and Movement.

General Morphology: A comparative study of some group of plants, especially along the lines of development and embryogeny. A study of the anatomy of seeds or some special organs of plants.

Advanced Course in Thallophytes: The morphology of some particular group of lower forms.

Advanced Morphology of the Flowering Plants: A comparative study of the morphology of the flowering plants.

Systematic Botany: A study of some special group of flowering plants or of some special group of the Thallophytes, especially plants of economic importance and those in some way related to agricultural and horticultural problems.

Applied Botany: A study of the more important food plants of man, their economic uses, and their distribution with reference to climatic conditions with a special study of the part of the plant that is used as food.

Advanced Mycology: A study of some specific group of plant diseases with its life history, structure, and development.

Microscopical Examination of Foods: A study of some particular form of food from a microscopical standpoint, the student selecting for himself the foods used by man or those used for stock.

Seed Testing: A study of some specific problem connected with the impurities of seeds and adulterations, as well as with the structure of the seed.
Poisonous Plants: An advanced course in poisonous plants, to be given only to those pursuing some minor work in the Department of Chemistry, and those who have some general knowledge of General Bacteriology.

Theses and Themes: A thesis embodying the results of some special line of work must be presented four weeks before the close of the semester, by those who major in botany. For students who take a minor, a theme must be prepared. Candidates in major and minor work must be generally well informed on botanical subjects and should be familiar with botanical literature.

Cytology: In this course the following things are emphasized: How to kill, imbed, section and stain material; a knowledge of cell structures and nuclear behavior in cell divisions; a knowledge of the various stages in the development of pistils and stamens of flowers; the investigation of some problem, which will give skill in the use of the above. This course will be adapted to the demands of those who take it.

CHEMISTRY

The Chemical Department provides work either as a major or minor line of study for students who are candidates for the master's degree. This work is offered as a major line of study to graduates of this College or of any other colleges of equal standing who have at least twenty hours of credit in this subject in work that is equivalent to courses 2, 5, 9 and 11, or to 21, 23, 25 and 26, or to 22, 24, 9 and 11. As a minor line of study the candidate must present at least fifteen credit hours in the subject corresponding to courses 2, 5 and 9.

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 process involved. 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 the best progress in the prosecution of the work. Minor subjects in this department will be arranged to help as much as is possible the major subjects selected in the other departments.

The following courses indicate the character of the work offered although other special courses may be arranged. See also the outline of courses under Chemical Department.

Advanced Qualitative Analysis: Carries forward the undergraduate courses in this subject.

Physical Chemistry: Considers the laws of mass action, chemical equilibrium, methods of atomic and molecular weight determinations, and the application of physical chemistry to manufacturing processes.

Advanced Water Analysis: Includes water and sewage analysis,
mineral analysis, and the examination of waters for use in boilers and for manufacturing purposes.

**Advanced Qualitative Analysis.** Studied from the theoretical and applied standpoint. Includes the analysis of complex ores, the rare earths, and the more difficult separations.

**Advanced Organic Chemistry:** Continuation of the study of the aliphatic, isocyclic and the heterocyclic series of organic compounds and the synthetic methods of preparing these compounds.

**Physiological Chemistry and Nutrition:** An investigation of some division of the subject, accompanied by an examination of the literature pertaining to it.

**Quantitative Analysis:** The application of quantitative methods to special substances and to selected chemical problems.

**Soils Chemistry:** Advance methods in qualitative and quantitative analysis of soils. Lectures and laboratory work. Credit as arranged.

**Dairy Chemistry:** An investigation of methods, or research work. Credit as arranged.

**Theses:** Problems for investigation along the lines of applied and theoretical chemistry will be selected by graduate students who make chemistry a major subject and the thesis will be founded upon this study.

**ECONOMICS OF AGRICULTURE**

**Economic Research:** Advanced students will be directed along specific lines of investigation in the Economics of Agriculture.

**Rural Sociology:** Problems like the rural school, rural church and other social or educational centers in the rural districts will be investigated from an economic and sociological standpoint.

**Distribution of Wealth:** Various problems along this line will be studied with special reference to the Economics of Agriculture and the distribution of rural and urban population.

**GEOLOGY**

The department of geology offers the following advanced courses in geology:

**Physical and Optical Mineralogy:** The course includes a careful study of the physical and optical properties of minerals both macroscopic and microscopic. Especial stress is put upon the use of the compound microscope in the study of thin sections. Idding's translation of Rosenbusch's "Mikroskopische Physiographie" of the common rocking minerals serves as a basis for the course. Essentially a laboratory course.

**Microscopic Petrology:** This is a continuation of the preceding course in which the larger part of the time is spent in a microscopic study of the igneous rocks. Some time is also spent in the mechanical-analysis of rocks by heavy solutions. It is essentially a laboratory course, but is
accompanied by lectures on the occurrence, association, and origin of the leading rock types.

Advanced Structural Geology: The course consists of a critical study of rock alteration, including weathering and metamorphism. Problems in structural geology, especially those related to the crystalline schists, receive due attention. It is mainly a lecture and reading course.

Mining Geology: The work, conducted by lectures, reading, and conferences includes a critical study of the occurrence, distribution, and origin of ore deposits and of the geological problems relating thereto.

Advanced Areal and Stratigraphic Geology: The work is based chiefly on a study of the stratigraphy of the United States, but includes work on correlation and the comparative stratigraphy of the world. Practical work in field mapping is required.

ZOLOGY

Opportunity for graduate work is offered, especially along the following lines:

Economic Entomology: In addition to the facilities offered in the department proper, graduate students can take advantage of the investigation work carried on in the Entomological section of the Experiment Station. A well-equipped insectary is available.

Systematic Entomology: The systematic collections of insects are large, and in some groups, particularly in the Hemiptera, are scarcely excelled in this country. A large number of types are included.

Vertebrate Morphology: While courses will be laid out in the comparative morphology of various systematic groups or of various systems of organs, the comparative morphology and physiological anatomy of the brain is especially emphasized.

Human Physiology: Equipment is available for most lines of physiological research, but particular attention is paid to studies on nutrition.
Division of Agriculture
Division of Agriculture

CHARLES FRANKLIN CURTISS, DEAN
SPENCER AMBROSE BEACH, VICE-DEAN

The division of Agriculture offers to its students work in any of the following four year courses:

- Course in Agronomy.
- Course in Dairying.
- Course in Animal Husbandry.
- Course in Horticulture.
- Course in Forestry.
- Course in Agricultural Engineering.
- Course in Agricultural Education.
- Course in Home Economics.

The agricultural instruction work offered in the foregoing courses of study is organized under department heads and associates, covering the following subjects: Animal husbandry, soils, farm crops, horticulture, forestry, dairying, agricultural engineering, agricultural journalism, poultry, agricultural education, and home economics.

These courses are so arranged as to furnish a good foundation from which a student may become either a successful farmer or may develop into a specialist in one of the many branches of the agricultural industry. The Division offers special courses as well as the regular four year courses, the difference being due largely to the degree in which the student wishes to specialize in any line of work. The farm as it is usually conducted is a union of many branches of industry, and the shorter course confines itself to laying a foundation that will secure success in some of these; 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 these courses shows that they have met with more than 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 the courses in practical agriculture, a field of work which is unsurpassed by any other college in the United States is open to our students.
The national government gives to the college about sixty thousand dollars annually for original experimentation and instruction in agriculture and the sciences related to this industry. 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, which produces, through all of its natural characteristics, to whatever is grown in agriculture from germ to finish.

The farm, consisting of 1,200 acres of rolling prairies, bottom and woodland, is stocked with good representatives of six breeds of horses, seven 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 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.

Three 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, the work ranging over all the questions of breeding and maturing domestic animals.

The work of this department 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 level of the educated in any profession. Special attention is given to the improved methods in all the various operations of farming, farm building, use of tools and machinery, and management of all kinds of stock and crops. The instruction embraces not only the principles, but also the practices of agriculture.

Employment for Students: A considerable number of students are paying all or a portion of their expenses by working while at the college. Such students are employed in various kinds of work in the different departments in general office or field work, caring for stock, helping in the dairy, greenhouse, garden, orchards, or shops, or doing janitor work about the buildings. They also find various kinds of employment about the city.

The secretaries of the Y. M. C. A. and Y. W. C. A. maintain information or employment bureaus for the service of the students who desire to secure work by which they can pay a part of their expenses. The heads of the various departments in the Division of Agriculture help to secure employment for a large number of students during summer vacations. These positions give the students practical work that is closely related to the instruction given in college and thereby strengthens
the student for service after graduation. The demand for student labor at the college is usually in excess of the supply from the opening of the college year until the holidays, and from the middle of the second semester until the close of the college year.

Credit 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 on 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.

Students must have at least six months of practical work before graduation, but credit will be given for such work only as stated above.

Department of Agricultural Scholarships: The State Department of Agriculture offers scholarship prizes in this institution amounting to $1,000. These scholarships are awarded at the Iowa State Fair, based upon boys' stock and grain judging contests and girls' cooking contests. There are five scholarships for boys, ranging from $200 to $25, and four for girls, ranging from $100 to $25. The winners of the contest receive the money in monthly installments during the year of college work, with the exception of the $25 scholarship which applies upon the two weeks short course. These scholarships offer opportunities for young men and women to receive substantial aid toward paying the expenses of a college education and many excellent students have come to the institution by this means.

The Clay, Robinson & Company Fellowship: Since the organization of the International Live Stock Exposition, Clay, Robinson & Company of Chicago have offered $1,000 annually to be competed for by the various Agricultural Colleges in their live stock exhibits at the International. This institution has always won a large share of these premiums and the funds have been used to provide for a fellowship in Agriculture to aid worthy students in advanced study. These fellowships have materially aided young men to make a better and more thorough preparation for Agricultural teaching and investigation and for practical work on the farm.

For further information about any of the scholarships or fellowships address the Dean of Agriculture.
**AGRICULTURAL COURSES**

The curriculum for Agronomy, Dairying, Animal Husbandry, Horticulture and Forestry is the same until the beginning of the Sophomore year, when the selection of the desired course will be made by the student. Students classified in the courses in Agricultural Engineering, Agricultural Education and Home Economics take the Freshman work as shown in the curriculum given for those courses.

### *Freshman Year*

#### FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Chemistry 21,</td>
<td></td>
</tr>
<tr>
<td>General Chemistry</td>
<td>4 1/2</td>
</tr>
<tr>
<td>Agricultural Engineering 1 or 2,</td>
<td></td>
</tr>
<tr>
<td>Shop Work</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Animal Husbandry 1,</td>
<td></td>
</tr>
<tr>
<td>Market Types of Cattle and Sheep</td>
<td>2</td>
</tr>
<tr>
<td>Farm Crops 1,</td>
<td></td>
</tr>
<tr>
<td>Corn Growing and Judging</td>
<td>2 3/5</td>
</tr>
<tr>
<td><em>Group Course</em></td>
<td></td>
</tr>
<tr>
<td>Group 1 or 2</td>
<td>5 1/2</td>
</tr>
<tr>
<td>Mathematics 17,</td>
<td></td>
</tr>
<tr>
<td>Algebra and Trigonometry</td>
<td>3</td>
</tr>
<tr>
<td>Military 1,</td>
<td></td>
</tr>
<tr>
<td>Military Drill</td>
<td>R</td>
</tr>
<tr>
<td>Library 1,</td>
<td></td>
</tr>
<tr>
<td>Library Instruction (4 hours during semester)</td>
<td>R</td>
</tr>
<tr>
<td>Physical Training 101,</td>
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</tr>
<tr>
<td>Gymnasium</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18 3/5

#### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Chemistry 23,</td>
<td></td>
</tr>
<tr>
<td>General Chemistry</td>
<td>4 1/2</td>
</tr>
<tr>
<td>Agricultural Engineering 1 or 2,</td>
<td></td>
</tr>
<tr>
<td>Shop Work</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Animal Husbandry 2,</td>
<td></td>
</tr>
<tr>
<td>Market Types of Dairy Cattle, Horses and Swine</td>
<td>2</td>
</tr>
<tr>
<td>Farm Crops 2,</td>
<td></td>
</tr>
<tr>
<td>Small Grains</td>
<td>2 3/5</td>
</tr>
<tr>
<td><em>Group Course</em></td>
<td></td>
</tr>
<tr>
<td>Group 1 or 2</td>
<td>5 1/2</td>
</tr>
<tr>
<td>Physics 205,</td>
<td></td>
</tr>
<tr>
<td>Mechanics, Heat and Light</td>
<td>3</td>
</tr>
<tr>
<td>Military 2,</td>
<td></td>
</tr>
<tr>
<td>Military Drill</td>
<td>R</td>
</tr>
<tr>
<td>Physical Training 202,</td>
<td></td>
</tr>
<tr>
<td>Gymnasium</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18 3/5

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*Freshmen who show deficient preparation in Mathematics may be assigned by the Dean of the Junior College and the Dean of Agriculture, to a special class, with one hour more work than indicated above, and in case of clear indication of failure even with this arrangement they will be dropped from the Freshman work until they have given proof of sufficient preparation to enable them to carry the work successfully.*
### *Group Courses*

<table>
<thead>
<tr>
<th>Group 1.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairying 12,</td>
<td>Farm Dairying</td>
<td>2½</td>
</tr>
<tr>
<td>Horticulture 3,</td>
<td>Orcharding</td>
<td>2½</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5½</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 29,</td>
<td>Graphic Methods</td>
<td>½</td>
</tr>
<tr>
<td>Botany 61,</td>
<td>Morphology</td>
<td>1½</td>
</tr>
<tr>
<td>Forestry 1,</td>
<td>Farm Forestry</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 56,</td>
<td>Anatomy of Domestic Animals</td>
<td>1</td>
</tr>
</tbody>
</table>

---

**Department of Agronomy**

WILLIAM HENRY STEVENSON, PROFESSOR  
HAROLD DE MOTT HUGHES, PROFESSOR OF FARM CROPS  
Percy-Edgar Brown, Assistant Professor of Soil Bacteriology  
Roy Eugene Smith, Assistant Professor of Soils  
William Roy Hechler, Assistant Professor of Farm Crops  
William Allen Lintner, Instructor in Farm Crops  
Lee W. Forman, Instructor in Soils  
Frank Cravens Grannis, Soil Extension Work  
Alfred Moore Ten Eyck, Farm Crops Extension Work  
Paul C. Taff, Farm Crops Extension Work  
George Dunlop, Farm Crops Extension Work

Agronomy is the science of the Field and its crops. It treats of Farm Management, the application of economic business methods to farm practices; Field Crops, their classification, production and improvement; Soils, their fertility, cultivation and improvement. The Department of Agronomy includes the Departments of Farm Crops and Soils.

The admirable quarters in the Hall of Agriculture enable the Agronomy Department to offer work in accord with the demands of the times. Commodious and well lighted class-rooms, with new and well equipped research laboratories, offer the best of facilities for lecture and laboratory work.

The general work in the study of cereals is conducted in the grain laboratory on the second floor of the stock and grain judging pavilion. The more advanced and more scientific study of crops is pursued in the corn and small grain laboratories on the fourth floor of the Hall of Agriculture. Research laboratories, equipped with chemical and general ap-

* In order to equalize the class work one of these groups will be required during each semester of the freshman year.
paratus used in Farm Crops research, offer special opportunities for in-
vestigation to graduate students.

The increased demand for competent farm managers has far outrun the supply. The demand is increasing for trained men in farm crops, to fill positions as teachers of agriculture in secondary schools, assistants in seed houses, and assistants on the editorial staffs of agricultural journals. The number of men well-trained in farm crops, who are putting in opera-
tion on the farm the principles and practices studied in college, is an-
ually increasing. Many men who have taken special training in farm crops production and breeding, have returned to their farms, where they are making a profitable specialty of raising pure-bred corn or small grain.

A knowledge of the fundamental principles which underlie all suc-
cessful systems of soil management should be the possession of every farmer. Without this knowledge he cannot produce maximum crops nor successfully maintain the fertility of his soil. No greater obligation rests upon the American farmer than the conservation of our greatest natural resource, namely, the land. It is the aim of the Soils Depart-
ment to teach in a logical way the important principles concerning phys-
ical, plant food, and bacteriological soil factors. In order that this work may be carried on successfully, carefully outlined courses are offered to undergraduate and graduate students, including courses in Soil Physics, Soil Fertility and Soil Bacteriology.

On the first floor of Agricultural Hall, five commodious and well ap-
pointed soils laboratories have been thoroughly equipped for accurate and scientific work. Apparatus of the latest design has been installed in these laboratories, thus affording excellent facilities for regular, advanced and graduate students in Soils. In addition to these excellent laboratory facilities, suitable greenhouses and field plots are available for certain lines of study and experimentation. The Department is also equipped with photographs, charts and maps which are used in the lecture room and laboratory. Valuable and abundant data, which have been secured by the Soils Section from extensive soil experiments, prove very helpful to students who are especially interested in the problems relating directly to the soils of Iowa.

The work of the department is twofold; first, to fit young men to successfully solve the soil problems which are an integral part of every farmer's experience; secondly, to fit some students to creditably fill posi-
tions in agricultural colleges and experiment stations and in other in-
stitutions in which the subject of Soils is taught. There is a constantly increasing demand for men well-trained in Soils, and each year the department is asked to recommend men for desirable positions.
For Freshman year, see Agricultural Course, page 85.

**Sophomore Year**

<table>
<thead>
<tr>
<th>Third Semester</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm Crops 3,</strong></td>
<td><strong>Corn and Small Grain Judging 2</strong></td>
</tr>
<tr>
<td><strong>Agricultural Chemistry 25,</strong></td>
<td><strong>Organic Chemistry 3½</strong></td>
</tr>
<tr>
<td><strong>Agricultural Engineering 4,</strong></td>
<td><strong>Farm Engineering 3½</strong></td>
</tr>
<tr>
<td><strong>Botany 68,</strong></td>
<td><strong>Vegetable Physiology 3½</strong></td>
</tr>
<tr>
<td><strong>Animal Husbandry 3,</strong></td>
<td><strong>Breed Types of Cattle and Sheep 3½</strong></td>
</tr>
<tr>
<td><strong>English 11,</strong></td>
<td><strong>Exposition 3</strong></td>
</tr>
<tr>
<td><strong>Military 3,</strong> or Physical Training 303,</td>
<td></td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td><strong>18½</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Semester</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm Crops 17,</strong></td>
<td><strong>Grasses, Forage and Fibre Crops 2</strong></td>
</tr>
<tr>
<td><strong>Agricultural Chemistry 26,</strong></td>
<td><strong>Agricultural Analysis 3½</strong></td>
</tr>
<tr>
<td><strong>Agricultural Engineering 5,</strong></td>
<td><strong>Farm Machinery and Farm Motors 2½</strong></td>
</tr>
<tr>
<td><strong>Animal Husbandry 4,</strong></td>
<td><strong>Breed Types of Dairy Cattle, Horses and Swine 3½</strong></td>
</tr>
<tr>
<td><strong>English 10,</strong></td>
<td><strong>Narration and Description 3</strong></td>
</tr>
<tr>
<td><strong>Zoology 16,</strong></td>
<td><strong>General Zoology 4½</strong></td>
</tr>
<tr>
<td><strong>Military 4,</strong> or Physical Training 404,</td>
<td></td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td><strong>18½</strong></td>
</tr>
</tbody>
</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Fifth Semester</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soils 1,</strong></td>
<td><strong>Soil Physics 4</strong></td>
</tr>
<tr>
<td><strong>Farm Crops 19,</strong></td>
<td><strong>Seminars R</strong></td>
</tr>
<tr>
<td><strong>Soils 17,</strong></td>
<td><strong>Seminars</strong></td>
</tr>
<tr>
<td><strong>Botany 24,</strong></td>
<td><strong>Embryogeny 1½</strong></td>
</tr>
<tr>
<td><strong>Economic Science 9,</strong></td>
<td><strong>Outlines of Economics 3</strong></td>
</tr>
<tr>
<td><strong>Horticulture 33,</strong></td>
<td><strong>Truck Farming 2</strong></td>
</tr>
<tr>
<td><strong>Horticulture 4,</strong></td>
<td><strong>Plant Breeding 2½</strong></td>
</tr>
</tbody>
</table>

*These courses must be continued through the year. Final standing will not be certified to recorder until close of sixth semester.
Zoology 4, Entomology 3½

Electives will be selected from the list on page 156, 0 to 3½

Total semester hours 16½ to 20

<table>
<thead>
<tr>
<th>Sixth Semester</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils 2,</td>
<td>Soil Fertility 4</td>
</tr>
<tr>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>{Farm Crops 9,</td>
<td>Research Work 2</td>
</tr>
<tr>
<td>Soils 3,</td>
<td>Research Work 2</td>
</tr>
<tr>
<td>Farm Crops 4,</td>
<td>Corn and Small Grain Breeding 1½</td>
</tr>
<tr>
<td>Bacteriology 1,</td>
<td>General Bacteriology 4</td>
</tr>
<tr>
<td>English 12,</td>
<td>Argumentation 2</td>
</tr>
<tr>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>{*Farm Crops 19,</td>
<td>Seminar 1</td>
</tr>
<tr>
<td>{Soils 17,</td>
<td>Seminar 1</td>
</tr>
</tbody>
</table>

Electives will be selected from the list on page 156, 1½ to 5½

Total semester hours 16 to 20

**Senior Year**

<table>
<thead>
<tr>
<th>Seventh Semester</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Crops 8,</td>
<td>Farmland Management 3</td>
</tr>
<tr>
<td>Soils 6,</td>
<td>Advanced Soil Fertility 2</td>
</tr>
<tr>
<td>Soils 8,</td>
<td>Soil Bacteriology 4</td>
</tr>
<tr>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>{Soils 4,</td>
<td>Research Work 2</td>
</tr>
<tr>
<td>{Farm Crops 9 or 10,</td>
<td>Research Work 2</td>
</tr>
<tr>
<td>Agricultural Journalism 8,</td>
<td>Beginning Journalism 2</td>
</tr>
<tr>
<td>Animal Husbandry 20,</td>
<td>Animal Feeding 2</td>
</tr>
<tr>
<td>Animal Husbandry 21,</td>
<td>Principles of Breeding 2</td>
</tr>
<tr>
<td>Horticulture 8,</td>
<td>Landscape Gardening 2</td>
</tr>
<tr>
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<tr>
<td>{*Farm Crops 20,</td>
<td>Seminar R</td>
</tr>
<tr>
<td>{Soils 18,</td>
<td>Seminar</td>
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</tbody>
</table>

Electives will be selected from the list on page 156, 0 to 1

Total semester hours 19 to 20

* A continuation of work in fifth semester. Standing will be for fifth and sixth semesters. One hour credit for both semesters' work will be recorded at end of the sixth semester.

* These courses must be continued through the year. Final standing will not be certified to recorder until the close of the eighth semester.
EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Crops 15,</td>
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<tr>
<td>Farm Crops 16,</td>
<td>Thesis</td>
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<tr>
<td>5, or 5</td>
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<tr>
<td>Soils 11,</td>
<td>Thesis</td>
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<tr>
<td>3</td>
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<tr>
<td>Soils 12,</td>
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<td>5</td>
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<td>*Farm Crops 20,</td>
<td>Seminar</td>
</tr>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>*Soils 18,</td>
<td>Seminar</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Agricultural Journalism 9,</td>
<td>Journalism Practice</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Botany 66,</td>
<td>Vegetable Pathology</td>
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<tr>
<td>23/2</td>
<td></td>
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<td>History 24,</td>
<td>History of Public Domain</td>
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<tr>
<td>2</td>
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</tbody>
</table>

Electives will be selected from the list on page 156, 6 7/2 Total semester hours 16 20

COURSES IN FARM CROPS

1. **Corn Growing and Judging.** The corn plant, methods of selecting, storing, testing, grading, planting, cultivating and harvesting. Cost of production, use of the crop, and commercial marketing are studied. Corn in the field with reference to per cent stand, barren stalks and suckers; leaf surface and correlation of the parts of the stalk. Each student is required to make his own plot, husk it, select the seed ears and hang them up for storage and shrinkage test. A detailed study is made of the structure of the cornstalk, ear, and kernel. The corn scoring and judging are taken up during the last part of the semester. **1S.** Recitations 2, lab. 1, 2 hr.; credit 2%; fee $1.00.

2. **Small Grain.** Oats, wheat (winter and spring), barley, rye, emmer and spelz and macaroni wheat; their adaptation to soils and climate, preparation of seed bed, methods of seeding, botanical structure, problems of germination and plant growth; also score card practice and the principles of commercial grading in small grains. 2S. Recitations 2, lab. 1, 2 hr.; credit 2%; fee $1.00.

3. **Corn and Small Grain Judging.** Under conditions identical to those found in show rooms, the student receives a training which makes him an excellent judge of quality in these grain seeds. He studies variety and breed characteristics, giving special attention to the strong and weak points of each. 3, 5 or 7S. Prerequisites 1 and 2; recitations 2, lab. 1, 2 hr.; credit 2; fee $2.00.

4. **Corn and Small Grain Breeding.** Origin of corn and small grains. Characteristics of the leading varieties of corn, and the adaptation of these varieties to the varying soil and climatic conditions of the state.

**A continuation of the work in the seventh semester. Standing will be for seventh and eighth semesters. One hour credit for both semesters' work will be recorded at end of eighth semester.**

**Meaning 1st semester, 2 recitations per week, 1, two hour laboratory period per week; 2% hours credit; required fee for materials $1.00.**
Principles of improvement and breeding are investigated. Methods employed in the breeding of corn and small grains by prominent commercial corn breeders are made a special feature in this course.

6 or 8S. Prerequisites 3, Hort. 4, Botany 24; recitation 1, lab. 1, 2 hr.; credit 1%; fee $1.50.

8. Farm Management. Typical illustrations of the differing phases of specialized farming and of general farming; problems of labor, fencing and marketing and methods employed by successful farmers are presented. A practical and thorough study of a system of farm accounts. Actual field study of the laying out and conducting of farms is made, and special exercises in planning of rotations, field locations and placing of buildings.

7S. Prerequisites 1 and 2, Soils 2; recitations 2, lab. and lecture 1; credit 3; fee $1.00.

9. Research in Farm Crops. Individual investigation of special problems relating to Farm Crops subjects. Experiments are conducted in both field and greenhouse.

6 or 7S. Prerequisites 1 and 2; labs. 3, 2 hr.; credit 2; fee $1.00.

10. Advanced Research in Farm Crops. Advanced research into the problems of crop production and breeding of farm crops.

7S. Prerequisite 9, labs. 3, 2 hr.; credit 2; fee $2.00.

11. Advanced Study of Corn. A deeper study of the principles underlying the breeding of corn. The latest scientific knowledge of corn breeding. Thorough study of the leading varieties of corn growing in the state.

7S. Prerequisite 3; recitation 1; credit 1.

12. Advanced Study of Small Grains. A special study of the principles of plant breeding, as they are revealed by the breeding of small grains. The evolution of plant breeding. Special attention to experiment station methods and accomplishments in this line of work. The object of the course is to put the student in possession of the scientific facts and principles underlying this work, as well as to give him working knowledge of scientific methods for the pursuit of such investigation. Grain judging, expert judging at fairs and expositions, and practical knowledge of grain.

8S. Prerequisite 4; recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

15. Thesis. This investigation must be pursued upon some subject requiring original work.

8S. Labs. 4½, 2 hr.; credit 3.

16. Thesis. Same as above.

8S. Labs. 7½, 2 hr.; credit 5.

17. Grasses, Forage and Fiber Crops. Grasses grown in the corn belt, investigation into their composition, habits of growth, adaptability to various types of soils and climatic conditions and the methods of seeding and handling. Such forage and fiber crops as have been grown in Iowa, and others that could be profitably introduced, will be given study similar to the above. Special attention will be given to the growth and breeding of alfalfa, clover and timothy.

4, 6 or 8S. Prerequisites 1 and 2; recitation 1, labs. 1½, 2 hr.; credit 2; fee $2.00.
18. **Summer Course in Farm Crops.** Small grains, grasses and clovers; habits of early growth, structure, rate of growth, reproduction, variations, correlations, effects of different methods of planting. Also Experiment Station Methods.

Summer School. Prerequisites 1 and 2; labs. 3 weeks; credit 5; fee $5.00.

19. **Farm Crops Seminar.** The Juniors and Seniors in Farm Crops and Soils hold a joint seminar every two weeks while college is in session. At each meeting papers prepared by students are presented and topics of special interest to Agronomy students are discussed.

5 and 6S. Prerequisites 1 and 2; credit 1.

20. **Farm Crops Seminar.** Continuation of Course 19.

7 and 8S. Prerequisites 1 and 2; credit 1.

21. **Special Advanced Judging.** Use will be made of the various score cards until the student's judgment is well developed and comparative values of various characteristics are well established. The greater part of the time will be devoted to the judging of corn, but sufficient time will be given to the small grains, oats, wheat and barley.

7S. Prerequisites 1 and 2; labs. 2, 2 hr.; credit 1½; fee $2.00.

**COURSES IN SOILS**

**(SOIL PHYSICS)**

1. **Soil Physics.** Origin, formation and classification of soils; soil moisture and methods of conserving it; the principles which underlie dry farming; soil temperature, and conditions influencing it; soil texture as affecting 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 also comprises the determination of the specific gravity, apparent specific gravity, volume weight, porosity, water-holding capacity, and capillary power of various soils; also effect of mulches on the evaporation of water from the soil and the physical effects upon the soil of different systems of rotation and of continuous cropping.

5S. Prerequisite Physics 205; recitations 2, labs. 2, 2 hr.; credit 4, fee $4.00.

3. **Research Work in Soil Physics.** Experimentation and study of special problems relating to the physical characteristics of soils and their relation to crop production. Experiments may be carried on in the laboratory, greenhouse, or field. Modern laboratory and greenhouse facilities offer an excellent opportunity for research work from the standpoint of Soil Physics. A wide range of special subjects. Special advantages for a study of the physical composition of soils.

6S. Prerequisite 1; labs. 3, 2 hr.; credit 2; deposit $5.00.

13. **Soil Surveying and Mapping.** Physical properties of Soils and their physical composition as determined by mechanical analysis. The
preparation of large scale plane table maps of selected areas and a detailed survey of the soils. Also the relation of topography and the physical and chemical composition of soils to the character and growth of the native vegetation. The principles underlying the adaptability of particular soils to different kinds of forest and fruit trees, and to various farm and garden crops.

7S. Prerequisite 2; recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.00.

15. Advanced Laboratory Work in Soil Physics. Physical composition of soils by mechanical analysis and petrological examination; the determination of the temperature, moisture, and soluble salt content of various soils under field conditions, including methods of testing for alkali soils. Greenhouse laboratory and field experiments are conducted to determine the effect upon soil conditions of different methods of soil management; the work also includes assigned readings, study of results of previous investigations, and written reports of results of experiments and investigations.

6 or 8S. Prerequisite 1; labs. 3, 2 hr.; credit 2; fee $4.00.

(SOIL FERTILITY)

2. Soil Fertility. Maintenance of fertility, fertilizers and rotations; the influence of commercial fertilizers barnyard manure, and green manure 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 storing, preserving, and application of farm-yard manure. This work is supplemented by a laboratory study of manures, fertilizers and soils; their composition and agricultural value. Pot and field experiments are 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. Special attention is given to legumes as fertilizers and their place in crop rotation. Special types of soil which are found in different sections of the state, such as clay, gumbo, loess, and peat, are studied with special reference to the best methods of handling and cropping these soils. In connection with the laboratory instruction the student is urged to make a chemical study of samples of soil taken from the home farm or of any other soil in which he may be interested.

6S. Prerequisite 1, and Chem. 26, except for Dairy Chem. 26 only, and for Horticulture Soils 1 only; recitations 2, labs. 2, 2 hr.; credit 4; fee $8.00.

4. Research Work in Soil Fertility. Experimentation, special problems relating to maintaining and increasing the productive capacity of soils. Types of soil, systems of soil management, plant food, and productive capacity of soils. For students not taking thesis work in Soils, this course can be arranged so that a complete fertility study may be made of samples of soil taken from the home farm. As a result of this study, systems of soil and crop management may be suggested. This is an
exceedingly valuable course, especially for men who expect to farm under corn-belt conditions.

7S. Prerequisite 2; labs. 3, 2 hr.; credit 2; deposit $5.00.

6. Advanced Soil Fertility. Plant food content and productiveness of particular types or classes of soils; the utilization of soils; and the principles which underlie the management of soils under arid, semi-arid, and sub-humid conditions. Special attention is given to the principles of soil conservation. Opportunity to study the methods of experimentation which are employed by leading investigators and farmers along soil fertility lines.

7S. Prerequisite 2; recitations 2; credit 2; fee $1.00.

7. Investigation of Special Soils. Work of the Rothamsted Experiment Station and at the leading Experiment Stations of this country, with special reference to the effect of different systems of soil management upon the productive capacity of the soil. An opportunity to study and discuss the great mass of data which has been collected during a period of more than half a century at the most famous experiment stations in the world.

8S. Prerequisite 6; recitation 1; credit 1.

16. Advanced Laboratory Work in Soil Fertility. Advanced methods of soil analysis. Exhaustive studies in Chemical and Physical methods, including complete analysis of soils according to the latest approved methods, together with greenhouse studies and methods. Pot culture work may be done in the greenhouse on soils from the home farm or other areas, to test the fertilizer requirements of the soil, the results of which will suggest to the student methods of soil management to be followed in the future.

8S. Prerequisite 2; labs. 3, 2 hr.; credit 2; deposit $5.00.

(SOIL BACTERIOLOGY)

8. Soil Bacteriology. Soil Bacteria and their activities in their natural habitat and a preliminary consideration of the influence which they exert on soil fertility. The work involves purely quantitative bacteriological examinations of different soil types followed by both qualitative and quantitative determinations of the various processes induced by their bacterial floras including ammonification, nitrification, denitrification, symbiotic and non-symbiotic nitrogen fixation, ammonia and nitrate-nitrogen transformation, cellulose fermentation, urea fermentation, etc. Organisms are isolated from each of the various groups and examined culturally, morphologically and physiologically. Special attention is devoted to comparisons of the methods available for the bacteriological and chemical technique involved and to the interpretation of results.

7S. Prerequisite 2; Chem. 26 and Bact. 1; recitations 2, labs. 3, 2 hr.; credit 4; deposit $8.00.

14. Advanced Soil Bacteriology. A continuation of the work given in Soils 8, involving a further consideration of the influence of bacterial activities on Soil Fertility. Special problems are studied by means of
laboratory and greenhouse experiments dealing with the fixation of atmospheric nitrogen; the transformation of nitrogenous carbonaceous, and mineral compounds in the soil; the effect of manurial and fertilizer treatment on the various bacterial activities; the adequacy of the bacteriological methods now employed in indicating the crop-producing power of soils.

8S. Prerequisite 8; recitation 1, labs. 3, 2 hr.; credit 3; deposit $8.00.

(THESIS AND SEMINAR)

11. Thesis. Must be upon some subject requiring original investigation in Soils.

8S. Investigations 9 hrs. per week; credit 3.


8S. Investigations 15 hrs. per week; credit 3.

17. Soils Seminar. The Juniors and Seniors in Soils and Farm Crops hold a joint seminar each two weeks while college is in session. At each meeting, papers prepared by students are presented and topics of special interest to Agronomy students are discussed.

5 and 6S. Credit 1.


7 and 8S. Credit 1.

Department of Dairying

MARTIN MORTENSEN, PROFESSOR
WALTER HENRY COOPER, ASSISTANT PROFESSOR
BERNARD WERNICK HAMMER, ASSISTANT PROFESSOR IN DAIRY BACTERIOLOGY
CLEM J. O'NEIL, INSTRUCTOR

Owing to the rapid progress and the application of scientific principles to the dairy industry, it is necessary that those engaged in this work should keep in touch with new ideas and principles. In order to meet this demand, the dairy department offers a four-year course for qualifying students to become competent teachers and investigators of dairying in agricultural colleges and experiment stations, inspectors of dairy products and creameries in municipal, state and government service, or superintendents of large creameries or dairy farms.

The Dairy Department offers unexcelled facilities for teaching dairying in a thoroughly practical and scientific manner. The dairy farm of 200 acres is well stocked with various types and breeds of milk cows. The milk from this herd, together with the milk and cream shipped and hauled to the college, supplies all the needs of the creamery.

The Dairy Building erected at a cost of about $75,000 is a practical working creamery, and cheese and ice-cream factory, and is considered by authorities to be one of the most practical and complete dairy buildings in existence.
# COURSE IN DAIRYING

For Freshman year, see Agricultural Course.

## Sophomore Year

### Third Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Dairying 11, Cheese Making</td>
<td>3</td>
</tr>
<tr>
<td>Animal Husbandry 3, Breed Types of Cattle and Sheep</td>
<td>3½</td>
</tr>
<tr>
<td>Agricultural Chemistry 25, Organic Chemistry</td>
<td>3½</td>
</tr>
<tr>
<td>Economic Science 9, Outlines of Economics</td>
<td>3</td>
</tr>
<tr>
<td>English 11, Exposition</td>
<td>3</td>
</tr>
<tr>
<td>History 24, History of Public Domain</td>
<td>2</td>
</tr>
<tr>
<td>Public Speaking 10, Extempore Speech</td>
<td>2</td>
</tr>
<tr>
<td>Military 3, or Physical Training 303,</td>
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<td><strong>Total semester hours</strong></td>
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### Fourth Semester

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Dairying 13, Milk Testing and Milk Inspection</td>
<td>1½</td>
</tr>
<tr>
<td>Dairying 24, Fancy Cheese Making</td>
<td>2½</td>
</tr>
<tr>
<td>Animal Husbandry 4, Breed Types of Dairy Cattle, Horses and Swine</td>
<td>3½</td>
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<tr>
<td>Agricultural Chemistry 26, Agricultural Analysis</td>
<td>3½</td>
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<tr>
<td>Economic Science 10, Agricultural Economics</td>
<td>3</td>
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<tr>
<td>History 8, History of the United States, 1763-1912</td>
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<tr>
<td>English 10, Narration and Description</td>
<td>3</td>
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<tr>
<td>Public Speaking 11, Extempore Speech</td>
<td>2</td>
</tr>
<tr>
<td>Military 4, or Physical Training 404,</td>
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<td><strong>Total semester hours</strong></td>
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## Junior Year

### Fifth Semester

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<tr>
<td>Dairying 14, Advanced Butter Making</td>
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<tr>
<td>Dairying 16, Technology of Milk</td>
<td>1</td>
</tr>
<tr>
<td>Dairying 26, Judging Dairy Products</td>
<td>1</td>
</tr>
<tr>
<td>Agricultural Chemistry 40, Dairy Chemistry</td>
<td>3½</td>
</tr>
<tr>
<td>Animal Husbandry 21, Principles of Breeding</td>
<td>2</td>
</tr>
<tr>
<td>Botany 72, Microscopical Examination of Foods</td>
<td>1½</td>
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### DIVISION OF AGRICULTURE

#### Horticulture 8, Bacteriology 1, Landscape Gardening, General Bacteriology

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
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<tr>
<td>Horticulture 8</td>
<td>2</td>
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<td>Bacteriology 1</td>
<td>4</td>
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Total semester hours 20

### SIXTH SEMESTER

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<td>Dairying 27</td>
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<td>Agricultural Engineering 23</td>
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<tr>
<td>Agricultural Chemistry 65</td>
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<tr>
<td>English 12</td>
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<td>Soils 2</td>
<td>4</td>
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</table>

Electives will be selected from the list on page 156, 0 to 2 1/3

Total semester hours 17 2/3 to 20

#### Senior Year

### SEVENTH SEMESTER

<table>
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<th>Course</th>
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<tr>
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<td>Dairying 28</td>
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<tr>
<td>Agricultural Journalism 8</td>
<td>2</td>
</tr>
<tr>
<td>Animal Husbandry 20</td>
<td>2</td>
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<td>Veterinary 19</td>
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<td>Veterinary 44</td>
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Electives will be selected from the list on page 156, 7 to 11

Total semester hours 16 to 20

### EIGHTH SEMESTER

<table>
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<tr>
<td>Dairying 20</td>
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</tr>
<tr>
<td>Dairying 21</td>
<td>1 1/3</td>
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<tr>
<td>Dairying 23</td>
<td>2</td>
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<tr>
<td>Animal Husbandry 15</td>
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<tr>
<td>Agricultural Journalism 9</td>
<td>2</td>
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<tr>
<td>Farm Crops 17</td>
<td>2</td>
</tr>
<tr>
<td>*Literature 3</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives will be selected from the list on page 156, 1 to 5

Total semester hours 16 to 20

* Or 3 hours elective in literature, history, psychology, economic science, public speaking, or agricultural journalism.
11. Cheesemaking. Cheddar cheesemaking, curing and marketing. 3, 5, or 7S. Prerequisite 12, Chem. 23; recitation 1, labs. 3, 2 hr.; credit 3; fee $3.50.

14. Advanced Buttermaking. Manufacture and marketing of butter. 5 or 7S. Recitations 3, labs. 3, 2 hr.; credit 5; fee $3.00.

20. Factory Management. Organization and construction of factories; creamery refrigeration, purchase of raw material and supplies, profit and loss in manufacturing, business correspondence, advertising, creamery accounting, salesmanship as related to the creamery industry. 6 or 8S. Prerequisites 14 and 28; recitations 2, labs. 2, 2 hr.; credit 3½.

21. Ice Creams and Ices. Care and preparation of materials used in the manufacture of ice cream and ices; manufacture of plain and fancy ice creams, ices, puddings, parfaits, mousses, etc. 6 or 8S. Recitation 1, lab. 1, 2 hr.; credit 1½; fee $3.00.

24. Fancy Cheesemaking. Manufacture, curing and marketing of the principal varieties of fancy cheese. 4, 6 or 8S. Prerequisites 11 and Chem. 25; recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00.

26. Judging Dairy Products. Judging of milk, cream, butter, cheese, and frozen products. 5 or 7S. Prerequisite 13; labs. 1½, 2 hr.; credit 1; fee $3.00.

27. Advanced Butter Judging. From the standpoint of market requirements. 6 or 8S. Prerequisites 14 and 26; labs. 1½, 2 hr.; credit 1; fee $3.00.

28. Advanced Butter Judging. With the intention of qualifying the student to fill the position of an official judge. 5 or 7S. Prerequisite 17; labs. 1½, 2 hr.; credit 1; fee $3.00.

GENERAL DAIRYING

10. Domestic Dairying. Nutritive and economic value of milk; its dietetics and hygiene; market milk, infants' milk, invalids' milk, cream, ice cream, condensed milk, milk chocolates, malted milk, dried milk, fermented milks (Kephir, Koumiss), buttermilk, butter, and cheese. Demonstrations are given in types of butter and cheese, and in testing the purity of milk and butter. 6 or 8S. Prerequisite, Chem. 5S; lectures and labs. 2; credit 2; fee $2.50.

12. Farm Dairying. Secretion, composition, testing, separation and acidity of milk, preparation of starters, ripening of cream, and churning and packing butter. 1, 2, 6 or 8S. Recitations 2, lab. 1, 2 hr.; credit 2½; fee $3.00.

13. Milk Testing and Milk Inspection. Advanced work in testing milk and dairy products. 4, 6 or 8S. Prerequisite 12 and Chem. 25; recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.50.

16. Technology of Milk. Utilization of milk and its products, man-
ufacture of condensed, powdered, and modified milk, casein, milk sugar, and fermented milk drinks. Food value of milk and its products.
5 or 7S. Prerequisites 13 and Chem. 26; recitation 1; credit 1.

5 or 7S. Prerequisites 14, 16, 24 and Chem. 65; recitation 1; credit 1.

23. Thesis. Original work on some dairy subject. May be worked in co-operation with the department of Chemistry. Students should consult the professor concerning their subject at the beginning of their Senior Year.
8S. Labs. 6 hr. per week; credit 2.

DAIRY BACTERIOLOGY

17. Dairy Bacteriology. Bacteria in milk and its products; their sources, mode of entry and subsequent changes produced; the production and handling of milk from a hygienic and economic viewpoint and its relation to the public health.
6 or 8S. Prerequisites Bact. 1 or 15, and Chem. 26; recitations 4; credit 4; fee $4.00.

25. Advanced Dairy Bacteriology. Laboratory investigation of bacteriological problems relating to dairying, the nature of the work being largely adapted to the individual student.
7S. Prerequisite 17; labs. 9 hrs. per week; credit 3; fee $4.00.

29. Milk Inspection. Testing of milk and cream by the Babcock methods. Inspection of dairy products for adulteration, etc.
6S. Prerequisite Chem. 69; recitation 1, lab. 1, 3 hr.; credit 2.

6S. Prerequisites 13 and 17; recitation 1, lab. 1, 2 hr.; credit 1½; fee $1.50.

Department of Animal Husbandry

WILLIAM HARPER PEO, PROFESSOR
GEORGE EDWARD NORRIS WENTWORTH, ASSOCIATE PROFESSOR
CLARE NEWTON ARNETT, ASSOCIATE PROFESSOR
HENRY HERBERT KILDEE, ASSOCIATE PROFESSOR, SUPT. OF DAIRY FARM
EVAN F. FERRIN, ASSISTANT PROFESSOR
GEORGE MELVIN TURPIN, PROFESSOR OF POULTRY HUSBANDRY
ROSS M. SHERWOOD, INSTRUCTOR IN POULTRY HUSBANDRY
PHINEAS SHEARER, ASSISTANT
ROY F. O'DONNELL, EXTENSION LECTURER
HOWARD VAUGHN, EXTENSION LECTURER

The department of Animal Husbandry stands for all lines of work which pertain to the judging, selecting, breeding, feeding, development, 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 because of the demand for instruction in this line, the equipment for instruction has been made as complete in every detail as possible.

The herds and flocks, established at an early date, have been added to from time to time until our equipment in this line, consisting of almost all recognized breeds of animals, places us in a position to do work in Animal Husbandry lines which cannot be accomplished in those institutions where such specimens are not furnished for instruction. Believing that training the eye is the only way to make a young man a proficient judge of live stock, the work of the lecture room and laboratory is demonstrated by the use of living specimens.

The three commodious judging pavilions, located near the barn, afford ample room for dividing the classes into many sections, thus allowing individual work.

An excellent collection of horses representing all the market classes and the breeds of both light and heavy types is maintained for instruction purposes. Among these are good representatives of the Shires, Percherons, Clydesdales, French Coachers, Hackneys, Standard breeds, 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 200 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. An excellent collection of steers, representing the highest type of fat steer, and all the other classes and grades to be found in 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.

The dairy farm is well stocked with dairy cattle, including a herd of about a hundred representatives of the Holsteins, Jerseys, Guernseys, Ayrshires, milking Short-horns, with good sires of the different breeds. This equipment affords an excellent opportunity for class work when studying the origin, history, and development of the different breeds of dairy cattle, their characteristics and the conditions under which they are evolved; also for carrying on investigations along the lines of breeding, feeding and management of the dairy herd for profit; and the relative values of home-grown feedstuffs and by-products in the production of milk and butter fat.

The flock of sheep, consisting of over 200 head of seven different breeds, have been carefully selected to represent the type and characteristic of each breed, both in regard to form and wool-bearing qualities. In addition to the breeding flocks, the department has a choice collection of fat wethers which affords an opportunity for the student to familiarize
himself with the highest type of finished mutton sheep. All these are available for class work.

In the swine department, representatives of six breeds of the best American and British varieties are maintained. As in the other departments, the aim in this has been to keep in touch with the modern ideas of 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. The College possesses the most complete set of the English Short-horn herd books in existence in America. Through herd book study, the student is enabled not only 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.

The department is also equipped with photographs, charts, and lantern slides which are used in the lecture room when it is impossible to illustrate with the living animal. The abundant material available from the herds and flocks is 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 or points for the different breeds in a similar way makes them skillful in judging representatives of 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 classroom.

Positions Open for Men Trained Along Animal Husbandry Lines. There is a great demand for competent young men trained along the lines of practical and scientific Animal Husbandry work, men who combine their college training with practical experience and native ability. Such is the training offered to the young men in this course. The demand for such students is unlimited at a compensation not exceeded in any other calling. 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 stockyard centers, and salesmen of animal feedstuffs manufactured by the packing houses, glucose companies, linseed and cottonseed oil companies.

POULTRY HUSBANDRY

The Poultry Husbandry group affords opportunities for instruction in all lines of poultry work, such as the selection, care and management, incubating, brooding, judging, breeding, feeding, showing, marketing and diseases of various varieties of fowls, ducks, turkeys and geese.

The Poultry Farm of nearly twenty acres, upon which the buildings have been erected during the last two years, offers unexcelled opportunities for practical instruction: The buildings consist of a large headquarters building, long poultry house, and many colony houses for brooders, young stock, breeding stock, and fattening stock. The Headquarters Building contains a large feed room, carpenter shop, incubator room, killing and marketing room, egg room, and room for attendants; and is, without doubt, the best building of its kind in the country. The long poultry house, used in laboratory and investigation work, is of the cloth curtain type, and consists of seven 12x12 pens which, together with the colony houses, have a capacity of approximately 1,000 head of poultry. All pens are equipped with trap nests so that individual egg records may be obtained from each hen. The Incubator Room is equipped with machines made by several of the leading incubator firms and affords opportunity for a complete study of the different types of incubators. A thorough study of the latest brooding methods is also made.

Positions Open to Men Trained Along Poultry Husbandry Lines. At the present time there is an urgent and increasing demand for college men who possess scientific training in Poultry Husbandry, together with practical experience and ability. Some of the openings for students trained along these lines are government, college and experiment station work, managers of utility and fancy poultry farms, poultry journalism and poultry judging, managers of poultry supply houses and poultry fattening establishments, and salesmen with the incubator and brooder manufacturers.
COURSE IN ANIMAL HUSBANDRY

For Freshman year see Agricultural Course, page 85.

**Sophomore Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
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<tbody>
<tr>
<td>Animal Husbandry 3</td>
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<tr>
<td>Animal Husbandry 46</td>
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<tr>
<td>Agricultural Chemistry 25</td>
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<td>Agricultural Engineering 4</td>
<td></td>
</tr>
<tr>
<td>English 11</td>
<td></td>
</tr>
<tr>
<td>Zoology 20</td>
<td></td>
</tr>
<tr>
<td>Military 3, or Physical Training 303</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Breed Types of Cattle and Sheep</td>
<td>3½</td>
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<tr>
<td>General Poultry Husbandry</td>
<td>2</td>
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<tr>
<td>Organic Chemistry</td>
<td>3½</td>
</tr>
<tr>
<td>Farm Engineering</td>
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<tr>
<td>Exposition</td>
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<tr>
<td>General Zoology</td>
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**Total semester hours** 19½

**FOURTH SEMESTER**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Animal Husbandry 4</td>
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<td>Animal Husbandry 47</td>
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<tr>
<td>Agricultural Chemistry 26</td>
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<td>Agricultural Engineering 5</td>
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<td>English 10</td>
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<td>Zoology 21</td>
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<tr>
<td>Military 4, or Physical Training 404</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Breed Types of Dairy Cattle, Horses and Swine</td>
<td>3½</td>
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<tr>
<td>General Poultry Husbandry</td>
<td>2</td>
</tr>
<tr>
<td>Agricultural Analysis</td>
<td>3½</td>
</tr>
<tr>
<td>Farm Machinery and Farm Motors</td>
<td>2½</td>
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<tr>
<td>Narration and Description</td>
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<tr>
<td>General Zoology</td>
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**Total semester hours** 18½

**Junior Year**

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
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<tbody>
<tr>
<td>Animal Husbandry 11</td>
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<tr>
<td>*Animal Husbandry 22</td>
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<tr>
<td>Bacteriology 15</td>
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<tr>
<td>History 24</td>
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<tr>
<td>Soils 1</td>
<td></td>
</tr>
<tr>
<td>Veterinary 22</td>
<td></td>
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<tr>
<td>Zoology 31</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Feeding and Management of Live Stock</td>
<td>2</td>
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<tr>
<td>Seminar</td>
<td>R</td>
</tr>
<tr>
<td>General Bacteriology</td>
<td>2½</td>
</tr>
<tr>
<td>History of Public Domain</td>
<td>2</td>
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<tr>
<td>Soil Physics</td>
<td>4</td>
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<tr>
<td>Comparative Physiology</td>
<td>2</td>
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<tr>
<td>Embryology</td>
<td>2½</td>
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</tbody>
</table>

Electives will be selected from the list on page 156, \( \frac{16}{16} \) to \( \frac{20}{20} \)

**Total semester hours** 15½

*This course must be continued through the year. Final standing will not be certified to recorder until the close of the sixth semester.*

* *
SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Animal Husbandry 8,</td>
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<td>Animal Husbandry 12,</td>
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<tr>
<td>Animal Husbandry 22,</td>
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<tr>
<td>Botany 26,</td>
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</tr>
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<td>English 12,</td>
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</tr>
<tr>
<td>Soils 2,</td>
<td></td>
</tr>
<tr>
<td>Zoology 8,</td>
<td></td>
</tr>
<tr>
<td>Animal Breeding</td>
<td>2</td>
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<tr>
<td>Feeding and Management of</td>
<td>2</td>
</tr>
<tr>
<td>Live Stock</td>
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</tr>
<tr>
<td>Seminar</td>
<td>1</td>
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<tr>
<td>Ecology</td>
<td>1½</td>
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<tr>
<td>Argumentation</td>
<td>2</td>
</tr>
<tr>
<td>Soil Fertility</td>
<td>4</td>
</tr>
<tr>
<td>Animal Parasites</td>
<td>2</td>
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<tr>
<td></td>
<td>14½</td>
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Electives will be selected from the list on page 156, 1½ to 5½

Total semester hours 16 to 20

Senior Year

SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Animal Husbandry 6,</td>
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<td>Animal Husbandry 9,</td>
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<td>Animal Husbandry 23,</td>
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<tr>
<td>Horticulture 8,</td>
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</tr>
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<td>Soils 6,</td>
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<td>Veterinary 19,</td>
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<td>Veterinary 44,</td>
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<tr>
<td>Veterinary 55,</td>
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<tr>
<td>Advanced Live Stock Judging</td>
<td>1½</td>
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<tr>
<td>Animal Nutrition and Packing</td>
<td>2</td>
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<tr>
<td>House By-Products</td>
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</tr>
<tr>
<td>Seminar</td>
<td>R</td>
</tr>
<tr>
<td>Landscape Gardening</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Fertility</td>
<td>2</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>1</td>
</tr>
<tr>
<td>Sanitary Science</td>
<td>2</td>
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<tr>
<td>Anatomy of Domestic Animals</td>
<td>1½</td>
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Electives will be selected from the list on page 156, 4½ to 8½

Total semester hours 16 to 20

EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
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<tbody>
<tr>
<td>Animal Husbandry 7,</td>
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<td>Animal Husbandry 10,</td>
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<td>Animal Husbandry 13,</td>
<td></td>
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<td>Animal Husbandry 14,</td>
<td></td>
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<tr>
<td>Herd Book Study</td>
<td>2</td>
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<tr>
<td>Thesis</td>
<td>2</td>
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<tr>
<td>Advanced Work in Beef Pro-</td>
<td>1</td>
</tr>
<tr>
<td>duction</td>
<td></td>
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<tr>
<td>Advanced Work in Pork Pro-</td>
<td>1</td>
</tr>
<tr>
<td>duction</td>
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</tbody>
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* A continuation of work in fifth semester. One hour credit for both the fifth and sixth semesters' work will be recorded at end of sixth semester.

* This course must be continued through the year. Final standing will not be certified to the recorder until the close of the eighth semester.
Animal Husbandry 15,  Milk Production 1
Animal Husbandry 16,  Advanced Work in Mutton and Wool Production 1
Animal Husbandry 17,  Advanced Work in Horse Feeding 1
*Animal Husbandry 23,  Seminar 1
Veterinary 17,  Soundness and Shoeing 2
Zoology 6,  Evolution of Animals 1

Electives will be selected from the list on page 156, 3 to 7

Total semester hours 16 to 20

POULTRY HUSBANDRY GROUP

For Sophomore year, see Animal Husbandry Course.

Junior Year

FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Animal Husbandry 11, Feeding and Management of Live Stock 2</td>
</tr>
<tr>
<td>Animal Husbandry 48, Breed Types and Judging of Poultry 2½</td>
</tr>
<tr>
<td>Animal Husbandry 49, Principles and Practices of Poultry Feeding 2</td>
</tr>
<tr>
<td>*Animal Husbandry 50, Poultry Seminar R</td>
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<tr>
<td>Bacteriology 15, General Bacteriology 2½</td>
</tr>
<tr>
<td>Horticulture 8, Landscape Gardening 2</td>
</tr>
<tr>
<td>Soils 1, Soil Physics 4</td>
</tr>
<tr>
<td>Zoology 31, Embryology 2½</td>
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</table>

Total semester hours 17½ to 20

SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Husbandry 8, Animal Breeding 2</td>
</tr>
<tr>
<td>*Animal Husbandry 50, Poultry Seminar 1</td>
</tr>
</tbody>
</table>

*A continuation of work in the seventh semester. One hour credit for both the seventh and eighth semesters' work will be recorded at close of eighth semester.

* This course must be continued through the year. Final standing will not be certified to recorder until the close of the sixth semester.

*A continuation of work in fifth semester. One hour credit for both the fifth and sixth semesters' work will be recorded at end of sixth semester.
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Animal Husbandry 51,</td>
<td>Incubation</td>
<td>2½</td>
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<tr>
<td>Animal Husbandry 52,</td>
<td>Brooding</td>
<td>1½</td>
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<tr>
<td>Soils 2,</td>
<td>Soil Fertility</td>
<td>4</td>
</tr>
<tr>
<td>Veterinary 22,</td>
<td>Comparative Physiology</td>
<td>2</td>
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<td>Zoology 8,</td>
<td>Animal Parasites</td>
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<td>Electives will be selected from list on page 156</td>
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<td>1 to 5</td>
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<td>Total semester hours</td>
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**Senior Year**

**SEVENTH SEMESTER**

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Animal Husbandry 9,</td>
<td>Animal Nutrition</td>
<td>2</td>
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<tr>
<td>Animal Husbandry 20,</td>
<td>Animal Feeding</td>
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<tr>
<td>Animal Husbandry 53,</td>
<td>Market Types of Poultry</td>
<td>2</td>
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<td>*Animal Husbandry 54,</td>
<td>Poultry Seminar</td>
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<tr>
<td>Agricultural Journalism 8,</td>
<td>Beginning Journalism</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 44,</td>
<td>Sanitary Science</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 770,</td>
<td>Anatomy and Physiology of Poultry</td>
<td>2</td>
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<td>Economics 9,</td>
<td>Outlines of Economics</td>
<td>3</td>
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**EIGHTH SEMESTER**

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Animal Husbandry 10,</td>
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<tr>
<td>Animal Husbandry 15,</td>
<td>Milk Production</td>
<td>1</td>
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<td>Animal Husbandry 17,</td>
<td>Advanced Horse Feeding</td>
<td>1</td>
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<tr>
<td>Animal Husbandry 54,</td>
<td>Poultry Seminar</td>
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<tr>
<td>Animal Husbandry 55,</td>
<td>Marketing and Judging</td>
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<td>Poultry Products</td>
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<td>Animal Husbandry 56,</td>
<td>Poultry Research</td>
<td>3</td>
</tr>
<tr>
<td>Agricultural Journalism 9,</td>
<td>Journalism Practice</td>
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<td>Bacteriology 16,</td>
<td>Poultry Bacteriology</td>
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<td>Veterinary 871,</td>
<td>Poultry Parasites, Diseases and Hygiene</td>
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<td>Zoology 6,</td>
<td>Evolution of Animals</td>
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<td>18½ to 20</td>
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</tbody>
</table>

*Course 54 continues through the year. Credit is given at the close of the eighth semester.

*A continuation of work in the seventh semester. One hour credit for both the seventh and eighth semesters' work will be recorded at close of eighth semester.*
COURSES IN ANIMAL HUSBANDRY

JUDGING, SELECTION AND PEDIGREES OF LIVE STOCK

1. Market Types of Cattle and Sheep. Judging of different market classes of beef cattle, and mutton and wool, sheep.
   1S. Recitation 1, labs. 1, 3 hr.; credit 2; fee $2.00.

2. Market Types of Dairy Cattle, Horses and Swine. Includes judging different market classes of dairy cattle, light and heavy horses, and (bacon and fat) swine.
   2S. Recitation 1, lab. 1, 3 hr.; credit 2; fee $2.00.

3. Breed Types of Cattle and Sheep. Judging representatives of different breeds according to their official standards, a study of their origin, history, characteristics, and adaptability to different conditions of climate and soil.
   3S. Prerequisite 1; recitations 2, labs. 2, 2 hr.; credit 3½; fee $2.00.

4. Breed Types of Dairy Cattle, Horses and Swine. Judging of representatives of different breeds according to their official standards, a study of their origin, history, characteristics, and adaptability to different conditions of climate and soil.
   4S. Prerequisite 2; recitations 2, labs. 2, 2 hr.; credit 3½; fee $2.00.

5. Advanced Live Stock Judging. Judging horses, cattle, sheep, and swine, especially in groups similar to county and state fair work.
   7S. Prerequisites 3 and 4, and Zoo. 21; recitation 1, lab. 1, 2 hr.; credit 1½; fee $1.00.

6. Herd Book Study. Pedigrees of the leading strains and families of the different breeds of live stock.
   8S. Prerequisite 4; recitations 2; credit 2.

25. Advanced Types and Breeds of Farm Animals. Summary and application of principles covered in Animal Husbandry 1, 2, 3, and 4.
   5 or 7S. Prerequisites 3, 4 and Zoo. 3 or 21; recitation and labs. 2; credit 2; fee $1.00.

26. Market and Breed Types of Beef Cattle and Sheep. Judging of market types; breed types, and representatives of the several breeds of beef cattle and sheep.
   1S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $2.00.

27. Market and Breed Types of Dairy Cattle, Horses and Swine. Judging of market types, breed types, and representatives of the several breeds of dairy cattle, horses and swine.
   2S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $2.00.

NUTRITION AND PRODUCTION

9. Animal Nutrition. Process of digestion in the different farm animals, absorption and assimilation, Metabolism under varying conditions, sources and utilization of energy, internal work, maintenance and factors influencing the digestion of food.
   5 or 7S. Prerequisite, Chem. 25; recitations 2; credit 2.

13. Advanced Work in Beef Production. Successful and economical methods of producing beef cattle for market purposes; production of
baby beef; advisability of long and short feeding periods; and the feeding of grain rations to cattle on grass.

8S. Prerequisite 12 and Zoo. 8; recitations 5, for first five months; credit 1.


8S. Prerequisite 12 and Zoo. 8; recitations 5, for second five weeks; credit 1.

15. Milk Production. Feeding stuffs and the methods of preparing and feeding same as related to most successful and economical production of milk.

8S. Prerequisite 9 or 20; recitations 5, for four weeks, following A. H. 14; credit 1.


8S. Prerequisites 9 or 20, and Zoo. 8; recitations, 5 for week following A. H. 15; credit 1.

17. Advanced Work in Horse Feeding. Growing and developing young animals, most economical and satisfactory rations for horses at light, medium and heavy work; also feeding stuffs best adapted to the production of heavy and economical gains on horses which are being fattened for market.

8S. Prerequisites 12 and Zoo. 8; recitations, 5 per week following A. H. 16; credit 1.

20. Animal Feeding. Composition and digestibility of feeding stuffs; the preparation of coarse fodders; the grinding, steaming and cooking of feeding stuffs; feeding standards and calculation of rations; feeding for meat, milk, wool, growth and work.

5 or 7S. Prerequisites Chem. 68 or 25; recitations 2; credit 2.

ANIMAL BREEDING

8. Animal Breeding. Principles of animal breeding, results of the most recent investigations, unifying where possible, the Mendelian, biometric and older theories. Practical points of breeding and the different systems in vogue. Stallion importing and other breeding laws as well as herd book regulations.

6 or 8S. Prerequisites 3, 4, and Zoo. 31; recitations 2; credit 2.

21. Principles of Breeding. General principles of breeding, selection, variation, heredity, atavism, etc., and historical study of the results.

5 or 7S. Prerequisites 1 and 2; recitations 2; credit 2.

24. Ancestry of Domestic Mammals. Forces which have caused a progressive evolution from the primitive hoofed mammals to the domestic mammals of today. The teeth and skeletal modifications, environmental adaptations, family and species relationships and the particularized effects of domestication.

6 or 8S. Prerequisites 8 or 21; recitation 1; credit 1.

LIVE STOCK MANAGEMENT

11. Feeding and Management of Live Stock. Feed stuffs, the
principles of animal feeding and the practical feeding, care and manage-
ment of breeding and growing beef cattle.

5 or 7S. Prerequisite Chem. 25; recitations 1½, labs. 1, 1½ hr.; credit 2; fee $2.00.


6 or 8S. Prerequisite 11; recitations 1¼, lab. 1, 1½ hr.; credit 2; fee $2.00.

SEMINAR

5 and 6S. Credit 1.

7 and 8S. Credit 1.

THESIS

10. Thesis. Must be along some line to be arranged with the head of the department.

8S. Laboratory 6 hrs. per week; credit 2.

COURSES IN POULTRY HUSBANDRY

46. General Poultry Husbandry. Present status of the poultry industry, various kinds of poultry products ordinarily produced for sale with special reference to their relative importance and their production as a branch of general agriculture and as a specialized industry, brief consideration of the more important classes and breeds of poultry and poultry management dealing particularly with breeding, housing, and yarding.

3, 5 or 7S. Recitations 1½; lab. 1, 1½ hr.; credit 2; fee $2.00.

47. General Poultry Husbandry. Continues the work in course 46 and takes up, in a general way, feeding, marketing, incubation and brood-
ing.

4, 6 or 8S. Prerequisite 46; recitations 1½, lab. 1, 1½ hr.; credit 2; fee $2.00.

48. Breed Types and Judging. Origin, history and characteristics of the more important breeds and varieties of poultry and practice in judging by score card and by comparison according to the American Standard of Perfection.

5 or 7S. Prerequisite 47; recitation 1, lab. 2, 2 hr.; credit 2½; fee $2.00.

49. Principles and Practice of Poultry Feeding. Practical and experimental work and a series of lectures on the important factors in-
volved in the making up of poultry rations for various classes of poultry and in feeding for various purposes, particularly that of egg production, development of young stock and for meat production.

5 or 7S. Prerequisite 47; lecture 1, lab. 1, 3 hr.; credit 2.

* The Animal Husbandry Seminar Courses 22 and 23 meet once each two weeks while college is in session and has for its members the professors and instructors in Animal Husbandry, and all students in the Junior and Senior classes in the course in Animal Husbandry. At each meeting, four students—two Seniors and two Juniors—present papers on associated Animal Husbandry topics. These subjects are selected a half year in advance and follow, in regular series, Animal Breeding, Relation of Animal Husbandry to Other Industries, Animal Feeding, and a study of Live Stock Organization, Expositions, College and Experiment Station Organization and Equipment.
50. Poultry Seminar.
5 and 6S. Credit 1.

51. Incubation. Successful hatching of eggs, including those factors which influence the hatching qualities before as well as during the incubation period. A consideration of general methods in vogue in the management of central or mammoth hatcheries and the distribution of baby chicks. Laboratory includes practical and experimental work in incubation.

6 or 8S. Prerequisite 47; recitations 2 for first 15 weeks, labs. 4 weeks, 1 hr. daily divided into 3 periods; credit 2½; fee $2.00.

52. Brooding. The principles and practices of brooding.
6 or 8S. Prerequisite 51; recitations 2 for last 3 weeks of semester, labs. 4 weeks, 1 hr. daily divided into three periods; credit 1½; fee $2.00.

53. Market Types of Poultry. Judging and breeding of the most suitable types of poultry for meat and egg production.
5 or 7S. Prerequisite 47; recitations 1½, lab. 1, 1½ hr.; credit 2; fee $2.00.

54. Poultry Seminar.
7 and 8S. Credit 1.

6 and 8S. Prerequisite 53; recitations 1½, lab. 1, 1½ hr.; credit 2; fee $2.00.

56. Poultry Research. Experimentation and study of special poultry problems. There are exceptional opportunities for effective research work in poultry husbandry and a great demand for men trained to carry on such work. Approved methods and technique as well as practical research work.
6 or 8S. Prerequisite 47; labs. 3, 3 hr.; credit 3; fee $2.00.

Department of Horticulture and Forestry

SPENCER AMBROSE BEACH, PROFESSOR
ARTHUR THOMAS ERWIN, PROFESSOR, TRUCK CROPS AND LANDSCAPE GARDENING
GILMOUR BYERS MACDONALD, ASSOCIATE PROFESSOR, FORESTRY
GEORGE CHESTER MORBECK, ASSISTANT PROFESSOR, FORESTRY
FRANK WISDOM ALLEN, JR., INSTRUCTOR IN HORTICULTURE
ROBERT SEYMOUR HERRICK, EXTENSION HORTICULTURIST
JOHN REARDON, FLORIST

Two distinct lines of work are offered in this Department each leading to a separate degree, one in Horticulture and the other in Forestry. Each is well supported by courses in fundamental sciences including Plant Pathology, Plant Physiology, Bacteriology, Entomology, Soils, Engineering, Physics, and Chemistry. The technical courses in Horticulture and Forestry instruct the student with reference to the nature and scope of these special lines and train him in the application of the fundamental
sciences to the subjects offered in the Department. The curricula provide also for a reasonable amount of cultural subjects such as tend to inspire the student with scholarly ideals, broaden his outlook and better train him to fill his place in society with dignity and honor.

HORTICULTURE

The trend today is towards a more intensive agriculture. The most intensive kind of agriculture is horticulture. The increase in population and wealth, the extension and improvement of transportation facilities, the enormous growth in the demand for agricultural products and the persistent rise in land values, are important factors in this movement. In many of the regions where land now commands the highest prices, the higher priced lands are being planted more and more exclusively to horticultural crops.

Present day American horticulture is composed of groups of great productive industries, notably orcharding, small fruit growing, viticulture, market gardening, the nursery, seed and floricultural lines of work, and also that part of landscape gardening which has to do with the care and management of ornamental plantings. More or less closely allied lines are fruit storage and transportation; the evaporating, desiccating and canning of fruits and vegetables and the manufacturing of other horticultural by-products. All these various industries are expanding continually. They are becoming better organized, better developed and better equipped each succeeding year. More and more the people who are engaged in them are looking to Agricultural Colleges for experts and to the Experiment Stations and the United States Department of Agriculture for specialists to assist and instruct them concerning the technical and scientific phases of their work and the investigation of their special problems.

Opportunities for Men with Horticultural Training

Fruit Growers, Truck Farmers and Florists. It is a significant fact that more fruit, nursery, and florist farms are owned by the men who operate them than any other class of farms in the United States. Commercial orcharding, grape growing, and small fruit culture offer a pleasant and profitable life work for men and women.

Floriculture and the growing of truck crops under glass and out of doors represents one of the highest and most intensive types of crop production. The rapid growth of city population means an increasing demand for such products and the returns are sufficient to prove profitable on high priced lands. The rich lands of the Corn Belt are well adapted to a number of the more intensive lines of vegetable crop production. Many cities throughout the country offer excellent openings for young men of technical training to establish a profitable business for themselves in floriculture.

Managers and Superintendents of Fruit and Vegetable Farms.
The demand is increasing for experts trained along horticultural lines to take charge of fruit and vegetable plantations for individuals and companies.

Managers of Co-operative Associations. Co-operative buying and marketing is being highly developed among fruit and vegetable growers. There is a continual call for men capable of managing such associations.

Government and Station Work. The United States Department of Agriculture and the Agricultural Experiment Stations in the various states are calling for experts who are capable of conducting experiments and investigations along horticultural lines.

Teachers in Colleges, Academies and High Schools. Agricultural education is being demanded all over this country today. The call for good horticultural teachers exceeds the supply.

Extension Experts for Agricultural Colleges, Railroads, Land Companies and Horticultural Associations. The field of extension work for men trained in horticulture is continually enlarging.

The Department is established for the purpose of giving scientific and practical instruction that will fit the student for such lines of work as have been mentioned above. The technical subjects which it offers may readily be classed in three groups: 1. Pomology or fruit growing; 2. Truck Crops, Floriculture and Landscape Gardening; 3. General Horticulture including subjects common to both of the preceding groups.

Fruit Growing

The student is given first a brief general course in Orcharding, taking up later in advanced courses commercial fruit production, including methods of managing fruit plantations and harvesting, grading, packing, marketing and storing the crop. A systematic study of varieties is also given. The Orchard Practice course requires a week's work or more in camp in the Experiment Station orchard at Council Bluffs, under the direction of an instructor. Here the student learns the latest methods in packing and handling fruit, and also has opportunity to study the markets and cold storage plants of the great distributing center at Council Bluffs and Omaha.

The Fruit Judging course gives training in scoring and judging plate exhibits and collections of fruit. From the students taking this course the team is chosen which represents the College in the Inter Collegiate Fruit Judging Contest.

The courses in Nursery Practice require work in the Spring in orchards and nurseries at or near the College supplemented by a week in some one of the large nurseries of the State. A systematic course in Small Fruits is also given.

The Department equipment includes orchards, vineyard, and nurseries. Students are also offered a certain amount of work in the Experiment Station orchard of 23 acres which is located at Council Bluffs. On the
whole, good facilities are provided for practice in pruning, spraying, harvesting, grading and packing fruit and in nursery operations.

**Truck Crops**

The courses in Truck Crops include the subjects of the cultivation, harvesting and marketing of the important commercial types of vegetables together with a laboratory course in canning, which deals with the processing of vegetables. The Department gardens provide a liberal supply of corn, tomatoes and other laboratory material for these courses.

**Floriculture and Landscape Gardening**

The work in Floriculture covers the propagation, cultivation and management of greenhouse crops and flowering plants for the lawn and garden. A laboratory course throughout the year gives the student experience in watering, ventilation and transplanting and in other greenhouse operations. The greenhouses, which comprise about 14,000 feet under glass, are largely devoted to the growing of carnations, foliage plants, vegetables and other important forcing crops.

The general course in Landscape Design includes a discussion of the principles of landscape gardening and a study of the more common plants used in landscape work. Following this are laboratory courses dealing with landscape design, a course in Plant Materials in which a more detailed study is made of trees and shrubs used in landscape work, and a course in the care of street and park trees including the subjects of tree surgery, mechanical injuries, transplanting large trees, and the preparation of soil for planting. The Department grounds contain a representative collection of ornamental shrubs. In addition over 100 species of deciduous and evergreen trees are available on the campus for the study of material for landscape planting. The greenhouses, parks and nurseries of the city of Des Moines are easily and quickly reached by steam and electric service.

**General Courses**

The seminars, the research courses and the theses offer opportunities to present special horticultural subjects and give some practice in methods of research and original investigation. A course in the History of American Horticulture treats of the development of the more important phases of Floriculture, Truck Farming and Pomology.

The course in Plant Propagation includes studies in principles and practice pertaining to the reproduction of plants from seed and by plant divisions as by buds, cutting and layers.

In Plant Breeding the general principles of this subject receive particular attention. Carefully recorded breeding experiments with apple, plum, tomato, and carnation, extending over periods of several years and continuing at the present time, afford abundant data for first hand study of the evolution and improvement of cultivated plants.
The general Department equipment includes class rooms, herbarium museums, research and seminar rooms, which, together with the various offices, occupy a large part of the second floor of Agricultural Hall. A two story horticultural laboratory building, 40 by 50 feet, adjoins the greenhouse.

**COURSE IN HORTICULTURE**

For Freshman year, see Agricultural Course, page 85.

**Sophomore Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Horticulture 5, *Agricultural Chemistry 25, Agricultural Engineering 4, Botany 68, English 11, Economic Science 9, Military 3, or Physical Training 303,</td>
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</tr>
<tr>
<td>Pomology, Organic Chemistry, Farm Engineering, Vegetable Physiology, Exposition, Outlines of Economics</td>
<td>2½, 3½, 3½, 3½, 3</td>
</tr>
<tr>
<td>Horticulture 38, Horticulture 39, Horticulture 45, Agricultural Engineering 22, Botany 66, English 10, History 24, ( \varepsilon ) Economic Science 10, ( \varepsilon ) History 8, Zoology 16, Military 4, or Physical Training 404,</td>
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</tr>
<tr>
<td>Plant Propagation, Nursery and Orchard Practice, Nursery Practice, Horticultural Mechanics, Vegetable Pathology, Narration and Description, History of Public Domain, Agricultural Economics, General Zoology</td>
<td>2, 1, ½, 1½, 2½, 3, 3, 3, 4½</td>
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<td>Total semester hours</td>
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**FOURTH SEMESTER**

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<th>Semester Hours</th>
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<tr>
<td>Horticulture 38, Horticulture 39, Horticulture 45, Agricultural Engineering 22, Botany 66, English 10, History 24, ( \varepsilon ) Economic Science 10, ( \varepsilon ) History 8, Zoology 16, Military 4, or Physical Training 404,</td>
<td></td>
</tr>
<tr>
<td>Plant Propagation, Nursery and Orchard Practice, Nursery Practice, Horticultural Mechanics, Vegetable Pathology, Narration and Description, History of Public Domain, Agricultural Economics, General Zoology</td>
<td>2, 1, ½, 1½, 2½, 3, 3, 3, 4½</td>
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<tr>
<td>Total semester hours</td>
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**Junior Year**

**FIFTH SEMESTER**

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<tr>
<td>Horticulture 4, Horticulture 28,</td>
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<tr>
<td>Plant Breeding, Seminar</td>
<td>2½, R</td>
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</tbody>
</table>

* This course must be continued throughout the year. Final standing will not be certified to the recorder until the close of the sixth semester.
DIVISION OF AGRICULTURE

Horticulture 30, Fruit Judging 1
Horticulture 33, Truck Farming 2
Horticulture 37, Orchard Practice 1
Botany 24, Plant Embryogeny 1½
Soils 1, Soil Physics 4
Civil Engineering 345, Surveying 2
Civil Engineering 366, Topographical Drawing 1

Electives selected from the list on page 156, with the approval of the Head of the Department.

Total semester hours 16 to 20

SIXTH SEMESTER

*Horticulture 28, Seminar R
Horticulture 34, Greenhouse Management 2½
Horticulture 40, Small Fruits 2
Bacteriology 1, General Bacteriology 4
Botany 70, Systematic Botany 2½
Soils 2, Soil Fertility 4

Electives selected from the list on page 156, with the approval of the Head of the Department.

Total semester hours 16 to 20

Senior Year

SEVENTH SEMESTER

*Horticulture 29, Landscape Gardening 2
Horticulture 35, Seminar R
Horticulture 42, Greenhouse Management 1
Horticulture 46, Ornamental Plants 1
Agricultural Journalism 8, Fruit Farm Management 2
Soils 13, Beginning Journalism 2
Zoology 4, Soil Mapping 1½

Electives selected from the list on page 156, with the approval of the Head of the Department.

Totals semester hours 16 to 20

* A continuation of work in fifth semester. Standing will be for the fifth and sixth semesters.

* This course must be continued throughout the year. Final standing will not be certified to the recorder until the close of the eighth semester.
## EIGHTH SEMESTER

<table>
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<th>Course</th>
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<tr>
<td>Horticulture 10,</td>
<td>2</td>
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<tr>
<td>*Horticulture 29,</td>
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<td>Horticulture 31,</td>
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<td>English 12,</td>
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<td>Agricultural Journalism 9,</td>
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<td>or 7,</td>
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<tr>
<td>Public Speaking 11,</td>
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<tr>
<td>History of American Horticulture</td>
<td>2</td>
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<tr>
<td>Seminar</td>
<td>R</td>
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<tr>
<td>Landscape Architecture</td>
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<td>Argumentation</td>
<td>2</td>
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<tr>
<td>Journalism Practice or Newspaper Management</td>
<td>1 or 2</td>
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<tr>
<td>Agricultural Advertising</td>
<td>2</td>
</tr>
</tbody>
</table>

Electives selected from the list on page 156, with the approval of the Head of the Department.

Total semester hours 16 to 20

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### COURSES IN HORTICULTURE.

#### POMOLOGY OR FRUIT GROWING

3. **Orcharding.** The establishment and care of home orchards and vineyards; systematic study of varieties adapted for planting in Iowa.

   1 or 2S. Recitations 2, lab. 1, 2 hr.; credit 2%; fee $1.00.

5. **Systematic Pomology.** Classification, geographical origin and distribution under cultivation of pomological groups and varieties.

   3S. Prerequisite 3; recitations 2, lab. 1, 2 hr.; credit 2%.

30. **Fruit Judging.** Scoring and judging plate displays and collections of fruit. Special attention given to the leading commercial varieties of apples. The intercollegiate fruit judging team is selected from students enrolled in this subject.

   5 or 7S. Prerequisite 5 or 36; credit 1; fee $1.00.

37. **Orchard Practice.** Handling fruit; harvesting, grading, packing, and other orchard operations. Work in some commercial orchard will be assigned for stated periods where the student will get practical experience in the above operations under the direction of the instructor.

   5 or 7S. Prerequisite 3; credit 1.

39. **Nursery and Orchard Practice.** Field practice in transplanting, pruning, grafting, and spraying, including the assignment of special topics in the above subjects.

   4, 6 or 8S. Prerequisite 3; lab. 1, 2 hr.; credit 1.

40. **Small Fruits.** Culture, harvesting, and marketing of the strawberry, raspberry, grape, currant, and other small fruits.

   5, 6, 7 or 8S. Prerequisite 3 or 36; credit 2.

46. **Fruit Farm Management.** Advanced problems in the location, development and maintenance of orchards, vineyards, and small fruit

* A continuation of work in seventh semester. Standing will be for the work of the seventh and eighth semesters.
plantations. Soil management. Fruit harvesting, storage, transportation and marketing problems.

7S. Prerequisite 30 or 40; credit 2.

**TRUCK CROPS AND FLORICULTURE**

8. **Landscape Gardening.** Planning and ornamentation of home grounds, parks, and other public grounds; ornamentals adapted for planting in Iowa. The trees and shrubs on the campus and in the department collection afford excellent material for laboratory work.

5 or 7S. Recitations 2; credit 2.

11. **Amateur Floriculture.** Propagation and general culture of house plants and ornamentals for the lawn, including the planning of home and school grounds.

8S. Ag. Ed. and H. E.; recitations 2; credit 2.

31. **Landscape Design.** Preparation of plans for home grounds, parks and other public grounds.

6 or 8S. Prerequisite 8; lab. 1; credit ½.

32. **Landscape Design.** A continuation of course 31, and may be taken simultaneously.

6 or 8S. Lab. 1; credit ½.

33. **Truck Farming.** Growing and marketing of the most important truck crops, such as the potato, cabbage, onion and tomato. Special attention is given to the trucking interests of Iowa.

5 or 7S. Recitations 2; credit 2.

34. **Greenhouse Management.** Greenhouse crops and their cultural requirements, including ventilation, watering and heating. The laboratory work includes routine operations in the green house.

6 or 8S. Prerequisite 2 or 38; recitations 2, lab. 1, 2 hr.; credit 2½.

35. **Greenhouse Management.** A continuation of Horticulture 34, designed to give the student practical experience in the various greenhouse operations through the different seasons of the year.

5 or 7S. Lab. 1, 2 hr.; credit 1.

41. **Advanced Greenhouse and Truck Crops.** A continuation of Horticulture 33 and 34, in which the student is offered opportunity of specializing in one or the other of these subjects.

6 or 8S. Credit 1.

42. **Ornamental Plants.** A continuation of Horticulture 8, in which a detailed study is made of the species of shrubbery and other ornamentals used in landscape work.

7S. Credit 1.

43. **Handling Truck Crops.** A laboratory course dealing with the harvesting, grading, marketing and storage of potatoes, cabbage, and other important truck crops.

7S. Prerequisite (or required with this course) 33; lab. 1; 2 hr.; credit ½.

44. **Canning Truck Crops.** A combined lecture and laboratory course devoted to the canning of corn, beans, tomatoes and other vegetables with a farm canning outfit. The department operates an outfit of
1,000 tins capacity per day. It grows on its grounds an ample supply of laboratory material for this work.

5 or 7S. Prerequisite (or required with this course) 33; credit 1.

**GENERAL HORTICULTURE**

2. **Plant Propagation.** Propagation of plants by asexual and sexual methods; germination, testing and storage of seeds; multiplication of plants by cuttage, layerage and graftage, including both greenhouse and nursery types.

Prerequisites, Botany 68 and Chem. 25; recitations 2, lab. 1, 2 hr.; credit 2%. fee $1.00.

4. **Plant Breeding.** Principles of plant breeding and their application to the improvement or plants.

5 or 7S. Prerequisite Bot. 11 or 24 (or required with this course); recitations 2, lab. 1, 2 hr.; credit 2%; fee $1.00.

9. **Research.** Investigation in some line of work under the supervision of some member of the Department Staff.

5 or 7S. Recitations 2; credit 2.


6 or 8S. Prerequisites 5, 33, and 34; recitations 2; credit 2.

13. **Thesis.** The subject chosen must be one requiring independent investigation. The results are to be presented in a carefully written report. May be a continuation of Courses 9 or 46.

8S. 6 hrs. work per week; credit 2.

28. **Horticultural Seminar.** Required both semesters of all Junior students in the course in Horticulture. Preparation and discussion of papers on special Horticultural topics.

5 and 6S. No credit.

29. **Horticultural Seminar.** A continuation of Course 28. Required both semesters of all Senior students in the course in Horticulture.

7 and 8S. No credit.

38. **Plant Propagation.** Propagation of plants by asexual and sexual methods; germination, testing and storage of seeds; multiplication of plants by cuttage, layerage and graftage, including nursery methods and management.

4, 6 or 8S. Prerequisites, Bot. 68 and Chem. 25; recitations 1, lectures and lab. 1, 2 hr.; credit 2; fee $1.00.

45. **Nursery Practice.** Nursery practice for a week in some commercial nursery under the direction of an instructor, followed by the presentation of a detailed report on the work.

4, 6 or 8S. Credit %.

47. **Care of Street and Park Trees.** Adaptation of trees for street and park use, mechanical injuries, tree surgery, root pruning, transplanting large specimens, injuries from electrolysis or from illuminating gas, soil preparation and management.

6 or 8S. Prerequisites, Bot. 68 and Chem. 25; recitations 1, lab. 1, 2 hr.; credit 1%.
FORESTRY

During the last decade forestry has advanced in this country from an almost unknown science to a profession of wide usefulness. The necessity of perpetuating the timber resources, and protecting the navigability of streams is recognized by practically every civilized country. The disasters which attend an utter disregard of forest conservation have been fully realized by various countries in the past. Benefiting by the experiences and mistakes of the past, the Federal Government, corporate and private timber owners are realizing more and more keenly the necessity of getting timber lands under management not only for the perpetuation of an adequate timber supply, but also for conserving water power and the navigability of important rivers.

The rapid development of forestry in the past few years has created a large and increasing demand for trained foresters.

Opportunities for Men with a Training in Forestry

Government Work. In view of the rapidly decreasing supply of available timber and for the better protection of the headwaters of important rivers, the National Government has put under administration about 190 million acres of forest lands. This immense area is divided into 160 National Forests, each of which requires a staff of trained foresters. The demand for trained men has been steadily increasing and there is every reason to believe that it will increase for many years to come. Upon passing the civil service examination for the position of forest assistant in the Forest Service these men are eligible for positions of tremendous responsibility, where both administrative and executive ability are required. The salary paid on entering the service is $1,100 per annum. All expenses are paid whenever the men are on field duty or are absent from their official headquarters. The opportunities for advancement, both in position and salary, are excellent in the service, and the men who have risen to the important positions have been in constant demand by states, private corporations, railroads and lumber companies or associations at much larger salaries than are paid in the Government work.

In the east the work is somewhat different in its nature. During the winter of 1911, Congress passed the Week's Law, which appropriated $2,000,000 for each of the next five years for the purchase of forest lands in the southern Appalachian and White Mountains. In a few years there will be a system of National Forests in the east similar to those in the west, and a large number of men will be needed to fill the executive and administrative places that will be open for technically trained foresters. Many technical lines of work are offered for scientific investigation in connection with the Forest Service, such as forest products, wood preservation, dendrology, planting, fire protection and forest management.

Besides the Government work in this country, the Philippine Forest Service, which is maintained as a separate organization in the Philippine
Islands, under the War Department, offers excellent opportunities for the future. Men, after passing the civil service examination, are eligible for entrance in the Department at a salary of $1,400 per annum and field expenses, including transportation from this country to the Islands.

**State Forestry Work.** The need of men for state forestry work is gradually increasing. Many of the states are acquiring title to the poorer classes of land and are holding these as State Forests, for the perpetuation of the timber supply and for the protection of important watersheds. The various states have set aside a total of 3,500,000 acres which are being handled along forestry principles. New York alone has an area of 1,600,000 acres in her state forests and employs a number of trained foresters. Wisconsin has approximately 400,000 acres reserved and about 20 of the other states have a well established forest policy. In a few years a majority of the states will probably have forests much the same as in Germany and other European countries. State forest work generally pays from $2,000 to $4,000 per annum, and men are constantly being drawn upon from the Federal Forest Service to supply the state positions. The future for state forestry work is very bright.

**With Railroads.** Besides the Government and state work there are good opportunities offered with railroads. Several of the most prominent railroads have already realized the importance of our rapidly vanishing timber supply and are taking up actively the work of planting and managing their forest lands on scientific forestry principles. This work is requiring the employment of a large number of foresters and the demand is steadily increasing.

**With Lumber Companies.** Large manufacturers and lumbermen are turning to practical forestry as a means of insuring the permanency of their industries. In no other phase of forestry work is the need of technically trained foresters so apparent as with the lumber companies. The large operators are employing foresters at good salaries to assist in timber estimates and in the management of their holdings.

**Teachers in Forestry.** Because of the newness of the field of Forestry, there is a constant demand for teachers. Many foresters take up work of this character after two or three years' experience in practical work.

**SUMMER FORESTRY CAMP**

A regular summer camp for the forestry students will be maintained during the months of June, July and August. Forestry subjects to the extent of one full semester's work will be required in this course, thus enabling the student to complete his work for the degree of Bachelor of Science in Forestry in 3½ years. The camp makes possible the pursuit of such courses as Forest Mensuration, Silviculture and Lumbering to best advantage. The location of the camp will vary from year to year, but will be in some good forested region in the Lake States or South.
The Department furnishes tents and general camp equipment, but the students are required to furnish their own bedding and personal equipment. A regular cook will be employed and board will be furnished at cost. The total expenses, including railroad fare, will be considerably less than the regular expenses for a semester's work at Ames. The camp comes regularly after the completion of the Freshman year, but by special arrangement may be taken after the Sophomore year.

**GENERAL COURSE**

In the course of "Farm Forestry" the questions that are of greatest importance in the development of forestry in Iowa are considered, such as the establishment, care, and harvesting of the woodlot; the value of wind breaks in protecting crops, and the utilization of the poorer species of woods in connection with preservative treatment. The farm is not complete without its woodlot and shelter belts for the production of fence posts and fuel, and for the protection of the home grounds, orchard, garden, and stock. Forests have so large a place in the national life that every citizen shares to some extent in the benefits attending their establishment and proper management.

**EQUIPMENT**

Forestry is housed in the new Hall of Agriculture where ample laboratory and class room is afforded. The museum contains the collection of American woods which was exhibited by Iowa at the Centennial Exposition and a large collection of South American and Philippine Island woods which were on display at the Louisiana Purchase Exposition. It also contains a large number of trunk specimens of trees which afford the student an opportunity to study the bark characteristics of trees not native to this region. About 800 lantern slides are used for illustrating, in the class room, the various phases of forestry work as carried on in different parts of the United States and foreign countries. A wooded tract of about 100 acres belonging to the Department serves as a demonstration area and affords ample room for the establishment and maintenance of forest plantations. The College Campus has about 150 different species of trees, and these, together with numerous old plantations in the vicinity, give the students a chance to observe the characteristics of many species and also to note the growth of woodlots under varying conditions.

The Department is well equipped for giving prospective foresters a good undergraduate training in forestry, such as will prepare them for work with the United States Forest Service, for State work, or for employment with companies requiring technical foresters. A number of the Forestry graduates from the Iowa State College are now in the employ of the Forest Service.
IOWA STATE COLLEGE

COURSE IN FORESTRY

Freshman Year

(For Freshman year, see Agricultural Course, page 85).

*Summer Camp (Three Months)

This comes regularly in the vacation period following the Freshman year.

Classes of 1915 and 1916 take Summer Camp Work with class of 1917 in the summer of 1914.

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry 20,</td>
<td>6</td>
</tr>
<tr>
<td>Forestry 21,</td>
<td>5</td>
</tr>
<tr>
<td>Forestry 22,</td>
<td>5</td>
</tr>
<tr>
<td>Forestry 23,</td>
<td>2</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>18</td>
</tr>
</tbody>
</table>

Sophomore Year

THIRD SEMESTER

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Chemistry 25,  Organic Chemistry 3½</td>
</tr>
<tr>
<td>Botany 63,              Dendrology 2½</td>
</tr>
<tr>
<td>Botany 68,              Vegetable Physiology 3½</td>
</tr>
<tr>
<td>English 11,             Exposition 3</td>
</tr>
<tr>
<td>Economic Science 9,     Outlines of Economics 3</td>
</tr>
<tr>
<td>Forestry 16,            Camp Technique ½</td>
</tr>
<tr>
<td>Forestry 17,            Forest History and Policy 2</td>
</tr>
<tr>
<td>Civil Engineering 366,  Topographical Drawing 1</td>
</tr>
<tr>
<td>Military 3, or Physical Training 303,</td>
</tr>
</tbody>
</table>

Total semester hours 19

FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horticulture 38,        Plant Propagation 2</td>
</tr>
<tr>
<td>Horticulture 39,        Nursery and Orchard Practice 1</td>
</tr>
<tr>
<td>Botany 62,              Dendrology 2½</td>
</tr>
<tr>
<td>English 10,             Narration and Description 3</td>
</tr>
<tr>
<td>Forestry 3,             Forest Planting 3½</td>
</tr>
<tr>
<td>Forestry 18,            Seminar R</td>
</tr>
</tbody>
</table>

* Class of 1916 Camp will be taken at the close of their Sophomore year, and for the class of 1915 at the close of their Junior year.

* Class of 1916 will take the Summer Camp during the summer of 1914.
DIVISION OF AGRICULTURE

Horticulture 47, Economic Science 23, Zoology 16, Military 4, or Physical Training 404,

Care of Street and Park Trees 1% Forest Economics 3 General Zoology 4% R

Total semester hours 20%5

Junior Year

Required
Semester Hours

FIFTH SEMESTER

Forestry 11, Forestry 18,
Civil Engineering 557,
Soils 1,
Zoology 4,
Choice
Botany 24, and
Horticulture 4,
Bacteriology 1,
History 24,
Agricultural Journalism 8,
Forestry Protection Seminar 1 R
Surveying Soil Physics 4
General Entomology 3% Plant Embryogeny 1% Plant Breeding 2% or 4
General Bacteriology 4
History of Public Domain 2
Agricultural Journalism 2

Total semester hours 20% or 20%5

SIXTH SEMESTER

Civil Engineering 658, Surveying 4
Civil Engineering 659, Timber Testing 13%
Botany 64, Range Forage Plants and Ecology 1%5
Botany 70, Systematic Phanerogams 2%5
Soils 2, Soil Fertility 4
Zoology 36, Forest Entomology 2%5
Agricultural Journalism 9, Advanced Journalism 2
Forestry 9, Forest Regulation and Working Plans 2
Forestry 19, Seminar R

Total semester hours 20%5

Senior Year

SEVENTH SEMESTER

Forestry 10, Forest Valuation 2
Forestry 12, Forest Administration 2

* Class of 1914 will take Forestry 12, Public Speaking 11, History 24, Botany 65 and English 12 this semester in place of Civil Engineering 658, Civil Engineering 659, Botany 70, Botany 64 and Soils 2.
Forestry 19, Seminar R
Forestry 25, Wood Technology 2 3/4
Horticulture 8, Landscape Gardening 2
English 12, Argumentation 2
Geology 10, General Geology 4
Botany 65, Forest Mycology and Pathology 2 3/4
Soils 13, Soil Surveying and Mapping 1 3/4
Public Speaking 10, Extempore Speech 2

Total semester hours 20 3/4

EIGHTH SEMESTER

The Forestry Course consists of seven semesters and a three months' Summer Camp, which is equivalent to a total of eight semesters of College work. This makes it possible for the students of this course to receive their degrees on January first, instead of the following June.

COURSES IN FORESTRY

1. **Farm Forestry.** Parts of the tree; functions of the parts; the requirements of trees for light, heat, and moisture; their relation to each other in the forest; a study of the more important commercial species. Influence of forests in the modification of climatic conditions with special reference to the effect of wind breaks, shelter-belts, and farm woodlots in Iowa. The species best suited for planting, kind of stock to plant, cost of planting and care of plantations; seasoning and preservative treatment of farm timbers. This course is designed to treat such problems as are of special interest to the Iowa farmers. Text, Principles of American Forestry, by Samuel B. Green.
   1, 2, 6 or 8S. Recitations 2; credit 2.

2. **Silviculture.** The establishment, development and care of forests, including the effect of light, heat, moisture, and soil on trees and stands; the effect of the forest on soil, humidity, precipitation, wind, soil erosion, etc.; the determination of permanent and temporary forest types, location of principal types by regions, classifying and naming forest types; treatment of types by the silvicultural systems of management; natural reproduction of the forest; pure versus mixed stands; advantages and disadvantages of each. Text, Grave's Principles of Handling Woodlands. Lectures, assigned readings, and field work.
   Summer Camp; Prerequisite 1; credit 6.

3. **Forest Planting.** Methods of collecting and storing tree seeds of different species. Costs by species. Regions of collecting; construction of modern seed extracting plants. Testing the vitality of seeds both in laboratory and field. Broadcast and seed spot methods of reforestation; planting of nursery stock. General considerations in the establishment

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* Class of 1914 will take Forestry 11, Forestry 17, Botany 24 and Horticulture 4 or Bacteriology 1, and Agricultural Journalism 8 this semester in place of Forestry 12, English 12, Botany 65, and Public Speaking 10. Class of 1915 will take Forestry 17 in their seventh semester.
of a nursery for the production of forest trees. A nursery maintained by the Department makes possible actual practice in the preparation of seed beds, methods of sowing, protection of seedlings, transplanting, -heeling-in, watering, mulching and field-planting. In addition actual construction of bird and rodent proof screens will be done by the students. Preparation of plans for nurseries; planting plans. Practical field operations form an important part of this course.

4, 6, or 8S. Prerequisite 20; recitations 2, lab. 2, 2 hr.; credit 3¼.

21. Lumbering. History of lumbering in the United States. Work preliminary to logging; labor used; the construction of camps; methods of transporting logs by land and water. The cost of the various operations of felling, swamping, skidding, driving, hauling, booming, etc. The development of the manufacture of lumber in the United States. The equipment, output, cost and efficiency of the various types of saw mills from the small capacity portable circular saw mill to the modern double band and gang saw mills. The costs of manufacturing and finishing lumber. The grading, selling, shipping, and marketing of lumber products. During the course typical operations in the various forest regions of the United States will be discussed in detail, giving special emphasis to a comparison of the costs of lumbering and manufacturing.

This course will be given in the summer camp in the woods, where, in addition to the lecture and reference work, the students will make an intensive study of a large logging and milling operation in the field. This will consist in the preparation of logging maps, the establishment of roads, the determination of costs for all logging and milling operations. The field work forms an important part of this course. Lectures, reference readings and field work.

Summer Camp; credit 5.

22. Forest Mensuration. Different units used in marketing forest products in this country; the use and construction of log rules and standards, a comparison of the more important rules with their advantages and disadvantages; methods of scaling used in various parts of the country both by lumber companies and on the National Forests. The principles underlying the determination of the contents of logs and trees. Methods of measuring board feet, cubic feet, cordwood, ties, fence posts, etc., on sample plots. The theory and practice of hyspmeters, dendrometers, and other instruments of common use in forest work in this country. The use and construction of form factor tables and their application in this country. The construction of height and diameter tables by graphic interpolation. The construction and use of volume tables; systems of estimating timber used on National Forests and by private lumber companies. Application of European methods of estimating timber to conditions in this country. The advantages and disadvantages of the various methods. The age of trees and forests; methods of determining the rate of growth of trees and stands in diameter, height, and volume. Stump and tree analyses The construction of yield and stand tables and their use in this country. Principles involved in working
plans. The field work will comprise a major portion of the work. Text, Grave's Forest Mensuration. Lecture, text, reference and field work.

Summer Camp; credit 5.

23. Forest Utilization. The utilization of products of the forest (aside from lumber). Including the use of the commercial timbers in the arts; the minor forest industries such as paper pulp manufacture, the destructive distillation of woods for the production of wood alcohol, and charcoal; production of tannin, turpentine, veneer, excelsior, cooperage stock, wagon and buggy stock, lath, shingles, boxes, railroad ties, poles, and posts. This course is given in connection with the summer camp. So far as possible, in addition to the lectures and assigned readings, the students will make detailed studies of the various types of plants while in actual operation.

Summer Camp; credit 2.

9. Forest Management. Management of government, state and private forests. The relation of the various branches of forestry to forest management. The regulation of the forest for the production of a sustained annual or periodic yield. American and European methods of regulation with the adaptation of the latter methods to conditions found in the United States. Forest working plans for National Forests and a comparison with European plans. Methods of forest management adopted in various parts of the country, especially on National Forests.

68. Prerequisites 3 and 22; recitations 2; credit 2.

10. Forest Valuation and Finance. The principles underlying the determination of the value of forest lands, with mature timber, young timber or no timber. The cost of growing timber including compound interest on the investment represented. The cost, sale, rental, and expectation value of timber and timber lands. The assessment of damages to forest property, especially those resulting from fire.

78. Prerequisite 9; recitations 2; credit 2.

11. Forest Protection. Injuries to the forest by fire, trespass, wind, erosion, frost, etc. The establishment of fire lines, look-out stations and patrol routes. Restrictions for railroads crossing National Forests. Care of camp fires. Penalties for violation of laws. Grazing restrictions with regard to goats, sheep, cattle, and horses on National Forests. (Destructive insects and fungi will be considered respectively in courses in Forest Entomology and Forest Mycology and Pathology).

5 or 78. Recitation 1; credit 1.

12. Forest Administration. The history of the forestry movement in this country. The development of the federal forest policy and conditions which led up to the creation and administration of the National Forests. The management of National and State Forests with particular reference to the silvicultural systems employed in reproducing and maintaining the various types of forest. The organization and work of the Forest Service, the handling of timber sales; the location of administrative sites, the policy of permanent improvements such as ranger cabins, telephones, roads, trails, ferries, bridges, etc., the listing of lands under the
Forest-Homestead Act of June 11, 1906, the allotment of the range for grazing, reforestation work, the leasing of special sites for water power projects, irrigation flumes and ditches, railroads, dams, etc., and the use of special forms.

5 or 7S. Recitations 2; credit 2.

13. Thesis. The subject chosen must be one relating to forestry which requires original, independent investigation such as the determination of the volume production of a species of timber on various classes of land. The results of the investigation must be presented in a carefully written report.

6 or 8S. Lab. 6 hrs. per week; credit 2.

15. Forest Research. An independent investigation in some line of forestry work under the direction of the instructors in forestry.

5, 6, 7 or 8S. Lab. 3, 2 hr.; credit 2.

25. Wood Technology. Economic woods of the United States; means of identification by characters such as grain, texture, color, density, odor, harness and toughness. Imperfections of timber such as frost cracks, shakes, resin pockets, loose and sound knots, etc. Causes of shrinking, checking, and warping. Methods of seasoning. The preservative treatment of timbers. In the laboratory the more important species of woods will be distinguished with the aid of the hand lens and again under the compound microscope.

7S. Recitation 1, lab. 2, 2 hr.; credit 2½; fee $2.00.

16. Camp Technique. Personal equipment for camp life, including clothing, bedding and personal accessories; camp equipment, including tents, tarps, horses, etc.; cook equipment, including stoves, cooking utensils, and dishes; food for camp and methods of preparing. Ration lists for man and horse packing trips, guns, cameras, snow shoes, riding saddles, and pack saddles; useful knots; man packing, and horse packing; practice in throwing the “diamond” and other packing hitches forms an important part of the course. Emergency equipment for sickness or accidents will be given consideration.

3, 6 or 8S. Lectures and lab. 1, 2 hr.; credit ½.

17. Forest History and Policy. History of forestry in foreign countries from the earliest times to the present. Special emphasis is laid upon conditions in Germany and France where scientific forestry has reached its highest development. The advance of forestry in the United States (other than that covered in Forestry 12). The progress of State forestry, chiefly in regard to fire laws, organization, taxation, and development. A few typical states are discussed in detail with particular reference to the above and the management of state reserves, fire protection, state forest laws, reforestation, etc. Text book, Fernow’s “History of Forestry.”

3, 6 or 8S. Recitations 2; credit 2.

18. Forestry Seminar. The Forestry Seminar will meet once in two weeks while the College is in session, and have for its members the instructors in Forestry and all students in the Junior class in the course
in Forestry. The work will consist in the preparation, presentation, and
discussion of papers on Forestry topics. All papers must be carefully
written and submitted to the professor in charge. Required of Junior
forestry students.

4 and 5S. No credit.

19. Forestry Seminar. A continuation of Course 18. Required of
all Senior forestry students.

6 and 7S. Prerequisite 18; no credit.

Note: The attention of the student is called to the following subjects which
are taught in the course in Forestry by the other Departments of the College:
Dendrology and Gymnosperms, Botany 62;
Dendrology and Angiosperms, Botany 63;
Mycology and Forest Pathology, Botany 65;
Forest Economics, Economic Science 23;
Forest Surveying, Civil Engineering 557;
Forest Surveying, Civil Engineering 558;
Timber Testing, Civil Engineering 659;
Forest Entomology, Zoology 36.

For full description of these courses see descriptive courses under the depart-
ments named (Index).

Department of Agricultural Engineering

This Department is administered in co-operation with the Division of En-
gineering.

JAY BROWNLEE DAVIDSON, PROFESSOR
MARTIN FRANCIS PAUL, COSTELLOE, ASSOCIATE PROFESSOR
ERNEST MUCHMORE MERVINE, ASSISTANT PROFESSOR
JAMES BYRON KELLEY, INSTRUCTOR
RICHARD RUBEN CLEM, INSTRUCTOR
HUGO HANS BECKMAN, INSTRUCTOR
EMILY Y. CABLE, EXTENSION LECTURER

The development of modern agricultural machinery, the increase in
the size and importance of farm structures, the improvement of land by
drainage and its reclamation by irrigation and the need of better roads,
demand that the successful farmer of today must be trained along me-
chanical and engineering lines. To give instruction in Agricultural En-
gineering subjects to general students and to those who desire to specialize
in agricultural engineering, and also to investigate problems related thereto,
is the work of the Department of Agricultural Engineering.

It is believed that the Department of Agricultural Engineering has
the most complete equipment of any similar department in existence. The
department occupies the two lower floors of Agricultural Engineering
Hall and practically all of Agricultural Engineering Annex, a fireproof
building connected with former building on the ground and first floors.

The farm machinery laboratories are located on the ground and first
floors of the Annex. Each floor has a large balcony entirely surround-
ing each room and increasing the floor by over one-half. A large assort-
ment of the best modern farm machinery is contained in these labora-
tories.
The farm machinery equipment includes samples of steam, gasoline and oil tractors, and one or more samples of almost every kind of the important lines of field and power machines used on the farm. Special apparatus for testing draft, adjustment and quality of work is used in connection with these machines, including a Kohlbush direct reading dynamometer, Stone and Polikeit recording traction dynamometers, a recording and integrating traction dynamometer designed by the Department, a special chain recording transmission dynamometer of twenty-five horse power capacity. By means of this instrument it is possible to accurately measure the power consumed by the smallest belt-driven machines as well as those requiring the full capacity of the instrument. Numerous other small instruments and parts of machines are used in this connection.

For instruction in internal combustion engines, ten modern engines are provided, nearly every one representing a different type of construction. To test these, suitable brakes, indicators, and other testing appliances are owned by the Department.

The steam engine laboratory contains a vertical boiler, a simple twenty horsepower engine and a thirty-five horsepower compound reversing engine. Steam is supplied for the engine from the college heating plant.

Two drawing rooms are provided which will accommodate twenty-five and thirty students, respectively. The cement laboratory contains bins for materials, molds, forms, an improved Fairbanks cement testing machines, and smaller apparatus. The pump laboratory contains an assortment of pumps, cylinders, tanks, and the spraying apparatus.

For teaching the courses in Agricultural Surveying the following instruments are provided: Two Gurley transits, one Bausch and Lomb transit, one Berger level, five Queen levels, five Gurley levels, three Dietzgen levels and two Bostrom and Brady levels; rods, flagstaffs, chains, hatchets, etc.

The Forge shop is equipped with thirty Buffalo and Sturdevant down draft forges and individual tool sets, together with a complete set of special tools, a press drill and grinder. The carpenter shop has benches and tool sets for thirty students and a miscellaneous tool equipment is provided in the tool room. This shop is also provided with a power cross cut and rip saw, a planer, two speed lathes, a band saw, emery grinder and grind stone.

The work of the Department is carried on in conjunction with the Agricultural Engineering Section of the Agricultural Experiment Station. An experimental staff devotes its entire time to research and is provided with a separate laboratory. This laboratory has many special instruments in the way of dynamometers, indicators, and testing machines, and also a tool equipment including a fourteen-inch engine lathe.

Commodious offices are provided for the members of the Department, in which is to be found a complete implement and farm machine catalog file, also a valuable collection of farm building plans.
COURSE IN AGRICULTURAL ENGINEERING

The work of the Department of Agricultural Engineering is principally that of giving instruction to those who intend to make the farm the object of their life work, but four years ago a four-year course was outlined for those who wish to make Agricultural Engineering a profession and special treatment of agricultural engineering subjects has been provided for. This course, in addition to being especially strong along the fundamental sciences upon which agricultural engineering depends, includes the usual cultural studies and enough agriculture to familiarize students with the modern methods of scientific agriculture and comprises a thorough treatment of agricultural engineering subjects.

POSITIONS OPEN FOR MEN TRAINED ALONG AGRICULTURAL ENGINEERING LINES

The course in Agricultural Engineering is designed to fit graduates for the following lines of work:

1. Managers and superintendents of farms, where drainage, irrigation, farm structures and the use of agricultural machinery is a large factor in the management.
2. Teachers and instructors of Agricultural Engineering in agricultural colleges.
3. Teachers of agricultural mechanics in Agricultural High Schools.
5. Positions in the farm machinery industry requiring an engineering training and a knowledge of the science of agriculture.
6. Professional work in agricultural engineering.

It is believed that the agricultural engineering course will furnish a good training for those who desire to become consulting engineers in Iowa and other agricultural states.

SPECIAL COURSE FOR ENGINEERING STUDENTS

This course is arranged to be especially strong along the fundamental sciences upon which Agricultural Engineering depends.

The degree of Bachelor of Science in Agricultural Engineering (B.S. in A.E.) is given to students who have completed a four-year course in Civil, Mechanical, or Electrical Engineering, followed by one year's prescribed work, approved by the faculty, in Agricultural Engineering and related sciences, under the rules and conditions governing work in other courses.

MEINRAD-RUMELY SCHOLARSHIP, AGRICULTURAL ENGINEERING SCHOLARSHIP AND FELLOWSHIP

The M. Rumely Company, of La Porte, Ind., "recognizing in Agricultural Engineering a profession which is developing rapidly and which must mean more and more to the American public, as its importance is fully recognized," desired to encourage the development of Agricultural
Engineering through the establishment of the Meinrad-Rumely Scholarship, rendering assistance to men who have voluntarily chosen Agricultural Engineering as a life work.

This scholarship requires the holder to carry on a line of research or investigation along Agricultural Engineering lines which will require the equivalent time of ten credit hours of college work. This work may count for five hours of thesis credit in the Agricultural Engineering course. The holder of this scholarship is selected by the Dean of Agriculture and the Professor of Agricultural Engineering. It will be granted to a graduate student. No student is eligible for more than one year. The Meinrad-Rumely Scholarship extends for a period of three years and has a value of $250.00 annually.

I. H. C. FELLOWSHIP

In like manner the International Harvester Company of Chicago, Illinois, established the I. H. C. Fellowship, which extends over a period of two years and has a value of $250.00 annually. The selection of the I. H. C. Fellowship student is also made in similar manner.

PROFESSIONAL DEGREE

PROFESSIONAL DEGREE OF AGRICULTURAL ENGINEER

The degree of Agricultural Engineer is conferred in a manner similar to other professional degrees in engineering. The candidate must be recommended, however, by the faculties of both the Agricultural and Engineering Divisions.

COURSE IN AGRICULTURAL ENGINEERING

*Freshman Year

FIRST SEMESTER

<table>
<thead>
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<th>Course</th>
<th>Required Hours</th>
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<tbody>
<tr>
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<tr>
<td>Agricultural Engineering 25,</td>
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</tr>
<tr>
<td>Animal Husbandry 1,</td>
<td></td>
</tr>
<tr>
<td>English 11,</td>
<td></td>
</tr>
<tr>
<td>Farm Crops 1,</td>
<td></td>
</tr>
<tr>
<td>History 17,</td>
<td></td>
</tr>
<tr>
<td>Horticulture 3,</td>
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<tr>
<td>Mathematics 120,</td>
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<tr>
<td>Mathematics 121,</td>
<td></td>
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<tr>
<td>Mechanical Engineering 181,</td>
<td></td>
</tr>
</tbody>
</table>

*Freshmen who show deficient preparation in Mathematics may be assigned by the Dean of the Junior College and the Dean of Agriculture, to a special class, with one hour more work than indicated above, and in case of clear indication of failure even with this arrangement they will be dropped from the Freshman work until they have given proof of sufficient preparation to enable them to carry the work successfully.
### Military 1, Physical Training 101

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military Drill</td>
<td>R</td>
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<tr>
<td>Gymnasiun</td>
<td>R</td>
</tr>
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</table>

**Total semester hours: 18½**

### Second Semester

#### Required Semester Hours

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Agricultural Engineering 1 or 2</td>
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<tr>
<td>Agricultural Engineering 26</td>
<td>R</td>
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<td>Animal Husbandry 2</td>
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<tr>
<td>Dairying 12</td>
<td>2½</td>
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<tr>
<td>English 10</td>
<td>3</td>
</tr>
<tr>
<td>Farm Crops 2</td>
<td>2½</td>
</tr>
<tr>
<td>Mathematics 222</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 223</td>
<td>2½</td>
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<tr>
<td>Mechanical Engineering 220</td>
<td>2</td>
</tr>
<tr>
<td>Military 2</td>
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<td>Physical Training 202</td>
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**Total semester hours: 18½**

### Sophomore Year

#### Third Semester

<table>
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<tbody>
<tr>
<td>Agricultural Engineering 16, Chemistry 21</td>
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</tr>
<tr>
<td>Mathematics 324</td>
<td>4½</td>
</tr>
<tr>
<td>Mathematics 325</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering 322</td>
<td>3</td>
</tr>
<tr>
<td>Physics 303</td>
<td>1</td>
</tr>
<tr>
<td>Military or Physical Training 303</td>
<td>R</td>
</tr>
</tbody>
</table>

**Total semester hours: 18½**

### Fourth Semester

#### Required Semester Hours

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 17, Chemistry 23</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 426</td>
<td>4½</td>
</tr>
<tr>
<td>Mechanical Engineering 401</td>
<td>5</td>
</tr>
<tr>
<td>Physics 404</td>
<td>3</td>
</tr>
<tr>
<td>Military or Physical Training 404</td>
<td>R</td>
</tr>
</tbody>
</table>

**Total semester hours: 19½**
### Junior Year

#### Fifth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 3,</td>
<td></td>
</tr>
</tbody>
</table>
* Agricultural Engineering 14, Seminar                                  | R                       |
| Agricultural Engineering 18,                                         |                          |
| Agricultural Engineering 19,                                         |                          |
| Horticulture 8,                                                      |                          |
| Civil Engineering 564,                                               |                          |
| Mechanical Engineering 502,                                          |                          |
| Mechanical Engineering 512,                                          |                          |
| Soils 1,                                                             |                          |
| Farm Blacksmithing and Horseshoeing 1½                                |                          |
| Farm Motors                                                          | 2                       |
| Rural Sanitation, Heating, Lighting and Ventilating                  | 1                       |
| Landscape Gardening                                                  | 2                       |
| Surveying                                                            | 3                       |
| Analytical Mechanics                                                 | 5                       |
| Engineering Laboratory                                               | 1                       |
| Soil Physics                                                         | 4                       |
| **Total semester hours**                                            | **19½**                 |

#### Sixth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
</table>
* Agricultural Engineering 14, Seminar                                  | 1                       |
| Agricultural Engineering 24,                                          | 3                       |
| Civil Engineering 653,                                               | 2                       |
| Civil Engineering 686,                                               | 3                       |
| Mechanical Engineering 606,                                          | 5                       |
| Mechanical Engineering 613,                                          | 1                       |
| Soils 2,                                                             | 4                       |
| **Total semester hours**                                            | **19**                  |

#### Senior Year

#### Seventh Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 10,</td>
<td>2</td>
</tr>
</tbody>
</table>
* Agricultural Engineering 15, Seminar                                  | R                       |
| Agricultural Engineering 27,                                          | 3                       |
| Animal Husbandry 20,                                                 | 2                       |
| Civil Engineering 712,                                               | 2                       |
| Farm Crops 8,                                                        | 3                       |
| English 12,                                                           | 2                       |
| Economic Science 9,                                                  | 3                       |
| Mechanical Engineering 714,                                          | 1                       |
| **Total semester hours**                                            | **18**                  |

* This course must be carried through the year, and final standing will not be certified to the recorder until the close of the sixth semester.
* See note in fifth semester.
* This course must be carried through the year, and final statements will not be certified to the recorder until the close of the eighth semester.
### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 11, Thesis</td>
<td>3</td>
</tr>
<tr>
<td>Agricultural Engineering 15, Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Agricultural Engineering 28, Irrigation</td>
<td>2</td>
</tr>
<tr>
<td>History 18, Political Parties and Party Leaders</td>
<td>1</td>
</tr>
<tr>
<td>Horticulture 31, Landscape Lab.</td>
<td>2/3</td>
</tr>
<tr>
<td>Mechanical Engineering 533, Shop Work</td>
<td>2</td>
</tr>
<tr>
<td>Electives will be selected with the approval of the Dean and the head of the department</td>
<td>6/3</td>
</tr>
</tbody>
</table>

Total semester hours: 16 to 20

### COURSES IN AGRICULTURAL ENGINEERING

#### FARM MACHINERY

5. **Farm Machinery and Farm Motors.** Mechanics and materials; the measurement and transmission of power; development, construction, functions and methods of operating, adjusting and repairing farm machinery and farm motors; also the principles of draft and the production of power. Laboratory work is devoted to the study of construction, operation, adjustment and testing the machines discussed in the class room.

4, 6 or 8S. Prerequisite Physics 205; recitations 2, lab. 1, 2 hr.; credit 2%; fee $3.00.

16. **Farm Machinery.** Elements of machines, the measurement and transmission of power, the development, use, adjustment, construction and repair of farm machinery.

3, 6 or 7S. Prerequisite 1 and 2; recitations 2, lab. 2, 2 hr.; credit 3%; fee $2.00.

22. **Horticultural Machinery.** Mechanics and machinery planned especially for horticultural students. Includes orchard machinery, farm motors, spraying apparatus and cold storage building construction.

4, 6 or 8S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

#### FARM POWER

13. **Gas and Oil Engines.** A comprehensive course in the practical operation and management of the internal combustion engine. The course includes a study of the development, the existing types, the theory and practice of operation, the adjustment, the repair, and the utility of gas, gasoline, oil, and alcohol engines. The laboratory work will consist of well arranged tests and exercises to familiarize the student with the practical care and management of this type of motor.

5, 6, 7 or 8S. Recitation 1, lab. 1, 2 hr.; credit 2; fee $2.50.
17. **Farm Motors.** The production of power for agricultural purposes. The horse as a motor, tread and sweep powers, steam, gas, gasoline, oil, air, engines, and tractors, windmills, electric power, as far as applicable to agricultural purposes.

4, 6 or 8S. Recitation 1, lab. 3 hr.; credit 2; fee $2.50.

18. **Farm Motors.** Continuation of 17.

5 or 7S. Prerequisite 17; recitation 1, lab. 3 hr.; credit 2; fee $2.50. (See A. E. 5.)

**DRAINAGE**

27. **Drainage Engineering.** The drainage of agricultural lands by means of tile drains and open ditches. Drainage districts. The reclamation of large areas by drainage works. Flood control and the protection of overflowed lands by levees and river improvement. Pumping for drainage. Storage. Analysis of hydrographic data. Grade, cross-section, and capacity of canals for drainage and irrigation. Laboratory work consists of surveys for and design of drainage systems for farm units. Investigations of the operation of drainage systems of tile drains and open ditches. The design of structures pertaining to works of drainage and irrigation.

5 or 7S. Prerequisite M. E. 606, C. E. 345; recitations 2, lab. 3 hr.; credit 3; fee $2.00. (See A. E. 4.)

**IRRIGATION**

28. **Irrigation.** The development of agriculture through drainage and irrigation. History of irrigation development. Irrigation law and practice, and methods. Water rights. Water requirements of crops; correlation of drainage and irrigation; influences of drainage and irrigation on the efficiency of natural and artificial water supplies; duty of water; seepage, return flow and underflow of rivers; economic importance of storage for irrigation water; supplemental water supplies; irrigation methods in the arid, humid, and sub-humid regions. Pumping for irrigation. Special emphasis is placed upon the improvements in irrigation practice which have resulted in a higher duty of irrigation water.

It is the intention of the course to present to the student the problems of irrigation which are of common interest to engineer, the expert agriculturist or horticulturist.

6 or 8S. Prerequisite 4; or 27 and Soils 1; recitations 2; credit 2. (See A. E. 4.)

(See A. E. 4).

Also Civil Engineering.

**PUBLIC ROADS**

(See A. E. 4).

**FARM STRUCTURES**

6. **Farm Structures.** Planning of all farm buildings, a study of their construction, lighting, ventilation, cost, convenience, also a study of the strength, durability, and cost of building materials, and making of plans and specifications. Elective to all junior and senior agricultural students.

6 or 8S. Prerequisite 4; recitation 1, lab. 6 hr.; credit 3.
24. **Farm Structures.** Similar to Course A. E. 6, but arranged for agricultural engineering students who have completed the freshman and sophomore years.

6S. Recitation 1, lab. 6; credit 3.


5 or 7S. Recitations 1; credit 1.

See Civil Engineering.

**GENERAL COURSES**

1. **Shop Work.** Blacksmithing, forging and welding of iron and steel, and making and tempering hand-tools. Work designed to be especially helpful in the repair and operation of machinery.

1, 2, 5, 6, 7 or 8S. Lab. 2, 2 hr; credit 1½; fee $2.50.

2. **Shop Work.** Carpentry, care, use and sharpening of tools, laying off work, making of joints and framing. Work designed to be especially helpful in planning, framing, and construction of farm buildings.

1, 2, 5, 6, 7 or 8S. Lab. 2, 2 hr; credit 1½; fee $2.50.

3. **Farm Blacksmithing and Horse Shoeing.** An advanced course in blacksmithing. Includes the repair of castings, brazing, plow work and horse-shoeing.

5 or 7S. Lab. 4; credit 1½; fee $2.50.

4. **Agricultural Surveying.** Includes instruction in the principles of land surveying, also a study of location of drainage districts, drainage laws, the best systems of drainage; irrigation methods and practice; location and construction of roads; the building of fences and concrete construction in farm work; also drawing, including lettering, map making, planning of drainage systems and road profiles; and field work, including the care, adjustment and practice in the use of surveying instruments.

3, 5 or 7S. Prerequisite Math. 17; recitations 2, lab. 4 hr.; credit 3½; fee $1.00.

9. **Research Work in Agricultural Engineering.** Subjects for research work pertain to Drainage, Farm Water Supply, Sewerage, Road Construction, Farm Structures, Fences, Use of Cement on the Farm, Testing and Calibrating Various Farm Machines and Traction Tests.

6 or 8S. Prerequisite 4 and 5 or 16 and 17; lab. 3, 2 hr; credit 2; fee $2.00.


5 or 7S. Prerequisites 4 and 5; lab. 3, 2 hr.; credit 2; fee $2.00.

11. **Thesis.** Must be upon some subject requiring original work taken in Agricultural Engineering.

8S. 9 hrs. work per week; credit 3.

12. **Thesis.** Same as Agricultural Engineering 11.

8S. 15 hrs. work per week; credit 5.

14. **Agricultural Engineering Seminar.**

5 and 6S. Recitation 1, each two weeks; credit 1.

15. **Agricultural Engineering Seminar.**

7 and 8S. Recitation 1, each two weeks; credit 1.
The Agricultural Engineering Seminar (Courses 14 and 15) meets once each two weeks while College is in session and has for its members the professors and instructors in Agricultural Engineering and all students in the Junior and Senior classes in the course of Agricultural Engineering. This consists in the preparation, presentation and discussion of papers on Agricultural Engineering subjects. All papers must be carefully written and submitted to the professor in charge. The schedule of subjects is made up one semester in advance.

21. **Cement Construction.** The use of cement in farm building construction. Cement testing study mixtures, construction of forms, reinforcements. Also other building materials.
   6 or 8S. 1, 2 hr. recitation and lab. period; credit 1; fee $2.00.

23. **Dairy Engineering.** Instruction in the management, care and operation of steam and gasoline engines and refrigeration machinery. Laboratory work besides, practice and testing of boilers, engines and accessories, includes plumbing, soldering, etc.
   6S. Recitations 2, lab. 2, 2 hr.; credit 3½; fee $2.50.

25. **Technical Lectures.** General agricultural engineering subjects. Also instruction in connection with the shop and other courses required. Includes the instruction given by the college librarian in the use of the catalogue system and reference books.
   1S. Lecture 1 hr. per week; required.

26. **Technical Lectures.** Course 25 continued.

28. Lecture 1 hr. per week; required.

29. **The Graphic Method.** A study of agricultural statistics and experimental data including the analysis, tabulation, plotting and the charting of the same.
   1 or 2S. Prerequisite Math. 17; lecture and lab. 2 hr; credit ½.

30. **Manual Training.** (Women). A course in the principles of carpentry, also the care, use and adjustment of wood working tools. Household carpentry and wood finishing.
   5 or 7S. Lab. 2, 2 hr; credit 1½; fee $2.50.

**Department of Agricultural Education**

G. M. WILSON, PROFESSOR

E. C. BISHOP, EXTENSION WORKER

R. K. FARRAR, EXTENSION WORKER

The field of agriculture presents such rapid changes, and there is such wide and varied demand for young men combining agricultural and educational training, that it has been deemed advisable to offer such combination in the courses outlined below.

The course in Agricultural Education is designed to meet the requirements of high schools and other institutions, public and private, requiring teachers in the general sciences and agriculture. There is a large demand
for strong, broadly educated, well trained teachers for this and other kinds of agricultural instruction in public and preparatory schools.

A new phase of agricultural education has developed in recent years in the various forms of agricultural extension work. This movement is destined to be far-reaching in its results, and it is clearly one of the most potent influences in the field of agriculture. This phase of agricultural instruction, which is bringing science to the aid of man in the field and on the farm, the children in the public school, the family in the home, is calling for well trained men far in excess of the supply.

Plans are now well under way for further increasing the staff of the department by adding critic teachers in Agriculture and Home Economics. These teachers will work through the Normal Training Department of the Ames High School. This will make possible work in observation and practice, open to students majoring in the department. Such work is now recognized as necessary in any course attempting to provide thorough teachers' training.

### COURSE IN AGRICULTURAL EDUCATION

***Freshman Year**

<table>
<thead>
<tr>
<th>FIRST SEMESTER</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Semester Hours</td>
</tr>
<tr>
<td>Botany 60,</td>
<td>Botany of Weeds</td>
</tr>
<tr>
<td>Agricultural Chemistry 21,</td>
<td>General Chemistry</td>
</tr>
<tr>
<td>Farm Crops 1,</td>
<td>Corn Growing and Judging</td>
</tr>
<tr>
<td>Mathematics 17,</td>
<td>Algebra and Trigonometry</td>
</tr>
<tr>
<td>Electives</td>
<td>Market Types of Cattle and Sheep</td>
</tr>
<tr>
<td>Animal Husbandry 1,</td>
<td>Sewing</td>
</tr>
<tr>
<td>*Home Economics 1,</td>
<td>Gymnasium</td>
</tr>
<tr>
<td>Military 1, Physical Training 101, (For Men)</td>
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</tr>
<tr>
<td>Physical Culture 1, (For Women)</td>
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</table>

Total semester hours: 16½ or 17

### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester Hours</td>
</tr>
<tr>
<td>Agricultural Chemistry 23,</td>
</tr>
<tr>
<td>Farm Crops 2,</td>
</tr>
<tr>
<td>Physics 205,</td>
</tr>
<tr>
<td>Public Speaking 2,</td>
</tr>
</tbody>
</table>

*Freshmen who show deficient preparation in Mathematics may be assigned by the Dean of the Junior College and the Dean of Agriculture, to a special class, with one hour more work than indicated above, and in case of clear indication of failure even with this arrangement they will be dropped from the Freshman work until they have given proof of sufficient preparation to enable them to carry the work successfully.
Zoology 16, Animal Husbandry 2, or *Home Economics 4, or Military 2, Physical Training 202, (For Men) Physical Culture 2, (For Women)

Total semester hours 17½ or 17¾

Sophomore Year

THIRD SEMESTER

Required Semester Hours

Agricultural Chemistry 25, Organic Chemistry 3½
English 11, Exposition 3
Horticulture 3, Orcharding 2½ or 2½
or Food Preparation 2½
Home Economics 43, Extempore Speech 2
Public Speaking 10, 
Zoology 4, Entomology 3½
Animal Husbandry 3, Breed Types of Cattle and Sheep 3½ or 3½
or Dress Making 2½
*Home Economics 6, 1 3½
and Elective
Military 3, or Physical Training 303, or Gymnasium R
Physical Culture 3,

Total semester hours 17½ or 18

FOURTH SEMESTER

Required Semester Hours

Agricultural Chemistry 26, Agricultural Analysis 3½
Botany 68, Vegetable Physiology 3½
Economic Science 14, Outlines of Economics 2
English 10, Narration and Description 3
Animal Husbandry 4, Breed Types of Dairy Cattle, 
or Horses and Swine 3½ or 3½
*Home Economics 7, Dress Making 2½
and Electives
Plant Propagation 2½
Horticulture 2, or Food Preparation 2½ or 2½ or 2½
Home Economics 44, Plant Propagation 2
Horticulture 38, Orchard Practice 1
Horticulture 39,
Electives, Military 4, or Physical Training 404 (For Men), Physical Culture 4, (For Women).

| Total semester hours | 18 or 17 3/4 or 17 1/4 |

### Junior Year

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Soils 1, Horticulture 4, Botany 24, Electives, Electives,</td>
</tr>
<tr>
<td>Soil Physics Plant Breeding Plant Embryogeny (See Note 1) (See Notes 2, 3 4, 5 and 6)</td>
</tr>
<tr>
<td>4 2 3/4 3 4 3/4 or 8 3/4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total semester hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 or 20</td>
</tr>
</tbody>
</table>

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany 26, Economic Science 24, English 12, Soils 2, Electives, Electives,</td>
</tr>
<tr>
<td>Ecology Rural Sociology Argumentation Soil Fertility (See Note 1) (See Notes 2, 3, 4, 5 and 6)</td>
</tr>
<tr>
<td>1 3 2 4 3 2 3/4 or 6 1/2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total semester hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 or 20</td>
</tr>
</tbody>
</table>

### Senior Year

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Crops 3, Literature 4, Electives, Electives,</td>
</tr>
<tr>
<td>Corn and Small Grain Judging American Literature (See Note 1) (See Notes 2, 3, 4, 5 and 6)</td>
</tr>
<tr>
<td>2 3 3 8 or 12</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total semester hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 or 20</td>
</tr>
</tbody>
</table>

**EIGHTH SEMESTER**

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Crops 4, or Horticulture 11, Corn and Small Grain Breeding</td>
</tr>
<tr>
<td>Corn and Small Grain Judging 1 3/4 1 1/2 or 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>
Note 1. The student must elect during his course subject to the approval of the head of the department, not fewer than twelve hours from the courses in Agricultural Education.

Note 2. To procure upon graduation a state teacher's certificate without examination, the student must elect from the Department of Psychology and Agricultural Education, not fewer than twenty hours (including those under Note 1) of such work as will meet the requirements of the State Board of Educational Examiners, these electives to be approved by the head of this department.

Note 3. The student, with the approval of the Dean of Agriculture and the head of this department, will select from the electives on pages 144-146 enough work to make a total of from 16 to 20 hours.

Note 4. Those courses starred (*) are electives for women students.

Note 5. Students taking Home Economics electives will select with the approval of the heads of the Departments of Home Economics and Agricultural Education, from the courses in Home Economics and the prerequisites thereto, enough work to make a total of 16 to 20 hours each semester, which electives must finally include Home Economics 9, 10, 27, 30, 41, 42, 43, 44, and 47.

Note 6. Students electing the Home Economics studies are allowed to substitute Chemistry 22, 24, 58 and 59, for Chemistry 21, 23, 25 and 26, as prerequisites for certain work in Home Economics.

Note 7. Students intending to teach the following year will be permitted to arrange an elective in Education during the Freshman or Sophomore year, with the consent of the Head of the Department.

COURSES IN AGRICULTURAL EDUCATION.

5 or 7S. Recitations 3; credit 3.

2. General Principles of Teaching.
6 or 8S. Prerequisite 1; recitations 3; credit 3.

5 or 7S. Recitations 2; credit 2.

4. Principles of Secondary Education.
6 or 8S. Prerequisite 3; recitations 2; credit 2.

5. Educational History. The history of education with reference
to its bearing upon the solution of present educational problems, espe-
cially scientific and vocational problems.

5 or 7S. Recitations 2; credit 2.

6 or 8S. Prerequisite 5; recitations 2; credit 2.

9. School Administration. The application of modern educational
methods to the solution of the problems of the school administrator, with
especial reference to the work of the principal, the superintendent, and
the fiscal agent of the board of education.
5 or 7S. Prerequisites 1 and 2; recitations 2; credit 2.

10. School Administration.
6 or 8S. Prerequisite 9; recitations 2; credit 2.

11. Methods and Practice Teaching. The organization of the
course of study with particular reference to the major subject of the
student; lesson plans; observation; practice teaching. For Home Econ-
omics students this course is identical with Home Economics 9. For
other students the work will be arranged separately, except for one hour
recitation per week. Credit entered as, One hour, Principles of Educa-
tion; Two hours, General Methods.
7S. Prerequisites 1 and 2; recitations 2, lab. 1, 3 hr.; credit 3.

12. Methods and Practice Teaching. A continuation of Agricul-
tural Education 7. For Home Economics students this course is identical
with Home Economics 10. Credit entered as, One hour, Principles of
Education; Two hours, Special Methods.
8S. Prerequisite 7; recitations 2, lab. 1, 3 hr.; credit 3.

Department of Agricultural Journalism

FREDERICK WILLIAM BECKMAN, PROFESSOR
SAMUEL, EUGENE CONYBEARE, ASSISTANT

Two main purposes govern the work in the department of agricultural
journalism:

First, to teach students how to write for the press so they may
multiply their usefulness many fold by contributing agricultural informa-
tion to farm journals, newspapers and magazines and thus make their
special training count more for rural progress.
Second, to teach students who want to go into agricultural journalism
some knowledge of its technical side and give them practical training in
its rudiments through the actual writing, editing, and publishing of the
Iowa Agriculturist, a monthly student magazine of recognized high char-
acter and wise circulation in Iowa.

Beginning with the fall semester, 1913, the department will give in-
struction to students in engineering as well as in agriculture. The foun-
dation course, beginning journalism, is now suited to engineering students
as their beginning course. In the second semester provision is made for a
course especially adapted to the needs of engineering students who desire
to learn to write for the press upon engineering and industrial subjects.

In addition, the department gives practical instruction to the staff of
the general student newspaper, The Student, published twice a week, so
that its members may get the best possible training from their work.

The department was established in 1905, and has since been main-
tained, through the generous aid of Mr. John Clay of Chicago, a good
friend of agricultural education and himself an able writer on agricul-
ture. Mr. Clay and others believed that agriculture needs "practical men
who have polished pens," as he expressed it, and that "the Book will help
more than the Plow in the development of the new agriculture."

This department was the first of its kind. Its announcement in 1905
was received with no little question, both by educators and journalists.
The former doubted its educational value; the latter felt that journalism
could be learned only by actual experience in an editorial office. Now
the department stands justified in the opinion of both. Educators recog-
nize that its instruction increases efficiency in the use of English and one
agricultural college after another has established similar work. Journal-
ists now admit that a college may teach some of the fundamentals of
writing for the press and every year agricultural publications come to this
department seeking young men for responsible positions.

The steady growth of the department has justified its founding. Its
work was first enlarged in 1911 to give instruction to the young women
of the home economics department. The year following, a course in agri-
cultural advertising was added in response to urgent demand. In that
year, also, arrangement was made to give college credit to those editors
of The Student who did satisfactory work under the department's super-
vision. In the year 1913-14, two even more important changes become
effective, first, in the increase of the credit hours from one to two hours
per week, and second, in providing instruction for students in engineering
as well as agriculture.

COURSES IN AGRICULTURAL JOURNALISM

8. Beginning Journalism. The fundamentals of journalistic writ-
ing, what editors require of contributors and how to meet those re-
quirements. Lectures on the essential principles of news writing, with
news writing and criticism.

Prerequisite English 12; recitations 2; credit 2.

9. Agricultural Journalism Practice. Especial emphasis on prac-
tice. Assignments given as by an editor. Students gather information
and write it, getting helpful criticism and then rewriting if necessary.
Lectures and individual instruction are combined. Besides increasing
readiness in writing, the course aims to develop originality and individ-
uality. The better articles written are published in The Iowa Agricul-
turist or submitted to agricultural journals.

Prerequisite 8; recitations 2; credit 2.
10. **Engineering Journalism Practice.** Adapted to the needs of engineering students. Otherwise similar in scope to Course 9.  
   5 or 7S. Prerequisite 8; recitations 2; credit 2.

11. **Beginning Journalism for Women.** Similar to Course 8, except that it teaches writing for women's and other journals upon subjects in which women are especially interested.  
   6 or 8S. Prerequisite Eng. 12; recitations 2; credit 2.

12. **Journalism Practice for Women.** Similar to Course 9, but designed to meet the especial requirements of women students.  
   7S. Prerequisite 11; recitations 2; credit 2.

5. **Newspaper Management.** Actual making of a monthly agricultural journal, *The Iowa Agriculturist*, a successful student publication of high merit editorially and typographically. The editor and manager are elected each year by the agricultural club but the staff includes, as far as possible, the students who wish to take this course. This staff meets once each week with the instructor to plan issues of *The Iowa Agriculturist* and to deal with the practical problems of its publication. At these meetings there are informal discussions on such subjects as: Newspaper organization, newspaper policies, planning the agricultural journal issues, ethics of journalism, editing manuscript, newspaper typography, illustration, proof reading, makeup, printing and printing machinery, editorial writing, advertising and circulation management, and others that arise from time to time.  
   7S. Prerequisite 9 or 12; recitation 1; credit 1.

6. **Newspaper Management.** A continuation of Course 5.  
   8S. Prerequisite 5; recitation 1; credit 1.

7. **Agricultural Advertising.** Fundamental principles of advertising, especially as applied to the selling of agricultural products. By lectures the principles of advertising are developed and by the planning and writing of advertising copy these principles are put into practice. Class work is illustrated with examples of advertising, both good and bad, thrown upon a screen. Each student at the beginning of the course establishes a hypothetical business for himself for which he plans and writes his advertising.  
   8S. Recitation 1; credit 1.

**Course in Photography**

**F. E. COLBURN**

1. **Practical Photography.** Scientific and practical work in photography along lines of agricultural and engineering journalism. Selection and use of lenses, cameras, and other photographic apparatus. Photographing a wide range of subjects under various conditions; developing and finishing photographs of high quality, and properly manipulating the different brands of commercial materials which are used in such processes. Photographic optics, cameras and accessories, negative develop-
ment and manipulation, flashlights, enlargements, copying, lantern slides, general printing methods. Preparation of half-tone, zinc and color plates.

Special attention to live stock, other agricultural subjects, machinery, scientific apparatus, exteriors and interiors of buildings both for agricultural and engineering students.

Individual cameras are to be furnished by the students and will be subject to the approval of the Instructor.

6 or 8S. Prerequisite Physics 511; recitation 1, lab. 1, 2 hr.; credit 1½
deposit $8.00.

Department of Home Economics

CATHERINE J. MACKAY, PROFESSOR
GRACE ELFLEDA RUSSELL, ASSOCIATE PROFESSOR, DOMESTIC ART
RUTH MICHAELS, ASSISTANT PROFESSOR, DOMESTIC SCIENCE
WINIFRED SARAH GETTEMY, INSTRUCTOR
IVA L. BRANDT, INSTRUCTOR
MARIE CLIFTON ADSIT, INSTRUCTOR
MABLE ADAMS, INSTRUCTOR
NEALE S. KNOWLES, EXTENSION WORKER
(MRS.) LOUISE H. CAMPBELL, EXTENSION WORKER

The Department of Home Economics offers opportunity for scientific and practical work along the lines of Domestic Science and Domestic Art which are unexcelled in any institution in this country.

Woman stands exactly at the point where science most closely touches life. Young women entering upon college training for life responsibilities should be made keenly alive to the fact. It is the right of every young woman who is seeking an education and who expects to do her share of the world's work to have that education to fit her for her special work. It is to this end that the Department of Home Economics is working.

The educational world has and is providing well for the special types of education of men; professional, technical and commercial, which are fitting men for greater proficiency, and greater earning capacity.

It is man's place to provide for the family, woman's work to use the funds provided to secure the best in all lines of expenditure; food, clothing, home-furnishings and materials for household maintenance. It is her task to wisely administer the home with well defined economic, scientific, artistic and ethical standards.

Woman's education in the majority of schools has been limited to cultural and disciplinary subjects. Upon the completion of such courses, she has been forced to meet the vital affairs of her life with merely academic training.

That woman's truest sphere of usefulness and therefore greatest joy in living is within the realm of home and its interest, few will contradict.
That the average woman is at all times responsible for her own physical well being and nine times out of ten for the physical, moral and mental well being of others dependent upon her as wife and mother, none can deny. Does not such an evident responsibility demand a scientific knowledge of the values of the foods she purchases and prepares for those dependent upon her, those for whose growth and health she is directly responsible? Should she not be able to apply the principles of sanitation to her own house and also to her city? For the clean and unclean condition of any town reacts immediately upon the health of its households.

The course in Home Economics meets a great need, higher education for women, which will apply to the every-day affairs of life. The object of the course is first to teach the proper administration of the home, and with it, to prepare all students who desire to teach the subject of Home Economics. The positions which students graduating in the course of Home Economics are fitted to fill are those of teaching in the public schools of all grades, dietitian work in Hospitals and other institutions, institutional house-keeping, etc. The field of work is unlimited, the demand for college technical women is far greater than can be supplied. No other calling for women presents the human interest and the broad outlook that is found in Home Economics.

**THE HOME ECONOMICS BUILDING**

The new Home Economics building was erected at a cost of $75,000.00. There is but one other Home Economics building in the United States which compares with it in beauty and completeness in every detail. The building is of red compressed brick and fire proof structure. It is north of Margaret Hall and faces the north. The ultimate plan is to join the building to Margaret Hall by the addition of two wings, leaving an open court in the center.

On the ground floors are six class-rooms; a large reading room, locker rooms and the laundry. The first floor is occupied by the Domestic Art Division, three large well lighted sewing rooms and fitting rooms with provision for dyeing and pressing. The Home Nursing Demonstration room and the general and private offices are on this floor.

On the second floor are the Domestic Science rooms, three large kitchens finished in white tile, marble and enamel, accommodating twenty students each, large pantries, two dining rooms, a home kitchen, and dining room in which individual work may be done, two large rooms for the Applied Design, a rest room and reception room. Large and beautiful halls run the length of the building on each floor. The heating is both direct and indirect radiation, the entire amount of air in the building is changed every few minutes, thus providing perfect ventilation. The entire building is being furnished and equipped from the standpoint of utility, simplicity and beauty. It offers to the young woman of the state of Iowa opportunity which few states have offered their daughters. With this excellent home equipment the Department of Home Economics is unhindered in meeting the demands of years to come.
COURSE OF STUDY

Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 1</td>
<td></td>
</tr>
<tr>
<td>Home Economics 41</td>
<td></td>
</tr>
<tr>
<td>Botany 61</td>
<td></td>
</tr>
<tr>
<td>Chemistry 22</td>
<td></td>
</tr>
<tr>
<td>English 11</td>
<td></td>
</tr>
<tr>
<td>Mathematics 4</td>
<td></td>
</tr>
<tr>
<td>French 1</td>
<td></td>
</tr>
<tr>
<td>German 5</td>
<td></td>
</tr>
<tr>
<td>Physical Culture 1</td>
<td></td>
</tr>
<tr>
<td>Library 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 hrs. during semester</td>
</tr>
<tr>
<td></td>
<td>17 1/2</td>
</tr>
<tr>
<td>Total semester hours</td>
<td></td>
</tr>
<tr>
<td>Electives to be selected</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

Note A. These electives, if selected, are to be added to the required hours and cannot afterward be transferred to any other semester.

Note B. Students entering with two entrance units in German may select German 7a for the first semester and German 8 for the second semester. Where French or German are selected the first semester, they must be continued during the second semester.

SECOND SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 4</td>
<td></td>
</tr>
<tr>
<td>Botany 68</td>
<td></td>
</tr>
<tr>
<td>Chemistry 24</td>
<td></td>
</tr>
<tr>
<td>English 10</td>
<td></td>
</tr>
<tr>
<td>History 14</td>
<td></td>
</tr>
<tr>
<td>Mathematics 30</td>
<td></td>
</tr>
<tr>
<td>French 2a</td>
<td></td>
</tr>
<tr>
<td>German 6a</td>
<td></td>
</tr>
<tr>
<td>Physical Culture 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Total semester hours</td>
<td></td>
</tr>
<tr>
<td>Electives to be selected</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

These electives, if selected, are to be added to the required semester hours and cannot be afterwards transferred to any other semester.
**Sophomore Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 37,</td>
<td></td>
</tr>
<tr>
<td>Home Economics 43,</td>
<td></td>
</tr>
<tr>
<td>Home Economics 50,</td>
<td></td>
</tr>
<tr>
<td>Chemistry 58,</td>
<td></td>
</tr>
<tr>
<td>English 12,</td>
<td></td>
</tr>
<tr>
<td>Physics 301,</td>
<td></td>
</tr>
<tr>
<td>Physical Culture 3,</td>
<td></td>
</tr>
<tr>
<td><strong>Home Sanitation</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Food Preparation</strong></td>
<td>2 1/2</td>
</tr>
<tr>
<td><strong>Applied Design</strong></td>
<td>1 1/2</td>
</tr>
<tr>
<td><strong>Organic Chemistry</strong></td>
<td>4 1/2</td>
</tr>
<tr>
<td><strong>Argumentation</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Mechanics and Heat</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Light Apparatus</strong></td>
<td>R</td>
</tr>
<tr>
<td>Electives to be selected from page 155,</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

**FOURTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 44,</td>
<td></td>
</tr>
<tr>
<td>Home Economics 51,</td>
<td></td>
</tr>
<tr>
<td>Chemistry 59,</td>
<td></td>
</tr>
<tr>
<td>Physical Culture 4,</td>
<td></td>
</tr>
<tr>
<td>Physics 402,</td>
<td></td>
</tr>
<tr>
<td>Zoology 19,</td>
<td></td>
</tr>
<tr>
<td><strong>Food Preparation</strong></td>
<td>2 1/2</td>
</tr>
<tr>
<td><strong>Applied Design, Theory of Design</strong></td>
<td>1 1/2</td>
</tr>
<tr>
<td><strong>Food Analysis</strong></td>
<td>4 1/2</td>
</tr>
<tr>
<td><strong>Swedish Gymnastics</strong></td>
<td>R</td>
</tr>
<tr>
<td><strong>General Physics</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>General Zoology</strong></td>
<td>4 1/2</td>
</tr>
<tr>
<td>Electives to be selected from page 155,</td>
<td>2 1/2 to 4 1/2</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

**DOMESTIC SCIENCE GROUP**

**Junior Year**

Note 1. Home Economics students who expect to teach will be required to elect work from the Departments of Psychology and Agricultural Education in accordance with the following: By electing Psychology 7 and 8, students, upon graduation, will be entitled to receive, without examination, the Special State Certificate, authorizing them to teach Home Economics (only). Should they desire to receive a General State Certificate authorizing them to teach Home Economics and other subjects also, they should elect in addition to the Psychology above, 10% hours from the courses in Agricultural Education.

Note 2. To students not wishing the General State Certificate, the Home Economics Department recommends that they elect four or more hours from Courses 6, 7, and 8 of the Department of Agricultural Education.

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 48,</td>
<td></td>
</tr>
<tr>
<td>Economic Science 2,</td>
<td></td>
</tr>
<tr>
<td><strong>Cookery</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Economics of Home Administration</strong></td>
<td>2</td>
</tr>
</tbody>
</table>
## DIVISION OF AGRICULTURE

### Chemistry 60, Zoology 12, Physiological Chemistry Human Physiology

*Electives:*

- Enough work will be elected from the Senior College electives on page 156 to make 4½ to 8½

**Total semester hours 16 to 20**

### SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 42,</td>
<td>2½</td>
</tr>
<tr>
<td>Home Economics 49,</td>
<td>2</td>
</tr>
<tr>
<td>Bacteriology 18,</td>
<td>3½</td>
</tr>
<tr>
<td>Zoology 13,</td>
<td>4½</td>
</tr>
</tbody>
</table>

*Electives to be selected from page 156, 4 to 8

**Total semester hours 16 to 20**

### SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 9,</td>
<td>1½</td>
</tr>
<tr>
<td>Home Economics 11,</td>
<td>2</td>
</tr>
<tr>
<td>Home Economics 27,</td>
<td>3½</td>
</tr>
<tr>
<td>Home Economics 45,</td>
<td>3</td>
</tr>
<tr>
<td><strong>Economic Science 11,</strong></td>
<td>2</td>
</tr>
<tr>
<td>Public Speaking 15,</td>
<td>2</td>
</tr>
</tbody>
</table>

*Electives to be selected from page 156, 4½ to 8½

**Total semester hours 16 to 20**

*If Journalism for Women is elected in this semester the student will be required to take Agricultural Journalism 11 as an elective, in the eighth semester.*

### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 10,</td>
<td>1½</td>
</tr>
<tr>
<td>Home Economics 12,</td>
<td>2</td>
</tr>
<tr>
<td>Home Economics 46,</td>
<td>3</td>
</tr>
<tr>
<td>Home Economics 47,</td>
<td>1</td>
</tr>
</tbody>
</table>

**Senior students in 1914 are requested to take Economic Science 2 instead of Economic Science 11.**
Home Economics 55, Interior Decoration and House Furnishing  
*English 13, 
Advanced Composition  
For electives see page 156

Total semester hours 16 to 20

Horticulture 11 elective in Senior year.

* If Journalism for Women is elected through the seventh and eighth semesters, the student may drop English 13.

DOMESTIC ART GROUP

Junior Year

Note 1. Home Economics students who expect to teach will be required to elect work from the Departments of Psychology and Agricultural Education in accordance with the following: By electing Psychology 7 and 8 students upon graduation will be entitled to receive, without examination, the Special State Certificate authorizing them to teach Home Economics (only). Should they desire a General State Certificate, authorizing them to teach Home Economics and other school subjects also, they should elect, in addition to the Psychology, 10½ hours from the course in Agricultural Education.

Note 2. To students not wishing the General State Certificate, the Home Economics Department recommends that they elect four or more hours from courses 6, 7, and 8 of the Department of Agricultural Education.

FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 6, *Chemistry 61, Economic Science 2, Zoology 12,</td>
<td></td>
</tr>
<tr>
<td>Dress Making, Chemistry of Textiles, Economics of Home Administration, Human Physiology</td>
<td>21/3, 31/3, 2</td>
</tr>
<tr>
<td>Electives to be selected from page 156</td>
<td>4 to 8</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>16 to 20</td>
</tr>
</tbody>
</table>

SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 7, Home Economics 42, Home Economics 54, Bacteriology 18, Zoology 13,</td>
<td></td>
</tr>
<tr>
<td>Dressmaking, Textiles and their Care, Textile Design, General Bacteriology and Fermentation, Human Physiology</td>
<td>21/3, 21/3, 11/3, 3, 41/3</td>
</tr>
<tr>
<td>Electives to be selected from page 156</td>
<td>21/3 to 61/3</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>16 to 20</td>
</tr>
</tbody>
</table>

* Class of 1914 will take Chemistry 59 instead of 61.
### SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 9,</td>
<td></td>
</tr>
<tr>
<td>Theory and Practice of Teaching Home</td>
<td>3</td>
</tr>
<tr>
<td>Economics</td>
<td></td>
</tr>
<tr>
<td>Home Economics 11,</td>
<td>2</td>
</tr>
<tr>
<td>History of Art</td>
<td></td>
</tr>
<tr>
<td>Home Economics 33,</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Dress Making</td>
<td></td>
</tr>
<tr>
<td>Home Economics 34,</td>
<td>1½</td>
</tr>
<tr>
<td>Advanced Course in Textiles</td>
<td></td>
</tr>
<tr>
<td>Home Economics 52,</td>
<td>1½</td>
</tr>
<tr>
<td><strong>Economic Science 11,</strong></td>
<td></td>
</tr>
<tr>
<td>Public Speaking 15,</td>
<td>2</td>
</tr>
<tr>
<td>The State in Relation to the House</td>
<td></td>
</tr>
<tr>
<td>Home Economics 35,</td>
<td>3</td>
</tr>
<tr>
<td>Costume Design</td>
<td></td>
</tr>
<tr>
<td><strong>Extempore Speech in Home Economics</strong></td>
<td></td>
</tr>
<tr>
<td><em>Electives to be selected from page 156,</em></td>
<td>1½ to 5½</td>
</tr>
<tr>
<td><em>Total semester hours</em></td>
<td>16 to 20</td>
</tr>
</tbody>
</table>

*If "Journalism for Women" is elected in this semester the student will be required to take Journalism 11 as an elective in the eighth semester.**

**Senior students in 1914 are requested to take Economic Science 2 instead of Economic Science 11.

### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics 10,</td>
<td></td>
</tr>
<tr>
<td>Theory and Practice of Teaching Home</td>
<td>3</td>
</tr>
<tr>
<td>Economics</td>
<td></td>
</tr>
<tr>
<td>Home Economics 12,</td>
<td>2</td>
</tr>
<tr>
<td>History of Art</td>
<td></td>
</tr>
<tr>
<td>Home Economics 35,</td>
<td>1½</td>
</tr>
<tr>
<td>Millinery</td>
<td></td>
</tr>
<tr>
<td>Home Economics 55,</td>
<td>2½</td>
</tr>
<tr>
<td>Interior Decoration and Household Furnishing</td>
<td></td>
</tr>
<tr>
<td><strong>English 13,</strong></td>
<td></td>
</tr>
<tr>
<td><em>Electives to be selected from page 156,</em></td>
<td>5½ to 9½</td>
</tr>
<tr>
<td><em>Total semester hours</em></td>
<td>16 to 20</td>
</tr>
</tbody>
</table>

* If "Journalism for Women" is elected through the seventh and eighth semesters, the student may drop English 13 and take two elective hours in its place.

### COURSES IN HOME ECONOMICS

#### DOMESTIC ART

1. **Sewing.** Drafting of patterns and hand sewing, including stitches, darning, patching, the making of button holes, etc., all of which will be applied to some useful garment.

   *Recitation 1, lab. 2, 2 hr.; credit 2½; fee $1.00.*

4. **Sewing.** Advanced drafting, hand and machine sewing, silk
skirts, slips or tailored skirts and tailored waists will be made. Economical cutting of material, fitting of garments, and choice of materials will be discussed from the standpoint of economy and beauty.

**2S.** Prerequisite 1; recitation 1, lab. 2, 2 hr.; credit 2½; fee $1.00.

6. **Dressmaking.** Designing of patterns and the making of fancy waists. In this course the students will be allowed to make some garment that will be especially useful to them along the line of wearing apparel. Special emphasis is given to the artistic side of the work and the history of costume.

3, 5 or 7S. Prerequisite 4; recitation 1, lab. 2, 1 hr.; credit 2½; fee $1.00.


4, 6 or 8S. Prerequisites 6 and 51; recitation 1, lab. 2, 2 hr.; credit 2½; fee $1.00.

33. **Advanced Dress Making.** Elaborate costume pattern designing and the making of a street, house and evening gown.

7S. Prerequisites 7 and 52; lab. 3, 2 hr.; credit 2; fee $1.00.

42. **Textiles and Their Care.** Fabrics, also the evolution of spinning and weaving from their beginnings in primitive life to the present day. Laboratory work will include laundering, dyeing of cotton, wool, silk and linen, simple weaving, and other work especially suitable for textiles in the home.

6S. Prerequisites 50 and Chem. 58; recitation 1, lab. 2, 2 hr.; credit 2½; fee $2.00.

34. **Advanced Course in Textiles.** Applied Design 54 will be put into practice in loom weaving, basket making, embroidering, crocheting, and knitting. Especially helpful to those wishing to teach in High Schools, Normals and Colleges.

7S. Prerequisite 42; lab. 2, 2 hr.; credit 1½; fee $3.00.

35. **Millinery.** Designing and drafting patterns for hats; construction of different kinds of frames such as buckram, wire, willow; also covering and finishing with velvet, straw, net, etc. Emphasis is laid on the placing on the trimming and the use of original designs, also the renovating of hats, curling of feathers, freshening velvets, ribbons, etc.

8S. Prerequisite 4; lab. 2, 2 hr; credit 1½; fee $1.00.

50. **Theory of Design.** Theory of Design. Principles, color analysis, tone value, harmony, rhythm, balance, subordination. These principles are first applied to simple abstract problems of borders, surface patterns and regular spaces.

3S. Physics 301 to be taken with this course; lab. 2, 2 hr; credit 1½; fee $1.00.

51. **Applied Design.** Principles of design applied to concrete problems such as: Rugs, Book-rovers, Stained Glass Windows, etc., and later through the mediums of leather, metal, wood-block prints and stencils applied to various useful articles.

4S. Prerequisite 50; lab. 2, 2 hr.; credit 1½; fee $1.00.

55. **Household Furnishing and Interior Decoration.** Principles of art in their application to home furnishing and every-day living. In-
terior mural decorations, floors, furniture, household linens, china, silver, and pottery are taken up from the standpoint of color combination and beauty of line as well as utility and economy. Practical work in design will be given which can be applied directly to house furnishings.

54. Textile Design. Designs for various articles which are to be executed in the advanced Textile class. Loom weaving for rugs, weaving of baskets, embroidery on linen, monograms, and designs for embroidered table runners and pillow covers.

52. Costume Design. Designing and sketching of costume. It aims to give emphasis to the aesthetic side of dressmaking and millinery. The principles of design applied to color combinations, proportions, and trimming arrangements for various articles of clothing.

11. History of Art. Historic architecture and ornament including the Egyptian, Greek, Roman, Byzantine, and Renaissance styles and consideration of architecture of the present day. The object is to develop within the student the aesthetic instinct and an appreciation for the elements of architecture.

37. House Structure and Sanitation. How to use and care for the equipment of homes and institutions, with particular reference to sanitary aspects. How modern appliances may be either nuisances or sources of comfort, according as one learns to make intelligent use of them. The course will deal with water supply, stoves, lamps, gas supply, plumbing, sewers, garbage, heating, ventilation, refrigeration, electric lighting, telephone, elevators, dumb waiters, mechanisms of machinery for dish washing, laundry, and cleaning; destruction of pests, sanitary cleaning; effects of sunlight and fresh air; fire extinguishers and general repairs.

43. Food Preparation. This course introduces the subject of foods and food preparation in its scientific and economic aspect. It is the study of the nutritive principles as they are found in various foods and the methods of cooking foods to retain those principles in digestible form;
serving of foods in a simple and attractive form. Economy of money, time and labor being considered,

3S. Prerequisite Chem. 22; recitation 1, lab. 2, 2 hr.; credit 2 1/2; fee $4.00.

44. Food Preparation.

4S. Prerequisite 43; recitation 1, lab. 2, 2 hr.; credit 2 1/2; fee $4.00.

48. Cookery. Study of foods and relation of same to the body, reviews of chemistry and physiology of digestion, study of fermentation in its relation to fruit preservation, marketing and serving and fruit preservation forms the laboratory work. An opportunity is given for practice in home cookery—includes the study, planning, marketing, preparation and serving meals.

5S. Prerequisites 44 and Chem. 59; recitation 1, lab. 2, 2 hr.; credit 2; fee $3.00.

49. Cookery.

6S. Prerequisite 48; recitation 1, lab. 2, 2 hr.; credit 2; fee $3.00.

45. Food and Dietetics. Includes a thorough and scientific study of food materials in their relation to the daily dietary of families under various conditions of health and environment. Also takes up institutional dietaries; the relation of dietetics to various diseases; the feeding of children. The practical work in this course is advanced cookery, therapeutic cookery, and the preparation of actual meals according to various dietary standards.

7S. Prerequisites 48, 49, Chem. 60 and Zoo. 16; recitation 1, lab. 3, 2 hr.; credit 3; fee $7.00.

46. Food and Dietetics.

8S. Prerequisite 45; recitation 1, lab. 3, 2 hr.; credit 3; fee $7.00.

30. Food Production and Commercial Distribution. This course consists of lectures upon the staple foods, their production, manufacture and distribution from the raw material to the finished product. Discussions of the composition and the cost of food materials, the process of preservation of foods, such as canning and preserving of foods, salting, smoking, drying, use of preservatives, adulteration and substitution. Also a resume of the state and national laws governing the distribution of food.

6 or 8S. Recitation 1; credit 1.

9. Theory and Practice of Teaching Home Economics. The working out of the relation of the subjects of instruction included in a complete Home Economics Course; the relation of these to other subjects in the school curriculum, the organization of practical information needed by a teacher in introducing and conducting this work, such as, the planning of courses, the cost of equipment, the management and care of the department, the presentation of lessons. The laboratory work consists of practice teaching; school classes; assisting in college classes; observations.

7S. Recitation 1; lab. 2, 3 hr.; credit 3; fee $3.00.

10. Theory and Practice of Teaching Home Economics.

8S. Prerequisite 9; recitation 1, lab. 2, 3 hr.; credit 3; fee $3.00.
27. **Household Accounts.** Methods and forms which can be readily adapted to the business of the household. Banking, renting, forms of contracts, etc., are taken up and discussed in their relation to the home. Systems of household bookkeeping will be studied and household and personal accounts kept. The Division of Income will be discussed and the approximate amount to be spent upon Rent, Fuel, Clothing, Food, Lighting, etc., considered.

7S. Laboratory 1, 2 hr.; credit ½.

47. **Home Nursing.** Study of the scientific care of the patient under home conditions, including the furnishing, temperature and ventilation of the room, bathing, dressing and administering food and medicine to patients, bed making, bandaging, lifting helpless patients, preparation and application of fomentations.

8S. Prerequisites 37 and Bact. 18; recitation 1; credit 1.

**JUNIOR COLLEGE ELECTIVES**

List of subjects which may be elected in the Freshman and Sophomore years in the course in Home Economics.

(The number in the parenthesis indicates the number of hours' credit).

<table>
<thead>
<tr>
<th>Semester</th>
<th>Department</th>
<th>Course Numbers and Hours</th>
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<tr>
<td>First</td>
<td>Agricultural Education</td>
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</tr>
<tr>
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<td>2 (3)</td>
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<tr>
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<td>Agricultural Engineering</td>
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<td>Agricultural Engineering</td>
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**ELECTIVES IN THE AGRICULTURAL COURSES**

Subjects which may be elected in the Junior or Senior Year in any of the Agricultural courses, provided the student has the prerequisites for each study chosen:

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<th>Department</th>
<th>Course Numbers, and Hours</th>
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DIVISION OF AGRICULTURE

Second Farm Crops 4 (1%), 9 (2), 10 (2), 12 (1%), 17 (2), 18 (5), 19 (1), 20 (1).

First Forestry 10 (2), 11 (1), 12 (2), 15 (2), 25 (2%).

Second Forestry 1 (2), 3 (3%), 13 (2), 15 (2), 16 (3%), 17 (2).

First Geology 10 (4), 501 (4).


First History 5 (3), 26 (2), 32 (2), 40 (2), 46 (2).

Second History 8 (3), 28 (2), 34 (3), 42 (2), 48 (2).

First Home Economics 6 (2½), 9 (1½), 52 (1½).

Second Home Economics 7 (2½), 10 (1½), 30 (1), 47 (1), 54 (1½).


First Modern Languages:
Language (French) 1 (5), 3 (3).
Language (German) 5 (5), 14 (5), 16 (3).
Language (Spanish) 30 (5).

Second Modern Languages:
Language (French) 2 (5), 4 (3).
Language (German) 6 (5), 15 (5), 17 (3).
Language (Spanish) 31 (5).


First Mathematics 4 (5), 8 (5), 324 (2), 325 (3).

Second Mathematics 6 (2), 9 (5), 223 (2½), 426 (5).

First Military 5 (1), 7 (1).

Second Military 6 (1), 8 (1).

Second Photography 1 (1½).

First Physics 511 (1).

Second Physics 404 (5).

First Psychology 6 (3), 7 (3), 8 (3), 10 (2), 11 (2).


First Public Speaking 2 (1), 3 (2), 4 (2), 5 (2), 10 (2), 16 (1), 17 (1).

Second Public Speaking 2 (1), 3 (2), 4 (2), 6 (2), 8 (1), 11 (2), 18 (1).

First Soils 1 (4), 4 (2), 6 (2), 8 (4), 13 (1½).


First Veterinary 19 (1), 23 (2), 33 (3), 44 (2).

Second Veterinary 22 (2½), 24 (2).

First Zoology 4 (3½), 10 (3 or 5), 12 (4½), 18 (2), 20 (4½), 19 (2½), 30 (5).

Second Zoology 3 (5), 6 (1), 7 (5), 8 (2), 10 (3 or 5), 13 (4½), 17 (3).
Agricultural Experiment Station
The investigations of the Experiment Station are intimately related 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 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 methods of cultivation, thus enabling the student to become acquainted with the latest ideas relating to these. Tests are made of different varieties of fodders, grasses and grains, also of different systems of culture and various crops.

The experimental investigations with animals embrace a study of the value of different feeds for different features of animal production, the preparation of feeds, systems of feeding, also a study of different types of animals suitable for the requirements of the market. The object sought in this department of Station work is 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 who has the opportunity of observing daily the development of it at every stage.

The work of the Experiment Station is in the closest touch with the Dairy industry. The problems which practical men are constantly confronting and asking aid in solving are at all times objects of experimentation by the Dairy Section. The students not only see, but assist in carrying out these experiments. In this way they become acquainted not only with the problems to be solved, but with the methods employed in the investigations. This experimental work relates to the various problems of both butter and cheesemaking. The results of this work, together with those of the bacteriological investigations, are daily used in class work.
The experimental work in Horticulture also affords the student an opportunity to study the results of the theory of the class room as practiced in 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. Experiments are conducted in spraying for the prevention of fungus pests and injurious insects; also in fertilizing, pruning, and thinning; in nursery work and in plant breeding. The Station work thus equips the student with the practice and technique necessary to a thorough horticultural training.

The work of the Experiment Station has been increased by the addition of Forestry as a line of investigation. Methods of practical treatment of fence posts and other timbers to increase durability are being determined in co-operation with the United States Forest Service and farmers and stockmen throughout the state. The adaptability of various trees for different sections of the state and methods of germination and storage are being tested. To get more definite data in reference to germination of seed and growth of seedlings in nursery rows, tree seed has been distributed to farmers in twenty-five counties of the state.

A 200-acre dairy farm is stocked and equipped for experimental and educational work in this important line of work. This farm and its equipment afford excellent facilities for experimental work in the farm production side of the dairy industry. A poultry department has also been added for experimental and instruction work.
Agricultural Extension Department

WILLARD JOHN KENNEDY, DIRECTOR

The Agricultural Extension work was established permanently by enactment of the Thirty-first General Assembly of Iowa. This act provided for giving lectures and demonstrations on the growing of crops and fruits, on stock raising, dairying, land drainage and kindred subjects, including Domestic Science. Specific mention was made in this act, of instruction in corn and stock judging at agricultural fairs, institutes and clubs and aid in conducting Short Courses of instruction at suitable places throughout the state. Under this act the Extension Department has been organized as a department of the Division of Agriculture.

The work and usefulness of this department have made rapid growth. Through the farmers' institute work, short courses, county fair work and other activities, it reaches the farmers in every county of the state. It takes the results of the Experiment Station investigations to the people. Through its many avenues of work, it annually reaches several hundred thousand people. The members of the instructional staff are people with excellent training and a wide range of experience in their respective lines of work.

Lines of Work Presented

1. Farmers' Institutes. Institute speakers and demonstrators are supplied to each county organization wishing help along any of the various lines of agriculture and home making.

2. Short Courses. The department is in a position to handle about 36 full week short courses in agriculture and home economics; 40 two- and three-day courses and about 30 special home economic courses. These courses will be assigned to the localities requesting the same. It will be impossible to take care of all the requests, and the early applications will receive first consideration.

3. Horse, Corn, Poultry, and Home Economics Shows. So far as possible competent judges and demonstrators will be furnished to county or other local organizations wishing judges for horse, corn, poultry, and home economics shows. These judges will be prepared to give intelligent reasons substantiating their awards, thus making such shows of educational value to all the people.

4. County Fair Work. With the hope of making our county and district fairs of more educational value to their respective localities, the department will furnish a limited number of competent judges along the
lines of livestock, farm crops, fruit, vegetables, and pantry stores. These judges will give reasons for the awards made and otherwise instruct the exhibitors and visitors along the respective lines of agricultural production and home building. Educational exhibits of the college and experiment station work will be put on at a limited number of fairs.

5. Picnics and Farmers’ Meetings. The department will stand ready to furnish competent speakers along agricultural lines, for picnics, farmers’ meetings, lecture courses, and other similar occasions.

6. Agricultural and Home Making Clubs. The future development of Iowa is dependent very largely upon the prosperity and happiness of our agricultural people. This being true, we are prepared to aid in the organization of agricultural and home making clubs. These organizations will furnish both education and recreation for the people on the farm.

7. Boys’ and Girls’ Club Work. Through the Schools Section of this department, over 15,000 boys and girls are now enrolled in study and contest work. This work is being gradually enlarged. We want more boys and girls to enroll. At present six lines of work are offered, Corn Growing, Poultry, Pig Contest, Cooking, Sewing, and Home Gardening.

8. County Station Work. The department through its farm crops and soils instructors, is in a position to conduct experiments of a demonstration nature, on a large number of county farms. At present 16 counties are cooperating in this work. At the end of the year the results of each county’s work are published in bulletin form and distributed free to the people of the county.

9. Cow Test Associations. For several years the department has conducted cow test associations. These are usually organized in cooperation with local creameries, condenseries, and cheese factories. Accurate reports of the amount of milk, butter-fat and cost of production are kept. The results of the work are published from year to year in bulletins and distributed free to the people.

10. Aid to Public and High School Teachers in Agriculture and Home Economics. The Schools Section stands ready to aid public and high school teachers to introduce agriculture and home economics in the schools. This work is accomplished through correspondence courses, publications, institutes and personal visits of the instructors.

11. Bulletins and Correspondence. The department publishes a large number of information bulletins dealing with the various phases of agriculture and home economics work. These publications are sent free to those desiring the same. In addition, the department is always ready to answer questions through correspondence. This feature of the work is making rapid growth and now amounts to some 60,000 letters per year.

The services of all members of the Agricultural Extension staff are free to the people. Local organizations are expected to pay their railroad and hotel expenses.
Division of Veterinary Medicine
Division of Veterinary Medicine

CHARLES HENRY STANGE, DEAN

The Division of Veterinary Medicine offers a four-year course of nine months each. The demand for veterinarians acquainted with the scientific methods of breeding, proper rations, correct types of the different breeds for market and for breeding purposes has led to the addition of this line of work given by the Animal Husbandry Department. The location of the college is in one of the richest live stock countries of the world, and the high class and variety of the live stock possessed by the college provides a rare opportunity for the veterinary student to study this phase of Animal Industry. The Freshman Year has been made sufficiently light to enable students (lacking entrance credits) to take some additional work. During the Senior year opportunity will be given to take special work in Bacteriology, Pathology, or do some individual research work. The new building affords special facilities for this kind of work.

In addition to the buildings occupied by the different Departments which have been constructed and equipped especially for the purpose intended, there is an Administration Building in which are located the Dean's general and private offices, a private laboratory for diagnostic work, faculty room, surgeon's office, a large assembly room, museum, library, and librarian's office. These occupy the first and second floors, while store-rooms for department supplies are located in the basement. To the south of the Administration Building is the Physiology and Pharmacology Building. To the north is the Pathology and Bacteriology Building. West of this is the Anatomy and Histology Building, while the Clinic Building closes the back of the court. The department buildings and facilities are described in connection with their respective departments. All the buildings have forced ventilation, automatic heat regulation, and are fire proof in every respect. They are supplied with hot and cold water, gas, electricity, steam, and the most modern equipment has been installed throughout.

A laboratory intended for the purpose of bacteriological and pathological investigation of the disease of domestic animals has been equipped as a part of the Experiment Station. It is supplied with the most modern biological apparatus, such as high power microscopes, incubators, hot air and steam sterilizers, microtomes, etc., and in fact all first-class facilities for scientific investigation. Specimens are received frequently for examination.

Students also have the advantages of a very extensive college 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.

Aside from the facilities which belong especially to the Veterinary Division, the equipment for instruction in Animal Husbandry, consisting of large flocks and herds of carefully selected breeds of live stock, helps to render practical instruction very efficient. This department is regarded as one of the strongest in the country, if not in the world, and the most perfect types of the different breeds are used for class work. In this way the work in Veterinary medicine is linked with that in agriculture, which proves of inestimable value to Veterinarians.

The work in Botany, Chemistry, Zoology, and other related sciences is adequately provided for in the special buildings for the accommodation of these several departments of college work. In this manner, each line of work is presented to the student by a specialist in his particular branch.

EXAMINATIONS AND DEGREE

Examinations are held at the close of each semester 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 prerequisite 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 satisfactory 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.

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 $5,008,327,000, 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 $1,400.00 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 10 per cent increase for each five years' service up to twenty years, with the same allowance as 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 livestock 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 Agricultural and Veterinary Colleges.

**COURSE IN VETERINARY MEDICINE**

**Freshman Year**

**FIRST SEMESTER**

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<td>Veterinary 133,</td>
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<td>Animal Husbandry 26,</td>
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<td>Botany 9,</td>
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<tr>
<td>Military Drill</td>
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**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Veterinary 202,</td>
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<tr>
<td>Veterinary 234,</td>
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<tr>
<td>Animal Husbandry 27,</td>
<td></td>
</tr>
<tr>
<td>Botany 16,</td>
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<td>Chemistry 69,</td>
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<td>Physical Training 202,</td>
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<td>Veterinary 202,</td>
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<tr>
<td>Comparative Anatomy</td>
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<td>Comparative Anatomy</td>
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<tr>
<td>Histology</td>
<td>3</td>
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<tr>
<td>Stock Judging and Breed Types</td>
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<td>Poisonous Plants</td>
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<tr>
<td>Organic and Bio-Chemistry</td>
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<td>Gymnasium</td>
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**Sophomore Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
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<tbody>
<tr>
<td>Veterinary 303,</td>
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<td>Veterinary 323,</td>
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<td>Veterinary 325,</td>
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<tr>
<td>Veterinary 328,</td>
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<tr>
<td>Zoology 15,</td>
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<tr>
<td>Comparative Anatomy</td>
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<td>Comparative Physiology</td>
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<tr>
<td>Pharmacy</td>
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<tr>
<td>General Bacteriology</td>
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<tr>
<td>General and Vertebrate Zoology</td>
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### FOURTH SEMESTER

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<tr>
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<tbody>
<tr>
<td>Veterinary 404</td>
<td>Comparative Anatomy</td>
<td>5 2/3</td>
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<tr>
<td>Veterinary 424</td>
<td>Comparative Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Veterinary 427</td>
<td>Materia Medica and Therapeutics</td>
<td>2</td>
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<tr>
<td>Veterinary 429</td>
<td>Bacteriology of the Pathogens</td>
<td>3 1/2</td>
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<tr>
<td>Veterinary 436</td>
<td>General Pathology</td>
<td>4</td>
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### Junior Year

### FIFTH SEMESTER

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<tbody>
<tr>
<td>Veterinary 510</td>
<td>Surgery</td>
<td>3</td>
</tr>
<tr>
<td>Veterinary 530</td>
<td>Materia Medica and Therapeutics</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 538</td>
<td>Special Pathology</td>
<td>5</td>
</tr>
<tr>
<td>Veterinary 540</td>
<td>Theory and Practice</td>
<td>3</td>
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<tr>
<td>Veterinary 550</td>
<td>Clinics</td>
<td>4</td>
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<tr>
<td>Veterinary 554</td>
<td>Physical Diagnosis</td>
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<tr>
<td>Veterinary 509</td>
<td>Descriptive Medicine</td>
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### SIXTH SEMESTER

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<tbody>
<tr>
<td>Veterinary 611</td>
<td>Principles and Practice of Surgery</td>
<td>3</td>
</tr>
<tr>
<td>Veterinary 631</td>
<td>Materia Medica and Therapeutics</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 637</td>
<td>Animal Parasites</td>
<td>3</td>
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<tr>
<td>Veterinary 641</td>
<td>Theory and Practice</td>
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<td>Veterinary 651</td>
<td>Clinics</td>
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<tr>
<td>Dairying 27</td>
<td>Milk Testing and Inspection</td>
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<tr>
<td>Economic Science 25</td>
<td>Veterinary Law</td>
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### Senior Year

### SEVENTH SEMESTER

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<tbody>
<tr>
<td>Veterinary 712</td>
<td>Principles and Practice of Surgery</td>
<td>4</td>
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<tr>
<td>Veterinary 739</td>
<td>Meat Inspection</td>
<td>2</td>
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<tr>
<td>Veterinary 742</td>
<td>Theory and Practice of Medicine</td>
<td>3</td>
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<td>Veterinary 752</td>
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<tbody>
<tr>
<td>Veterinary 746</td>
<td>Laboratory Diagnosis</td>
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<tr>
<td>Animal Husbandry 20</td>
<td>Animal Feeding</td>
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<td>Zoology 5</td>
<td>Embryology</td>
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**Eighth Semester**

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<tr>
<td>Veterinary 813</td>
<td>Principles and Practice of Surgery</td>
<td>4</td>
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<tr>
<td>Veterinary 818</td>
<td>Conformation and Horseshoeing</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 820</td>
<td>Obstetrics</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary 843</td>
<td>Theory and Practice of Medicine</td>
<td>4</td>
</tr>
<tr>
<td>Veterinary 845</td>
<td>Sanitary Science</td>
<td>2</td>
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<tr>
<td>Veterinary 853</td>
<td>Clinics</td>
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<tr>
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**Department of Veterinary Anatomy and Histology**

**Dr. Murphey**

**Mr. White**

**Mr. Leith**

The Department of Anatomy and Histology occupies the northwest building of the Veterinary group. The amphitheatre class room is arranged so that all students have an equal opportunity to observe the class room demonstrations which are favored by the ample amount of light.

The dissecting room is lighted by windows on three sides as well as sky lights and equipped with tracks to which animals may be suspended in a normal position. There are individual tables for dissecting parts and hot and cold water for cleansing and dilating purposes. Skeletons of the horse, ox, pig, sheep and dog are at all times available to assist the student in his laboratory work. A modern odorless rendering apparatus disposes of all dissected material and offal from the hospital.

The private laboratory adjacent to the dissecting room provides for the preparation of tissues for laboratory work and microscopical sections for histology.

The histology laboratory is a large well lighted room with thirty-six desks for individual students. Each student is provided with a complete set of apparatus including a microscope, consequently no student's work is hampered or interfered with by another.

101. **Osteology and Arthrology.** Structure and classification of bones in general, followed by the bones of the horse in detail, with comparative differences in the ox, pig, and dog. Bones are furnished for
study, and emphasis is placed on the "sculpture," as related to the muscular and ligamentous attachments, and the position of organs, vessels, and nerve conducts. Following Osteology the recitations take up the general structure and classification of articulations. Prepared specimens are used in the class room to demonstrate the various subjects. Laboratory consists of drawings made to scale, of the bones of the horse, and a dissection of the articulations of the horse. Soft material is used.

1S  Recitations 3, lab. 1, 3 hr.; credit 4; fee $1.00.

202. **Myology and Sphalanchnology of the Horse.** Demonstrations of dissected specimens, covering the muscular, digestive, respiratory, and genito-urinary systems in detail; special emphasis on the fascia, tendon sheaths, and their various relationships. The laboratory work consists of a complete dissection by each student of the above structures. As far as practicable a living horse is used in class work demonstration.

2S  Recitations 3, labs. 2, 4 hr.; credit 5%; fee $3.00.

303. **Angiology, Neurology and Topography.** The recitations with Topographic (surgical) anatomy of all regions. The laboratory work includes a second complete dissection of the horse, special emphasis being placed on above subjects.

3S  Recitations 3, labs. 2, 4 hr.; credit 5%; fee $4.00.

404. **Comparative Anatomy.** The horse, ox, pig, sheep, and dog. Special emphasis being placed on the superficial structures, digestive, respiratory, circulatory, and genito-urinary systems. Care is used to bring out the particular features of clinical and surgical importance. The microscopic anatomy being emphasized.

4S  Recitations 3, labs. 2, 4 hr.; credit 5%; fee $4.00.

133. **Microscopy and Microscopic Anatomy (normal histology).** The theory, use, and care of microscopes, and the simple and standard methods of preparing, staining, and mounting cells, tissues, and organs. A brief description of the cell, its method of growth and reproduction, and its origin from an embryological standpoint, together with the classification and description of the cells and tissues of the body.

1S  Recitations 2, lab. 1, 3 hr.; credit 3; fee $5.00.

234. **Microscopic Anatomy of the Organs of Domesticated Animals.** The organs of domesticated animals in detail. Special emphasis is placed on the structural changes during the different phases of physiological activity, thus associating structure and function as far as possible.

2S  Recitations 2, lab. 1, 3 hr.; credit 3; fee $3.00.

**Text and Reference Books**

**Required:** Sisson's Veterinary Anatomy and Dissecting Guide, Schafer's Essentials of Histology.


Text Book of Histology by Bohm Davidhoff and Huber and Ellenberger's Handbuch der Vergleichenden Mikroskopischen Anatomie der Haustiere.
The purpose of the courses in Physiology is to point out, and make a detailed study, of all the topics which will be of the greatest use to the student in comprehending the vital phenomena of the animal body. It is necessary to have a complete understanding of all the normal functions, before attempting a proper conception of diseased conditions. The various courses in Physiology consist of lectures, recitations, demonstrations, and laboratory work, in which the chemical and physical processes and constituents of the animal body are considered, and the various systems, organs, and their functions, taken up in logical order. The lecture work is illustrated by the use of dissected specimens, drawings, practical demonstrations, etc.

The Physiology and Pharmacology Building lies just south of the Administration Building, and forms the southeast corner of the Veterinary Group. In this building may be found modern laboratories and equipment for carrying on general laboratory or research work in either physiological or pharmaceutical subjects. Aside from a large class room, three well lighted general laboratories for student use, a private laboratory and dark room for research work, specimen room, preparation room, experimental animal room, and store rooms are located here, each of which is admirably equipped to suit its respective purposes. In the general laboratories, each student has his own individual equipment for both physiological and pharmaceutical work, and thus being made independent, individual work and self reliance are encouraged.

The laboratory has been newly equipped, and in it may be found the latest apparatus for practical physiological demonstrations and research work. The equipment includes kymographs, inductoria, tambours, cardiographs, sphygmographs, sphygmomanometers, plethysmographs, ergographs, myocardiographs, manometers, haemocytometers, and various other apparatus for complete work.

A large portion of the laboratory work is devoted to a study of the phenomena of the respiratory, circulatory, muscular and nervous systems. The remainder is spent in testing the actions of artificial digestive juices upon the various foodstuffs, and in the study of the blood, including a spectroscopic examination.

As the course in Pharmacy is prerequisite to the course in Materia Medica, and Materia Medica to Therapeutics, the subjects are considered in that order.

The pharmaceutical laboratory located in the new Veterinary Building is well lighted and ventilated, and modern in every detail. It is divided into sections, each of which is supplied with scales and weights, mortars, capsules, stands, drugs, etc. Each individual section is also sup-
plied with gas, hot and cold water, drain, and lockers; by this arrangement all confusion is avoided and individual responsibility developed. It serves as an introduction to Materia Medica and Therapeutics.

Materia Medica coming in the second term of the sophomore year deals entirely with drugs, their preparations and combinations, and their action, direct and indirect, is explained and demonstrated pharmacologically. Therapeutics is taught throughout the junior year. The field of Therapeutics is quite thoroughly covered from a rational, empirical, and general standpoint.

325. Pharmacy. Pharmaceutical processes and principles, official drugs, chemicals and proximate principles are studied, and their solubility and incompatibility impressed on the student’s mind. The student is also required to prepare each of the official preparations, and is introduced to the subject of Toxicology. Prescription writing and pharmaceutical arithmetic.

3S Recitations 2, lab. 1, 2 hr.; credit 2%; fee $2.00.

427. Materia Medica. This course is introduced by definitions and discussions of the composition of drugs, classifications, official preparations, incompatibilities, combinations, and the form of administration. Numerous pharmacological demonstrations.

4S Recitations 2; credit 2.


Text Books: United States Pharmacopoeia Practice of Pharmacy, Remington; Principles of Pharmacy, Arny.

323. Comparative Physiology. The animal cell, the unit of organization, its origin, modifications of form and structures in the different tissues, as muscles and nerve tissue, etc., and the various chemical and physical laws which affect its nutrition, growth, reproduction, and development. Physiological functions of the circulatory, muscular and respiratory systems, including the study of the various organs concerned, the composition of the blood and air, the interchange of the various gases, etc.

3S Recitations 3; credit 3.

424. Comparative Physiology. Special functions of various organs and tissues of body, including the study of the alimentary tract, the nervous system, genito-urinary tract, and special senses.

4S Recitations 3, lab. 1, 3 hr.; credit 4 fee $2.00.


530. Therapeutics. Modes of actions of drugs, the physiological laws governing the same absorption, elimination, methods of administra-
tion, posology, incompatibilities, prescription writing, etc. The different systems and organs of the animal body, and the drugs influencing them are considered in logical order. The physiological and therapeutic actions, indications, contra indications, and toxicology of each therapeutic agent are discussed in detail.

5S Recitations 2; clinical demonstrations; credit 2.

631. Therapeutics. A continuation of course 530.

6S Recitations 2; credit 2.

Text and Reference Books: Winslow's Veterinary Materia Medica and Therapeutics; "Veterinary Medicines," by Findlay Dun; "Arzneimittelhers fur Tierarzte," by Frohner; "United States Dispensatory," "Pharmacology and Therapeutics," by Cushny, Quitman, E. Wallis Hoare, Stevens, Hare, Potter.

Department of Pathology and Bacteriology

DR. DIMOCK
DR. MURRAY
MR. ROSS
MR. RICE

The northeast building of Veterinary group is devoted to the work in Pathology, Bacteriology and Meat Inspection. It comprises two offices, a private laboratory for individual research work, a class room, accommodating fifty students with provision for lantern slide and microscopic projection work, and a large general laboratory. The laboratory equipment is complete and modern in every respect, each student being provided with an individual glass topped desk, microscope and accessories. Special attention has been paid to the lighting of the laboratory, windows being on three sides with electricity and gas available. In connection with the laboratory are pathology preparation room for fixing, imbedding sectioning, staining, and mounting sections of tissue, sterilizing room and incubation room.

In the basement are found rooms for small animals for inoculation and post mortem work; for the preparation and storing of museum specimens and for demonstration work in both general and special pathology. Photographic and dark room are also located here.

436. General Pathology. The causes of diseases, their spread and generalization, fever, protective and healing forces, disturbances of circulation; retrograde disturbances of nutrition and infiltration, hyper trophy and regeneration, inflammation and tumors. Fixed and stained microscopical preparations showing the various pathological phenomena. Preparation and preservation of gross specimens, preparation of sections for microscopical study and general technique of laboratory diagnosis.

4S Recitations 3, lab. 1, 3 hr.; credit 4; fee $4.00.
538. **Special Pathology.** Causes, morbid anatomy and morbid histology of the principal organic diseases, covering diseases of the blood and circulatory organs, respiratory apparatus, liver, peritoneum, urinogenital organs, digestive apparatus, spleen, lymph glands, muscles, bones, tendons, bursae and ligaments, the nervous system and the cutis. The etiology, morbid anatomy, and morbid histology of the infectious diseases caused by streptococci, bacilli, higher fungi, protozoa, animal parasites, and those diseases, the specific cause of which is not yet determined.

SS Recitations 4, lab. 1, 3 hr.; credit 5; fee $5.00.

739. **Meat Inspection.** The physical characteristics of the normal flesh; modes of transportation; rules for ante mortem examination, methods of slaughter, post mortem examination, together with the principles of refrigeration, and preservation, the decomposition, putrefaction and contamination of meats. It further considers those pathological conditions resulting from organic, constitutional, infectious, and parasitic diseases with their effect upon the edibility of meat and upon the possible transmission of disease to man. The meat inspection laws of the United States.

7S Recitations 2; credit 2.

637. **Animal Parasites.** A classification, study of the life history, anatomy, and morphology for identification, and mode of infestation of those parasites injurious to our domestic animals, together with a study of the lesions produced as a result of their presence upon or within the animal body.

6S Recitations 2, lab. 1, 3 hr.; credit 3; fee $2.00.

328. **Veterinary Bacteriology.** Morphology, classification, cultivation, and physiological characters of bacteria; the preparation of plain and special media; the principles of infection and contagion and the discussion of the various theories of immunity as related to bacterial infection.

3S Recitations 2, labs. 2, 2 hr.; credit 3½; fee $2.00.

429. **Veterinary Bacteriology.** Pathogenic organisms, infecting domestic animals. Laboratory studies of methods of producing immunity.

4S Recitations 2, lab. 2, 2 hr.; credit 3½; fee $3.00.

845. **Sanitary Science.** Practical methods of disinfection, disinfecting agents and their mode of action, methods of dipping and dips, principles of serum therapy, vaccination and quarantine, also manner of spread, and sanitary police of the individual infections and parasitic animal diseases.

8S Recitations 2; credit 2.

509. **Descriptive Medicine.** Technical style of writing and technical terms used in description of tissues, symptoms, morbid changes, etc. Brief articles on diseases of domestic animals will be prepared by the student, criticized by the instructor and made the basis of class discussions.

5S Recitation 1; credit 1.

746. **Laboratory Diagnosis.** An application of the theories developed in the study of immunity to such biological tests as the agglutina-
tion, precipitation, and complement fixation; also microscopical tests for the detection of specific and non-specific organisms in their relation to disease. The gross and histological examinations of pathological specimens together with urine and blood analysis. Confirming clinical diagnosis by the most recent laboratory methods.

7S Recitation 1; credit 1.

Text and Reference Books


Special Pathology—Moore, Hays Translation of Infectious Diseases of Animals by Friedberger and Frohner, Law Vol. IV., Hutyra and Marek, Adami, Vol. II.

Meat Inspection, Meat Hygiene—Eddleman Moehler and Eichorn, Ostertag's Hand Book of "Meat Inspection."


Bacteriology—Buchanan, Moore, Jordan, Kitt.

Department of Surgery and Obstetrics

DR. BEMIS

DR. NELSON

All the class work under the department of surgery and obstetrics is conducted in the amphitheatre in the clinic building where animals affected with conditions under discussion, as well as instruments and apparatus to be used in diagnosis, treatment, or restraint, can be brought before the class. The clinic cases are constantly used to correlate the theoretical and the practical.

510 and 611. General Surgery, Surgical Diagnosis and Lameness. Lectures supplemented by demonstrations in surgical restraint, wound dressing, sutures and suturing, anaesthesia, antisepsis, etc., the treatment of inflammation, diseases of bones, muscles, nerves, articulations, tendons, tendon-sheaths, surgical diagnosis and lameness.

5S and 6S Credit 3 each; fee $10.00.

712 and 813. Special Surgery. The diagnosis and treatment of the surgical diseases of the various regions of the body. Serial sections through the regions of important surgical operations are used in class room demonstrations.

7S and 8S Credit 4 each.

818. Soundness and Horseshoeing. Lectures illustrated by charts, prepared hoofs, and shoes for special purposes. The anatomy and physiology of the foot; factors that influence the form of hoof and style of
going, preparing the hoof, and fitting the shoe, winter shoeing, the correcting of faulty gait, pathological shoeing. Defects which predispose to unsoundness. A consideration of the defects, vices, and unsoundness with reference to their effect upon the value of the animal. Practice in certificate writing, etc.

8S Recitations 2; credit 2.

820. Obstetrics. Physiological obstetrics, ovulation, oestrus, fecundation, gestation, sterility, hygiene of pregnant animals, and care of the new born. Diseases of, and accidents due to pregnancy, obstetrical operations, the sequelae of parturition, and diseases of the young animal. The ambulatory clinic renders many cases from the college farm and surrounding country available for the practical work in this subject.

8S Recitations 2; credit 2.

Text and Reference Books


Obstetrics—Fleming's "Veterinary Obstetrics;" Bourney, Obstetrique Veterinaire;" Dalrymple's "Veterinary Obstetrics;" De Bruin's "Bovine Obstetrics," translated by Wyman; William's "Veterinary Obstetrics;"

Conformation and Soundness—Goubaux and Barrier's "Exterior of the Horse," translated by Harger; Hayes' "Points of the Horse."


Department of Theory and Practice of Veterinary Medicine

DR. STANGE

DR. NELSON

The work in this course is given in the clinical amphitheatre where an abundance of clinical cases are available for demonstration purposes. Cases as they become available are brought before the classes and thus the symptoms as well as etiology and treatment are more readily explained and easily understood. The various domestic animals are considered, and all of the lecture work is supplemented by practice in the daily clinics.

554. Diagnostic Methods. Living animals are utilized so far as possible, and each student is required to make the different forms of physical examinations. Healthy animals are first considered in order that the student may become thoroughly familiar with the normal condition, after which diseased animals from the clinic are used, which intensifies the
student's ability to distinguish the slightest variation from the normal or healthy condition. This course is preliminary to the courses in Theory and Practice of Medicine, and prepares the student for work in the clinics where his diagnostic ability is put to practical, daily tests.

55 Recitations 2; credit 2.

540. **Theory and Practice.** Diseases of a sporadic nature are considered, including diseases of nasal cavities and sinuses, larynx, lungs, pleura, mouth, salivary glands, oesophagus, stomach, and intestines.

55 Recitations 3; credit 3.

641. **Theory and Practice.** Diseases of the liver, peritoneum, brain, spinal cord, peripheral nervous system, organs of locomotion, and diseases of the skin. Symptoms of the diseases caused by the various animal parasites and their treatment in connection with the organs affected.

65 Recitations 4; credit 4.

742. **Theory and Practice.** Infectious diseases which are taken up in the following order: acute general infectious diseases, acute exanthematic infectious diseases, acute infectious diseases localizing in certain organs, infectious diseases affecting especially the nervous system.

75 Recitations 3; credit 3.

843. **Theory and Practice.** The chronic infectious diseases, infectious diseases caused by protozoa, diseases of blood and blood forming organs, diseases of metabolism, diseases of the kidneys, diseases of the bladder, diseases of the pericardium and heart, and diseases of the eyes

85 Recitations 4; credit 4.

Text and Reference Books

Spezielle Pathologie und Therapie der Haustiere, by Hutyra und Marek.


Klinische Untersuchungsmethoden fur Tierarzte Friedberger und Frohner.


Veterinary Hygiene, Klimmer.
Free Clinics are held at the hospital every day from one to three o'clock P. M. These clinics furnish an abundance of material for practical work. Being situated in an extensive stock growing district the college is especially favored in this respect as not only horses, but all species of animals are brought to the hospital for treatment. This affords the student an opportunity to acquire a familiarity with their treatment such as will enable him to give good service to clients immediately upon entrance into practice. The clinical professor when examining a case, performing an operation, or administering internal treatment, discusses the various aspects of the case, thus the cases are made of the greatest possible benefit to the students.

The clinic building has a large clinic room for general clinic work, two special operating rooms, one for large, and one for small animals, an operating and lecture amphitheatre, a dispensary, and instrument room with steam sterilizers, instrument cabinets, and a complete pharmacy for hospital purposes. Accommodations are furnished for about seventy-five patients, and all of the stalls and kennels are as sanitary and comfortable as possible to construct them. An ambulance and team are kept in readiness in order that animals unable to walk to the hospital can be secured for clinical purposes.

550 and 651. Clinics. Junior students assist the Seniors in their clinical and hospital work, which consists in making daily examinations and assisting in the dressing of wounds and daily treatment of the hospital cases. Junior students are also detailed in alphabetical order to assist the pharmacist in the compounding of prescriptions, in this way becoming familiar with the various forms in which drugs are administered.

5S and 6S Labs. 6, 2 hr.; credit 4 each.

752 and 853. Clinics. The cases brought to the hospital for treatment are assigned to the senior students who are required to prepare a full report of their examination, diagnosis, and proposed treatment. They are required to confine animals for operations, and assist the clinical professor during surgical procedure.

7S and 8S Labs. 6, 2 hr.; credit 4 each.

VETERINARY STUDIES IN AGRICULTURAL COURSES

17. Soundness and Shoeing. Common unsoundness of the horse. Anatomy and physiology of the foot, factors affecting the style of going, preparation of the foot for going barefoot, and for the shoe, special purpose shoeing, and pathological shoeing.

8S. Recitations 2, credit 2.
19. Obstetrics. Anatomy and physiology of the genital organs of the male and female, ovulation, estrum, fecundation, gestation, sterility, hygiene of pregnant animals and care of the new born animals.
7S. Prerequisite Zoo 3; recitation 1; credit 1.

22. Physiology. Normal functions of such organs and apparatus of the animal body as are more actively concerned in the feeding, breeding, etc. of live stock. Particular attention is paid to the functional activity of the digestive tract, and the organs of elimination of the body, as related to nutrition.
5 or 6S. Recitations 2; credit 2.

44. Sanitary Science. General consideration of the causes of the disease, manner of spread, disinfectants, and disinfecting, general hygiene and stable sanitation including drainage, selection of site, etc.
7S. Recitations 2; credit 2.

7S Labs. 2, 2 hr.; credit 1½.

56. Anatomy for Agricultural Students. A comprehensive knowledge of the structures of the animal body as related to function and form. The skeleton as a framework, articulations as concerned in locomotion, the muscular system as a source of food supply as well as the propelling power, and the digestive tract as related to nutrition.
1 or 2S. Recitation 1; credit 1.

770. Anatomy and Physiology of Poultry.
7S. Recitations 2; credit 2.

871. Poultry Parasites, Diseases and Hygiene.
8S. Recitations 2; credit 2.

SPECIAL LECTURES

As frequently as possible, specialists interested in veterinary medicine, or closely allied branches will give lectures to veterinary students. These lectures render it possible for the students to hear and meet personally some of the leaders of the profession.

SPECIAL COURSE FOR PRACTITIONERS

The last Legislature provided a special fund for courses of instruction for practitioners. Early in the year 1914 the first of these courses will be given. It will include lectures and demonstrations covering some of the newest developments in the science of veterinary medicine. Every practitioner knows that his work is rapidly changing because of scientific investigations being made in all parts of the world. And it is practically impossible for the busy man to keep up with the developments of the subject. It is proposed to arrange the course so that practitioners may spend a few days at Ames and get the latest and best that is being made available in any state or country. At the same time, there will be a rapid
review of some phases of veterinary medicine with reference to the needs of practitioners.

A special announcement of this course will be sent later on application.

STATE BIOLOGICAL LABORATORY

FOR THE PRODUCTION OF HOG CHOLERA SERUM, TOXINES, VACCINES AND BIOLOGICAL PRODUCTS

The last Legislature provided for the establishment of this laboratory in connection with the State College. An important part of its work will be the manufacture and distribution of hog cholera serum and virus. The law requires special instruction before any person is permitted to use virus in the future, and such instruction may be secured in the above mentioned special course.

VETERINARY MEDICAL SOCIETY

The Veterinary Medical Society is an organization of veterinary students. Two meetings are held each month and topics relating to veterinary medicine are discussed. All veterinary students become members and much benefit is derived along literary, social and professional lines.
Division of Engineering
Division of Engineering

ANSON MARSTON, DEAN
SAMUEL WALKER BEYER, VICE-DEAN

The regular instruction work of the Division of Engineering of the college is apportioned among six departments, viz.:

THE DEPARTMENT OF MECHANICAL ENGINEERING.
THE DEPARTMENT OF CIVIL ENGINEERING.
THE DEPARTMENT OF PHYSICS AND ILLUMINATING ENGINEERING.
THE DEPARTMENT OF ELECTRICAL ENGINEERING.
THE DEPARTMENT OF MINING ENGINEERING, CERAMICS, AND CHEMICAL ENGINEERING.

Through these departments the College offers systematic four year and five year courses in MECHANICAL ENGINEERING, CIVIL ENGINEERING, ELECTRICAL ENGINEERING, MINING ENGINEERING AND AND CERAMICS.

The course in AGRICULTURAL ENGINEERING is administered in co-operation with this Division. (See page 128.)

FIVE YEAR ENGINEERING COURSES OF STUDY

The engineering graduates of the Iowa State College have now come to occupy so many positions of responsibility that there has come from them a strong demand for longer and broader training of part of the engineering students, for executive and other positions of large responsibility.

The fact is that in the marvelous advance of civilization in recent years the place of the engineer has become—continually more important, and more and more are responsibilities of the widest character placed upon him. To furnish opportunity for the training of such men, five year engineering courses of study were established a few years ago, and all engineering students who can afford the necessary time and expense are urged to take this course in preference to the four year course.

COURSE IN CERAMICS

At the instance of the Iowa Brick and Tile Manufacturers' Association, and of the Association of Iowa Cemenł Users, the legislature has
passed a law establishing instruction and experimentation along these lines at the State College.

In obedience to the law a four year course of study in Ceramics has been established, and the proper facilities for instruction and experimentation in the lines of cement and clay products have been provided, including the construction of a new building exclusively for this work.

Iowa has great undeveloped resources in these lines which offer an inviting and remunerative field for professional work. We already have more calls for graduates to take remunerative positions in the cement and clay industries than we can possibly supply. The work in Ceramics leads to opportunities not only for securing salaried positions, but also for the ultimate management and ownership of important manufacturing institutions.

**CHEMICAL ENGINEERING**

The chemical facilities required for ceramics instruction and investigation and for the chemical side of the Engineering Experiment Station work have made it possible to offer a good course in Chemical Engineering at small additional expense.

Four years ago a special course in Industrial Chemistry was offered to Junior and Senior students. There appears to be a real demand for the work. This year a course in Chemical Engineering has been revised carefully and definitely outlined for the full four years.

**DEPARTMENT OF PHYSICS AND ILLUMINATING ENGINEERING**

Recently the Department of Physics and Electrical Engineering has been divided into two departments; i.e., Electrical Engineering, and Physics and Illuminating Engineering.

Illuminating Engineering has become so important that it has been necessary to introduce special instruction in the subject. All Electrical Engineering students are required to take the new work for at least one semester, and may take it for two, while students in the Civil and Mechanical Engineering Courses are offered the option of taking work in Illuminating Engineering in the second semester of the Senior year.

**THE ENGINEERING COURSES**

The 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 railroads, manufacturers and other corporations, as well as municipalities 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 that no college course in engineering can give to a student 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 everyday 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 a credit 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 grouped conveniently as culture studies, training or disciplinary studies, professional studies, and practical work.

The culture studies include History, English, Public Speaking, English Literature, Modern Language and Economic Science. 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 must also 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.
Modern Language, either French, German, or Spanish, not only gives access to the technical foreign literature, but also aids the work in English. History and Economic Science cultivate interest in mankind at large and are thus broadening to the student.

The training studies include two or more years of Mathematics and a thorough course in Physics. These studies are the very backbone of engineering education and of the training 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. The training studies include also one or more year's work in Chemistry, where the habits of observing and recording facts are thoroughly instilled.

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 this means students are frequently able to obtain valuable practical experience during their vacations and are thereby, in turn, benefited by acquiring a clearer idea of the usefulness of their college work.

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 experiment station work, as well as the research work carried on by the individual members of the engineering faculty, are devoted to the various industrial interests of the state.

Advanced students are given an opportunity to assist in research or commercial work which is being conducted by the engineering departments.

**FIVE YEAR ENGINEERING COURSES OF STUDY**

The five year engineering courses of study have already been referred to. As compared with the four year courses of study, they contain a much larger amount of general culture subjects, a much wider opportunity for electives, and some advanced engineering work.

The added culture work includes advanced English, advanced History, and nine to twenty-six hours of elective work. This considerable amount
of electives will permit of the selection by each student of general and scientific subjects of such a nature as will be best suited to his particular needs. In addition, there will be opportunity in the advanced courses for the pursuit of advanced engineering work along lines selected by each student.

These five year courses will be of great benefit to those who can pursue them, combining much of the advantages of a general college training with very thorough technical instruction. It is generally admitted that the ideal training for the engineer would be a complete general college course plus a complete engineering course, but the time and expense of the two courses place such ideal training beyond the reach of all but very few. The five year courses will be found to be within the reach of every student, even those who must earn the money to pay their own way through college, and all students are urged to take them.

The five year courses are now arranged so that students already pursuing the four year courses can do the additional year of work, should they so elect at any time while they are in college.

DEMAND FOR I. S. C. ENGINEERING GRADUATES

The engineering graduates of the College are scattered in remunerative and most responsible positions over the entire world. The demand for them is, in normal times, constantly greater than the supply. Many of the seniors are engaged long anterior to commencement.

The graduates are scattered from Panama to Alaska, and from New York to the Philippines, with large representation at the principal centers of engineering work. Their representation at such centers is so large that I. S. C. Alumni Associations are numerous throughout the United States and on both coasts of the same, and one exists even in the Philippine Islands.

THE GEORGE W. CATT ENGINEERING LIBRARY

A signal example of the loyalty to the College of its engineering graduates has been presented in the bequests to the College by Mr. George W. Catt, C. E., '82, who was President of the Atlantic, Gulf and Pacific Dredging Company, and who, on his death, bequeathed to his Alma Mater his extensive engineering and economic libraries and one-half of his large fortune.

The engineering library has been placed in Engineering Hall, in conjunction with the engineering books and periodicals from the general college library, and thus, through Mr. Catt's devotion, the engineering students are afforded free access to the best engineering literature. Extensive use of these library privileges is strongly urged on all engineering students. Only by extensive technical reading, especially of the current periodicals, can one become a worthy member of the engineering profession.
BUILDINGS AND EQUIPMENT

The buildings occupied exclusively by the Division of Engineering are the Engineering Hall, the Engineering Annex, the Structural and Hydraulic Laboratory, the Power Station, the Foundry, the Ceramic Building, the Pattern Shop, the Locomotive Laboratory, the Forge Shop, and the Machine Shop. A new Mechanical Laboratory Building is now under construction. It is hoped to have this ready by September 1, 1913.

COURSES IN ENGINEERING

The following general courses are given by the Dean and Vice-Dean of the Engineering Division, and the Professor of Mechanical Engineering, and are included in the courses of study in each of the engineering departments:

603. Conservation of our Natural Resources. Ways and means not only of preventing unnecessary destruction of our natural resources by unwise use, but also of preventing waste of our natural resources from disuse. Inventory of our natural resources compiled. 6S Recitation 1; credit 1.


801. History of Engineering. The early development of engineering, as traced from history and from the remains of ancient works; development of engineering in later periods and its growth into a separate profession; the effect on civilization, general history and economic problems of the several inventions and other improvements which have marked the development of engineering; study of lives of the more famous engineers; also the development of the general technical principles of engineering. One hour per week. 8S Recitation 1; credit 1.
Department of Mechanical Engineering

WARREN H. MEEKER, PROFESSOR

MARK PERKINS CLEGHORN, CHARLES CURTIS MAJOR, ROY A. NORMAN, ASSOCIATE PROFESSORS

ROY HIRAM PORTER, JESSE GREENLEAF HUMMEL, JOHN THAXTER BATES, ASSISTANT PROFESSORS

EZRA C. POTTER, EDWARD MERRITT SPANGLER, JAMES WILLIAM CAMERON, JOHN A. SAWIN, JOHN HUG, ALOISE F. NICKELS, GEORGE HAMILTON

MONTILLON, REUBEN CHARLES RIEDESEHL, INSTRUCTORS

FRANK ALOIS HILL, STUDENT ASSISTANT

The headquarters of this department are in Engineering Hall. The principal offices are on the second floor. On this floor are a lecture room and a combination lecture and drafting room. On the first floor are two rooms devoted to research work in mechanical engineering. On the fourth floor are two drafting rooms accommodating 160 students at one time, fitted with combination drafting tables, instrument cabinets and boards, providing drawing facilities for 480 students during any semester. In conjunction with these rooms is a commodious office for the instructors in drafting. In addition the department has a common interest in and use of photographic and blue print rooms on the fourth floor, the engineering museum, and the faculty room on the third floor and the assembly room on the second floor.

The drafting and lecture rooms are equipped with ample blackboard space and the offices are fitted with convenient furniture for efficient and accurate 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 Machine Shop, Forge, Foundry, the Pattern Shops, and the Locomotive Laboratory. A Mechanical Laboratory building is now being constructed.

In the Engineering Laboratory the hydraulic laboratory is used conjointly with the Department of Civil Engineering, the first, second and third floors are used for general engineering laboratory work.

Shop Work. Students in mechanical engineering pursue the full course in shop work which consists of six hours per week for three and one-half years. Partial courses are given to students in mining and electrical engineering.

The systems of instruction in the several shops begin 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 in 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 Shop is a new brick building 150 feet long by 45 feet wide and has a main floor and gallery. At one end of the main floor are located a locker room, a reading room and an office. The tool room is placed near the middle of the shop with room enclosed in the gallery above for small stores.

The Machine Shop is equipped with a fifty-one inch vertical boring mill, a twenty-four by twenty-four inch planer, a twelve by forty-eight inch Universal milling machine, a six by thirty inch milling machine, a universal grinding machine, a shaper, a drill press, two emery grinders, a polishing wheel, a power hack saw, cut-off machine, sixteen 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 fireproof room is provided for patterns. The equipment of the pattern shop consists of a universal buzz saw, a mortising machine, planer, buzz planer, joiner, band saw, jig saw, core box machine, sander, grindstone, two pattern makers’ lathes, fifteen turning lathes, benches for thirty students, thirty 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 foundry equipment is housed 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 and castings. A cupola and blower for melting cast iron, a brass furnace, a core oven, core benches, twenty-four sets of moulder’s tools, crucibles, and a large assortment of flasks are used for foundry work.

The Forge Shop is housed in a brick building thirty-eight by seventy-eight feet, with a store room. Thirty forges, an oil burning, annealing, and tempering furnace, donated by the Rockwell Engineering Company, blower and exhaust fan, drill press, screw press, power hammer, punch and shear, vises, anvils, grindstones and small tools, such as sledges, fullers, swages, and swage blocks, constitute the equipment for forge work.

Electric motors supply power for the forge shop and the foundry.

Students are advised to work in outside shops during their vacations. Credit is frequently given on work required in the regular course for such commercial experience.

Drafting. The regular drafting room work of the courses begins with mechanical drawing given in the first semester of the Freshman year. This is followed successively by projective drawing, machine sketching and
detailing, kinematic drawing, and designing. The last two years of the courses are given up to designing.

The object sought by the drafting room courses 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 drafting rooms on the fourth floor of Engineering Hall and a part of the combination drafting and lecture room on the second floor of the same building are equipped with fifty combination drafting tables, each accommodating four students at once. The drafting 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 drawings, instruments, and supplies. Extra drafting 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, transverse, torsion, and compression tests of materials;
- Calibration of steam gauges, indicator springs, weirs, and dynamometers;
- Study and analysis of lubricants, and flue gases;
- Calorimeter analysis of steam and fuels;
- Indicator practice;
- Corliss and slide valve setting;
- Efficiency tests of water wheels, injectors, pumps, fan blowers, steam engines, boilers, gas producer and engine, gasoline engines, and steam heating, electric lighting, refrigerating, power, and pumping plants;
- Together with special investigations on current topics. Tests on power plants outside of the College are frequently made. 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 theses by students in the engineering courses.

The Central Heating and Power Station contains the complete electric light, power and pumping plants of the College, all of which are available for experimental work. In the power station are two 264-H. P. Cahall horizontal water tube boilers, with Roney mechanical stokers with induced draught, four 500-H. P. Sterling boilers with Green chain grates, a 250-H. P. Corliss engine direct connected to 150 K. W. generator, a 400-H. P. Corliss engine direct connected to a 250 K. W. generator, a 75-H. P. Straight Line engine, a 50-H. P. Ball engine, with five electric generators for 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 50-H. P. Fairbanks, Morse & Co.'s suction gas producer and engine equipped with absorption
brake, a 25-H. P. Harris Corliss engine, with Alden absorption brake, a 15-H. P. Payne slide valve engine, a 10-H. P. Otto gasoline engine, a 12-H. P. Olds gas engine, a 6-H. P. Mietz & Weiss engine, two 2 cycle gasoline engines each of 2-H. P. capacity, a 1½-H. P. 4 cycle gasoline engine, an Ericsson hot air engine, a Wheeler condenser, one Worthington and three other water meters, two Venturi meters, a Pelton water motor, a Doble water wheel, a Holley duplex pump, a Morris Machine Works centrifugal pump, injectors, weir and weighing tanks, gas meters, a Crosby steam gauge tester, fan blowers for experimental work, a Westinghouse air pump, a 100,000-pound Riehle testing machine with Gray autographic device, a 50,000-pound Olsen testing machine, an Olson torsion testing machine, a Doolittle Viscosimeter, a Scott’s Viscosimeter, a Thurston oil tester, a complete De La Vergne refrigerating machine, gas and air analysis apparatus, anemometers, two Thompson, five Crosby, two Star, and one Richards steam indicator, two Lippincott ammonia indicators, dynamometers, Prony brakes, Parr coal calorimeter, platform scales and other apparatus essential and accessory to experimental engineering.

The Hydraulic Laboratory is supplied with 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. In the laboratory a tank is provided 50 feet long by 6 feet wide by 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 & 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, one of the first in service on the mountain roads of Colorado. The valve mechanism is of the Waelschert type and
the drivers and leading wheels are on a truck with cylinders entirely separate from the boilers.

This engine is a very interesting machine and will be the nucleus for a museum of railway mechanical engineering.

Class Room Work. In the class room the work is carried on by means of recitations and lectures, a text book and recitation 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. The projective lantern is freely used in illustrating subjects presented by lecture.

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.

Non-Resident Lecturers. 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 professional engineer and the problems of modern engineering.

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 to whom the thesis must be first of all an opportunity to think for himself and to apply the 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 all lines.

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 IN MECHANICAL ENGINEERING

Four Year Course in Mechanical Engineering

This course leads to the degree of Bachelor of Science in Mechanical Engineering. Graduates from this course may receive the full professional degree of Mechanical Engineer by devoting one year to resident study and one year to a responsible engineering position and presentation of a satisfactory thesis, or by five years' service in responsible engineering work and presentation of thesis.
N. B. Engineering Course numbers. The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

*Freshman Year

FIRST SEMESTER

Required
Semester Hours

| Mathematics 40, | Algebra | 3 |
| Mathematics 41, | Plane Trigonometry | 2 |
| Modern Languages, | Language selected must be carried through the entire year. | |
| Language 18 or 57, | French | 3 |
| Language 20 or 5a, | German | 3 |
| Language 36 or 33, | Spanish | 3 |
| Literature 15, | English | 3 |

* Freshmen who show deficient preparation in English or Mathematics may be assigned by the Dean of the Junior College and the Dean of Engineering, to special classes, with one hour more work than indicated above, and in case of clear indication of failure in either of these subjects, even with this arrangement, they will be dropped from the Freshman work in this line until they have given proof of sufficient preparation to enable them to carry the work successfully.

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

| English 11, | Exposition | 3 |
| Chemistry 41, | General Chemistry | 3 |
| Mechanical Engineering 121, | Mechanical Drawing | 2 |
| Mechanical Engineering 130, | Forge Work | 2 |
| Mechanical Engineering 117, | Technical Lecture | R† |
| Military 1, | Military Drill | R |
| Physical Training 101, | Gymnasium Work | R |

Total semester hours 18

† R indicates a subject which is required but for which no credit is allowed.

SECOND SEMESTER

Required
Semester Hours

| Mathematics 42, | Trigonometry | 2 |
| Mathematics 43, | Analytical Geometry | 3 |
| Modern Languages, | | |
Language selected must be a continuation of the one chosen in first semester.

- Language 19 or 58,
- Language 21 or 6a,
- Language 37 or 34,
- Literature 16,
- English 10,
- Chemistry 42,
- Mechanical Engineering 220,
- Mechanical Engineering 232,
- Mechanical Engineering 218,
- Military 2,
- Physical Training 202,
- Spanish
- German
- French
- English
- Narration and Description
- General Chemistry
- Descriptive Geometry
- Foundry Work
- Technical Lecture
- Military Drill
- Gymnasium Work

Total semester hours 18

Sophomore Year

THIRD SEMESTER

- Mathematics 44,
- English 12,
- Chemistry 43,
- Physics 303,
- Mechanical Engineering 331,
- Mechanical Engineering 322,
- Analytical Geometry and Calculus
- Argumentation
- Qualitative Chemistry
- Mechanics and Heat
- Elementary Pattern Work
- Mechanical Drawing

Total semester hours 18

FOURTH SEMESTER

- Mathematics 45,
- Chemistry 45,
- Physics 404,
- Mechanical Engineering 401,
- Mechanical Engineering 437,
- Mechanical Engineering 439,
- Mechanical Engineering 423,

Required Semester Hours

- Differential and Integral Calculus 5
- Analytical Chemistry 2
- Electricity and Magnetism and Light and Sound 5
- Analytical Mechanics 3
- Advanced Pattern Work 1
- Steam Fitting Work 1
- Mechanical Drawing 1
- Military Drill 1
- Gymnasium Work 1

Total semester hours 18
### Junior Year

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
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<tbody>
<tr>
<td><strong>Mechanical Engineering 502</strong>, Analytical Mechanics</td>
<td>5</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 503</strong>, Materials of Construction</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 541</strong>, Descriptive Engineering</td>
<td>2</td>
</tr>
<tr>
<td><strong>Electrical Engineering 506</strong>, Principles of Electrical Engineering</td>
<td>3</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 524</strong>, Valve Gear Design</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 519</strong>, Mechanical Drafting</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 512</strong>, Mechanical Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 533</strong>, Machine Work</td>
<td>2</td>
</tr>
<tr>
<td><strong>Physics 523</strong>, Physical Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total semester hours 18**

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical Engineering 606</strong>, Hydraulics, Reinforced Concrete</td>
<td>5</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 605</strong>, Machine Design</td>
<td>3</td>
</tr>
<tr>
<td><strong>Engineering 603</strong>, Conservation of Natural Resources</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 642</strong>, Descriptive Engineering</td>
<td>1</td>
</tr>
<tr>
<td><strong>Electrical Engineering 610</strong>, Direct Current Machinery</td>
<td>3</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 625</strong>, Designing</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 634</strong>, Machine Work</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 613</strong>, Mechanical Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td><strong>Physics 615</strong>, Physical Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total semester hours 18**

Optional:

Students obtaining approval of the head of the department may classify, during any semester of the Junior or Senior years, in one to three hours of optional, technical or culture work.

### Senior Year

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering 702</strong>, Specifications and Contracts</td>
<td>1</td>
</tr>
<tr>
<td>[2{<strong>Mechanical Engineering 710</strong>, Gas Engines and Producers }</td>
<td>3</td>
</tr>
<tr>
<td>[2{<strong>Mechanical Engineering 704</strong>, Heat Engines }</td>
<td>3</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 707</strong>, Heating and Ventilation</td>
<td>2</td>
</tr>
<tr>
<td><strong>Electrical Engineering 715</strong>, Alternating Current Machinery</td>
<td>3</td>
</tr>
<tr>
<td><strong>Economic Science 9</strong>, Outlines of Economics</td>
<td>3</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 726</strong>, Designing</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering 735</strong>, Machine Work</td>
<td>2</td>
</tr>
</tbody>
</table>
Mechanical Engineering 714, Mechanical Engineering Laboratory 1
Electrical Engineering 717, Electrical Engineering Laboratory 1
Mechanical Engineering 743, Mechanical Engineering Seminar R
Mechanical Engineering, Thesis begun R

Total semester hours 18

EIGHTH SEMESTER

Required Semester Hours

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering 801,</td>
<td>1</td>
</tr>
<tr>
<td>Mechanical Engineering 809,</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 808,</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 811,</td>
<td>4</td>
</tr>
<tr>
<td>[Civil Engineering 855,</td>
<td>2</td>
</tr>
<tr>
<td>Water Supply Engineering]</td>
<td></td>
</tr>
<tr>
<td>[Mechanical Engineering 815,</td>
<td>1</td>
</tr>
<tr>
<td>Mech. Eng. Laboratory]</td>
<td></td>
</tr>
<tr>
<td>[Physics 810,</td>
<td>3</td>
</tr>
<tr>
<td>Illuminating Engineering]</td>
<td></td>
</tr>
<tr>
<td>[Mechanical Engineering 827,</td>
<td>3</td>
</tr>
<tr>
<td>Designing]</td>
<td></td>
</tr>
<tr>
<td>[Mechanical Engineering 828,</td>
<td>3</td>
</tr>
<tr>
<td>Designing]</td>
<td></td>
</tr>
<tr>
<td>Electrical Engineering 818,</td>
<td>1</td>
</tr>
<tr>
<td>Mechanical Engineering 844,</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours 18

Optional:

Students obtaining approval of the head of the department may classify, during any semester of the Junior or Senior years, in one to three hours of optional, technical or culture work.

Suggested Senior College Optionals

(The number before the parenthesis indicates the course number. The number in the parenthesis indicates the number of recitations per week).

FALL SEMESTER

Agricultural Engineering 5 (2).
Agricultural Journalism (Engineering Journalism) 10 (2).
Civil. Engineering 723 (2), 751 (2), 761 (2).
Economic Science 12 (2).
English 13 (2).
History 20 (2).
Literature 10 (2).
Physics 708 (2).
Psychology 10 (2).
Public Speaking 10 (2).

SPRING SEMESTER

Civil Engineering 863 (2).
English 14 (2).
History 20 (2).
Literature 19 (2).
Physics 809 (3), 810 (3).
Psychology 10 (2).
Public Speaking 11 (2).
FIVE-YEAR COURSE IN MECHANICAL ENGINEERING

The following five-year course in Mechanical Engineering is offered in response to a demand for an engineering course giving the student a better education in the culture studies and the natural sciences together with an opportunity to specialize along certain engineering lines not possible in the time available in the four-year course of study. The course includes all of the work given in the four-year course and in addition twenty-four hours of culture and scientific studies, together with ten hours of work given in the engineering departments.

This course leads to the same degree granted to graduates of the four-year course, but a graduate may obtain the full professional degree of Mechanical Engineer after one year of responsible professional work and the presentation of a satisfactory thesis.

N. B. Engineering Course Numbers.—The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

### Freshman Year

#### FIRST SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40,</td>
<td>Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 41,</td>
<td>Plane Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>Modern Language,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Language selected must be carried through the entire year.

\[
\begin{align*}
\text{Choice} & \quad \text{Language 18 or 57,} & \quad \text{French} & \quad 3  \\
& \quad \text{Language 20 or 5a,} & \quad \text{German} & \quad 3  \\
& \quad \text{Language 36 or 33,} & \quad \text{Spanish} & \quad 3  \\
& \quad \text{Literature 15,} & \quad \text{English} & \quad 3  \\
\end{align*}
\]

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 11,</td>
<td>Exposition</td>
<td>3</td>
</tr>
<tr>
<td>History 5,</td>
<td>History of Modern Europe</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 121,</td>
<td>Mechanical Drawing</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering 130,</td>
<td>Forge Work</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering 117,</td>
<td>Technical Lecture</td>
<td>R</td>
</tr>
<tr>
<td>Military 1,</td>
<td>Drill</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>
### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 42</td>
<td>2</td>
</tr>
<tr>
<td>Math 43</td>
<td>3</td>
</tr>
<tr>
<td>Modern Language,</td>
<td></td>
</tr>
<tr>
<td>Language selected must be a continuation of the one chosen in the first semester.</td>
<td></td>
</tr>
<tr>
<td>Language 19 or 58</td>
<td>French 3</td>
</tr>
<tr>
<td>Language 21 or 6a</td>
<td>German 3</td>
</tr>
<tr>
<td>Language 37 or 34</td>
<td>Spanish 3</td>
</tr>
<tr>
<td>Literature 16</td>
<td>English 3</td>
</tr>
<tr>
<td>English 10</td>
<td>Narration and Description 3</td>
</tr>
<tr>
<td>History 8</td>
<td>History of the United States 1763-1912 3</td>
</tr>
<tr>
<td>Mechanical Engineering 220</td>
<td>Descriptive Geometry 2</td>
</tr>
<tr>
<td>Mechanical Engineering 232</td>
<td>Foundry Work 2</td>
</tr>
<tr>
<td>Mechanical Engineering 218</td>
<td>Technical Lecture R</td>
</tr>
<tr>
<td>Military 2</td>
<td>Drill R</td>
</tr>
</tbody>
</table>

**Sophomore Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 44</td>
<td>Analytical Geometry and Calculus 5</td>
</tr>
<tr>
<td>English 12</td>
<td>Argumentation 2</td>
</tr>
<tr>
<td>Chemistry 2</td>
<td>General Chemistry 5</td>
</tr>
<tr>
<td>Mechanical Engineering 322</td>
<td>Mechanical Drawing 1</td>
</tr>
<tr>
<td>Mechanical Engineering 331</td>
<td>Elementary Pattern Work 2</td>
</tr>
<tr>
<td>History 17</td>
<td>The American People 1</td>
</tr>
<tr>
<td>Elective</td>
<td>Non-technical work 2</td>
</tr>
<tr>
<td>Military 3, or Athletics</td>
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</tbody>
</table>

**FOURTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 45</td>
<td>Differential and Integral Calculus 5</td>
</tr>
<tr>
<td>Chemistry 5</td>
<td>Qualitative Analysis 5</td>
</tr>
<tr>
<td>Mechanical Engineering 423</td>
<td>Mechanical Drawing 1</td>
</tr>
<tr>
<td>Mechanical Engineering 437</td>
<td>Advanced Pattern Work 1</td>
</tr>
<tr>
<td>Mechanical Engineering 439</td>
<td>Steam Fitting Work 1</td>
</tr>
<tr>
<td>History 18</td>
<td>Political Parties and Party Leaders 1</td>
</tr>
<tr>
<td>Elective</td>
<td>Non-technical Work R</td>
</tr>
<tr>
<td>Military 4, or Athletics</td>
<td></td>
</tr>
</tbody>
</table>
**Junior Year**

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 503 (303), Mechanical Engineering 503, Mechanical Engineering 519, Economic Science 9, Civil Engineering 545 (345), Mechanical Engineering 533, Mechanical Engineering 524, Mechanical Engineering 541,</td>
<td>Semester Hours</td>
</tr>
<tr>
<td>Mechanics and Heat, Materials of Construction, Mechanical Drafting, Outlines of Economics, Surveying, Machine Work, Valve Gear Design, Descriptive Engineering</td>
<td>5, 2, 1, 3, 2, 1, 2</td>
</tr>
<tr>
<td></td>
<td>18</td>
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</tbody>
</table>

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 604 (404), Mechanical Engineering 601 (401), Economic Science 12, Civil Engineering 646 (446), Mechanical Engineering 634, Mechanical Engineering 642, Elective:</td>
<td>Semester Hours</td>
</tr>
<tr>
<td>Electricity and Magnetism, Light and Sound, Analytical Mechanics, Engineering Economics, Surveying, Machine Work, Descriptive Engineering, Non-technical Work</td>
<td>5, 3, 3, 2, 2, 1, 2</td>
</tr>
<tr>
<td></td>
<td>18</td>
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</tbody>
</table>

**Senior Year**

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 702 (502), Electrical Engineering 706 (506), Mechanical Engineering 707, Physics 723 (523), Mechanical Engineering 712 (512), Mechanical Engineering 735, Mechanical Engineering 726, Elective:</td>
<td>Semester Hours</td>
</tr>
<tr>
<td>Analytical Mechanics, Principles of Electrical Engineering, Heating and Ventilating, Physical Laboratory, M. E. Laboratory, Machine Work, Designing, Non-technical Work</td>
<td>5, 3, 2, 1, 1, 2, 2</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>
### Eighth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering 803 (603), Mechanical Engineering 806 (606), Mechanical Engineering 805 (605), Electrical Engineering 810 (610), Physics 815 (615), Mechanical Engineering 813 (613), Mechanical Engineering 825 (625), Physics 810,</td>
<td>Conservation of Natural Resources 1</td>
</tr>
<tr>
<td></td>
<td>Hydraulics-Reinforced Concrete 5</td>
</tr>
<tr>
<td></td>
<td>Machine Design 3</td>
</tr>
<tr>
<td></td>
<td>Direct Current Machinery 3</td>
</tr>
<tr>
<td></td>
<td>Physical Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>M. E. Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>Designing 1</td>
</tr>
<tr>
<td></td>
<td>Illuminating Engineering 3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong> 18</td>
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</tbody>
</table>

### Post-Senior Year

#### Ninth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering 902 (702), Mechanical Engineering 904 (704), Mechanical Engineering 910 (710), Electrical Engineering 915 (715), Civil Engineering 921 (721), Mechanical Engineering 914 (714), Electrical Engineering 920 (720), Mechanical Engineering, Elective:</td>
<td>Specifications and Contracts 1</td>
</tr>
<tr>
<td></td>
<td>Heat Engines 3</td>
</tr>
<tr>
<td></td>
<td>Gas Engines and Producers 3</td>
</tr>
<tr>
<td></td>
<td>Alternating Current Machinery 3</td>
</tr>
<tr>
<td></td>
<td>Sanitary Engineering 3</td>
</tr>
<tr>
<td></td>
<td>M. E. Laboratory 1</td>
</tr>
<tr>
<td></td>
<td>E. E. Laboratory 2</td>
</tr>
<tr>
<td></td>
<td>Thesis subject R</td>
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<tr>
<td></td>
<td><strong>Total</strong> 18</td>
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</tbody>
</table>

### Tenth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering 1001 (801), Mechanical Engineering 1009 (809), Mechanical Engineering 1008 (808),</td>
<td>History of Engineering 1</td>
</tr>
<tr>
<td></td>
<td>Constructive Engineering 3</td>
</tr>
<tr>
<td></td>
<td>Railway Mechanical Engineering 3</td>
</tr>
</tbody>
</table>
Civil Engineering 1055 (855), Water Supply Engineering 2
Electrical Engineering 1015 (815), Alternating Current Machinery 3
Electrical Engineering 1018 (818), E. E. Laboratory 1
Choice
Mechanical Engineering 1027 (827), Designing 3
Mechanical Engineering 1028 (828), Designing 3
Mechanical Engineering 1011 (811), Thesis 4

COURSES IN MECHANICAL ENGINEERING

N. B. Engineering Course Numbers. The number in hundreds place indicates the semester in which the subject is taught.

1S. Recitation 1.

121. Mechanical Drawing. Use of drawing instruments, practice in lettering, and making working drawings:
1S. Labs. 2, 3 hr.; credit 2.

130. Shop Work. Forge work, forging and welding iron and steel, and dressing and tempering tools.
1S. Labs. 2, 3 hr.; credit 2; fee $5.00.

1S. Lab. 1, 3 hr.; credit 1.

218. Technical Lecture. Course in connection with required shop work. Study of shop methods, tools and appliances. Three lectures of this course are given by college librarian on explanation of the catalogue system and the use of reference books.
2S. Recitation 1; credit 1.

220. Descriptive Geometry. Study of the principles of projection of the point, line, and plane. The principles are illustrated and fixed in mind by the solution of numerous familiar examples to show the practical application of the subject.
2S. Prerequisites 121 or 181; recitation 1, lab. 1, 5 hr.; credit 2.

2S. Labs. 2, 3 hr.; credit 2; fee $5.00.

3S. Prerequisites 121 and 220; lab. 1, 3 hr.; credit 1.

331. Shop Work. Pattern work, principles of joinery, wood turning and carving as applied to the making of simple patterns and core boxes for iron, brass and aluminum castings.
3S. Prerequisite 232; labs. 2, 3 hr.; credit 2; fee $5.00.
382. **Mechanical Drawing.** Machine sketching and detailing.

3S. Prerequisites 121 and 230; labs. 2, 3 hr.; credit 2.


4S. Prerequisites Math. 325 and 426; recitations 3, credit 3.

423. **Mechanical Drawing.** Working drawings, tracings, blue prints of complete machines and their details.

4S. Prerequisite 322; lab. 1, 3 hr.; credit 1.

433. **Shop Work.** Same as 533.

4S. Prerequisite 130; labs. 2, 3 hr.; credit 2; fee $5.00.

437. **Shop Work.** Advanced pattern making, gearing, sweep and molding machine work.

4S. Prerequisite 331; lab. 1, 3 hr.; credit 1; fee $2.00.

439. **Shop Work.** Steam fitting and plumbing, cutting and making up threaded, flanged and leaded joints with standard fittings.

4S. Lab. 1, 3 hr.; credit 1; fee $3.00.


5S. Prerequisite 401; recitations 5; credit 5.


5S. Prerequisites Chem. 5 or 45; recitations 2; credit 2.


5S. Prerequisites 401 and Chem. 5 or 42; lab. 1, 4 hr.; credit 1; fee $3.00.

516. **Laboratory.** Calibration of instruments, indicator practice, valve setting, engines and pumps, efficiency tests, steam and gasoline engines, boilers and pumps. Specially arranged for Junior students in Mining Engineering.

5S. Prerequisites Chem. 5 or 42 and 502; lab. 1, 4 hr.; credit 1; fee $3.00.

519. **Mechanical Drafting.** Working drawings of machine details and elementary empirical and theoretical machine design.

5S. Prerequisite 423; lab. 1, 3 hr., credit 1.

524. **Valve Gear Design.** Kinematics and valve gear design.

5S. Prerequisite 423; lab. 1, 3 hr.; credit 1.

533. **Shop Work.** Use of hand and machine tools for working iron, steel and brass, finishing and assembling of machines and parts thereof.

5S and 8S. Prerequisite 130; labs. 2, 3 hr.; credit 2; fee $5.00.

541. **Descriptive Engineering.** Study and written reports on engineering processes, methods and current engineering construction. References; magazines, journals, and proceedings of engineering societies.

5S. Prerequisite English 10, 11, 12; recitations 2; credit 2.

584. **Steam Engines and Boilers.** Construction, operation and


606. Hydraulics-Reinforced Concrete. Principles of analytical mechanics applied to design and construction of hydraulic apparatus and machinery and to plain and reinforced concrete construction. Text books, Treatise on Hydraulics, Hughes and Safford; Principles of Reinforced Concrete, Turneaure and Maurer.

613. Laboratory. Continuation of course 512.

625. Designing. Design of steam boilers, study of forms, strength and proportions of the frames and moving parts of punches, and other machines with detailed drawings of same. Reference books, Mechanical Engineers' Pocket-Book, Kent; Cambria Steel, Cambria Steel Co.

634. Shop Work. Course 533 continued.

642. Descriptive Engineering.


704. Heat Engines. Theory of heat energy and its practical application to the steam and other heat engines. Text books, Applied Thermodynamics for Engineers, Ennis; Steam Tables and Diagrams, Marks and Davis.


710. Gas Engines and Producers. Theory, design and operation of the modern internal combustion engine and gas producer. Text book, Modern Gas Engine and Producer, Levin. Students choosing this course will continue the same line of work by choosing 828 in the second semester of the Senior year.

714. Laboratory. Efficiency tests of steam, gas, gasoline and hot air engines, boilers, refrigerating machinery and complete plants.

726. Designing. Computation and design of heating and ventilating plants and apparatus.
735. **Shop Work.** Advanced machine work, milling, grinding, fitting and assembling.

7S. Prerequisite 634; labs. 2, 3 hr.; credit 2; fee $5.00.

743. **Seminar.** Written papers and discussions of assigned topics.

7S. Recitation 1; no credit.


7S. Prerequisites 502, 503, and 512; recitations 2; credit 2.


8S. Prerequisites 605, 613, and 625; recitations 3; credit 3.


8S. Prerequisite 704 or 584; recitations 3; credit 3.

811. **Thesis.** This course is devoted to special work on an approved topic to be selected before the end of the first semester of the Senior year. Taken by those students of the Mechanical Engineering Department who have completed the work of the Junior year. Expenses of the thesis are adjusted by special arrangement in each case.

8S. Labs. 4, 3 hr.; credit 4.

815. **Laboratory.**

8S. Prerequisite 714; lab. 1, 4 hr.; credit 1; fee $3.00.


8S. Prerequisite work of Jr. year; lab. 3, 3 hr.; credit 3.


8S. Prerequisite work of Jr. year and 710; labs. 3, 3 hr.; credit 3.

844. **Seminar.** Written papers and discussions of assigned topics. One meeting per week.

8S. Recitation 1; no credit.

884. **Steam Engines and Boilers.** Construction, operation and maintenance of standard types of steam engines and boilers. Text book, Steam Power Plant Engineering, Gebhardt.

8S. Recitation 2; credit 2.

887. **Gas Engine Construction and Operation.** Optional for Senior College students in Engineering. A study of types, construction, operation and management of the internal combustion engine. The laboratory work will familiarize the student with the construction of such engines, enabling him to assemble, adjust, repair and test for power and fuel consumption.

8S. Recitation 1; lab. 1, 4 hr.; credit 2; fee $2.00.
Department of Civil Engineering

ANSON MARSTON, PROFESSOR
JOHN EDWARD KIRKHAM, ASSOCIATE PROFESSOR, STRUCTURAL ENGINEERING
EVERTT EDGAR KING, ASSOCIATE PROFESSOR, RAILWAY ENGINEERING
HOWARD CARLTON FORD, ASSOCIATE PROFESSOR, SURVEYING, ASTRONOMY AND GEODESY
MORRIS IRWIN EVINGER, ASSISTANT PROFESSOR, HYDRAULIC AND SANITARY ENGINEERING
ROY WINCHESTER CRUM, ASSISTANT PROFESSOR, EXPERIMENTAL ENGINEERING
CHARLES ALTON BAUGHMAN, INSTRUCTOR
ROLLAND SCHANEL WALLIS, INSTRUCTOR
CLAUDE CARLYLE COYKENDALL, INSTRUCTOR
BRUCE A. COLE, MECHANICIAN

The Department of Civil Engineering has its headquarters in 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 a large class room and a large drawing room in the third story, and a drawing room 40 feet by 70 feet, and a large class room in the fourth 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 and Library in the third story, and the large Assembly Room in the second story. All of these rooms are finely furnished and equipped throughout.

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 Engineering Hall, part of the equipment of the Department is placed in the Engineering Annex. Here are located two large drawing rooms, one recitation room, one instrument room, and two offices, occupied by the departments of surveying and drawing.

In addition, the Department has in Engineering Annex, in conjunction with the Electrical Engineering Department, a repair shop, with the services of a mechanician.

The laboratory work of the Civil Engineering Department is located in the Structural and Hydraulic Laboratory Building, a three story brick structure which will be given over entirely, in the near future, to the Civil Engineering Department and the Engineering Experiment Station.

Surveying Equipment. Instrumental surveying equipment is kept in a large instrument room on the ground floor of the Engineering Annex where fifty steel lockers have been provided. By means of the lockers, a bulletin board, and a dispensing room, the instruments are let out and returned in a rapid and systematic manner. The system is as nearly
automatic as possible and results in a great saving of time to both instructors and students, and in an increase in the amount and thoroughness of the work done.

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.

The instrumental equipment includes sixteen engineers’ transits, one plain transit, one astronomical transit, one 7-inch theodolite, one precise level, U. S. Coast Survey type, and two rods of U. S. Geological Survey pattern, two plane tables, four surveyor’s compasses, one railroad compass, one solar compass, six traverse tables, thirteen engineer’s levels, one Level Tester, and numerous chains, tapes, chaining pins, range-poles, level rods, stadia rods, axes, 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.

The Structural and Hydraulic Laboratory. Another important part of the equipment of the department is placed in the Structural and Hydraulic Laboratory. On the top floor of this building are located the offices of the Civil Engineering Laboratory work, together with the cement laboratory. The hydraulic laboratory and structural laboratory occupy two large rooms on the first and second floors respectively, which are also used in part by the Mechanical Engineering Department. The hydraulic laboratory is located in the basement and first floor.

The Roads and Paving Laboratory. The College is fully equipped for the testing of all road materials, including sand, gravel, cement, brick, stone, and bituminous materials. The equipment is partly located in the Structural and Hydraulic Laboratory Building, and partly in the Ceramics Building. This laboratory is partially equipped and operated by the Iowa Highway Commission.

The Cement Laboratory. The cement laboratory is located in the top story of the Structural and Hydraulic Laboratory Building. Stone topped tables are provided on which the mixing and breaking of briquettes and similar work are done. Devices underneath these tables provide for the storing of briquettes. Investigations are constantly under way with cement and similar substances and the cement testing work of the Engineering Experiment Station is carried on in this laboratory. Two cement testing machines are used for breaking the briquettes. There is an ample supply of molds for making the briquettes. Electric ovens and heating appliances are provided for soundness tests of cement, and for absorption tests, etc. The equipment includes two moist closets.

The Hydraulic Laboratory is located in the basement and first story of the Structural and Hydraulic Laboratory. The basement is lined with enameled brick. In the floor above is a large railed opening to the basement occupying about one-third of the floor space. The floors and
columns are of reinforced concrete. 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.

To supply the water at perfectly uniform pressure and at different moderate heads for experimental work, a steel stand pipe is provided, thirty inches in diameter by 40 feet high.

The waste water from all the apparatus discharges into a tank six feet wide by four feet deep by fifty feet long, located in the floor of the basement.

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.

Structural Laboratory Facilities for other tests of the materials of construction are provided in connection with the Mechanical Engineering Department in the same building. A 100,000 lbs. tension and compression machine, a 100,000 lbs. transverse machine, a 60,000- and a 20,000-lbs. tension and compression machine, a torsion testing machine, a 20,000 lbs. wire testing machine, a 10,000 lbs. transverse machine, and other apparatus are available. Two large laboratory rooms, rooms for computations, instrument rooms, and offices are provided.

Standard Engineering Plans. The Department has a large collection of blue prints 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 works 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.

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 State. 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 available for tests of the efficiency.

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.

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 the 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. Many of the calls for men to fill good positions come from the older Alumni themselves.

The nature of the positions open to new graduates may be seen from those occupied by one class one year after graduation. Of this class eleven were engaged in railway engineering in the states of Iowa, Illinois, Nebraska, South Dakota, Idaho, New Mexico, Arizona and Washington; two were engaged in reinforced concrete work in Iowa and New York respectively; four were in Panama on the Panama Canal work; one was employed on the Government Civil Engineering work in the Philippine Islands; two were employed with consulting engineers in general engineering practice in Texas and New York respectively; four were employed in irrigation engineering work in Wyoming, Montana, and California; four were employed in structural engineering work in St. Louis, Chicago, and Ambridge, Penn.; one was engaged in water works construction in Iowa, and one was an instructor at the Iowa State College. The salaries of these men ranged up to $125 per month. The salaries of the successful older graduates usually range from $3,000 to $10,000 per year.

During the year we usually have calls, for men, under normal business conditions, considerably exceeding the total number of the graduating class.

Civil Engineering Course of Study. This course includes a very careful study of English, Modern Language, either French, German or Spanish, History, Economic Science, pure and applied Mathematics, Physics, Geology and Chemistry, together with the professional studies in Civil Engineering.

For detailed information as to the nature of the professional work given in the course of Civil Engineering, the reader is referred to the statements regarding each specific subject under the head of "Courses" below. 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 drafting office. Special attention is paid to Lettering 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, six hours per week, with the exception of the second term of the Freshman year, when only three hours are devoted to Field Practice. The student becomes familiar with the various instruments and methods by actually using them. Starting with the simplest problems—pacing, ranging, chaining, and compass work, he gradually works up to the use of the transit, level, and other instruments of greater accuracy and delicacy. He becomes familiar with land surveying, leveling, topographical surveying and railroad surveying by actual work in the field. It is the aim of the course to give the student that 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 remunerative 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 for two summers, but each student must attend at least one summer surveying camp. 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, Topographical, City and Mining Surveying, runs throughout the Sophomore year and one in Railway Engineering runs throughout the Junior year.

Electric Railways and Power Transmission are also studied in the Junior year, and Steam Engines and Boilers in the Senior year.

Instruction in Roads and Pavements is given in the first semester of the Senior year, Sanitary Engineering, Water Works Engineering, Water Power Engineering, Irrigation and Drainage 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 information 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, reinforced concrete, 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 student with methods of testing and with the properties of the materials of construction. Special instruction in reinforced concrete is given in the Senior year.
General instruction in engineering practice and in the spirit of the profession is given by courses of technical lectures in the Freshman and Sophomore years, and by Seminar work in the Junior and Senior years.

Besides the work as given in the outlined course of study, the student in Civil Engineering gains a part of his experience and training 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 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.

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.

Civil Engineering Society. A Civil Engineering club composed of Senior and Junior Civil Engineering students has been organized with a membership of more than 100. This club holds regular meetings every two weeks, at which addresses are given by representative engineers secured from outside places, or, in some cases, programs are prepared by the members of the society. The society has been very successful, and is a very important factor in the training of civil engineers in this college.

FOUR YEAR COURSE IN CIVIL ENGINEERING

The four year Civil Engineering Course, as given below, leads to the degree of Bachelor of Science in Civil Engineering. Graduates of this four year course can secure the advanced degree of Civil Engineer on the completion of five years of successful professional work and the presentation of a satisfactory thesis, or by taking one year of graduate work at the College, completing one year of satisfactory professional work and presenting a satisfactory thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40,</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 41,</td>
<td>2</td>
</tr>
<tr>
<td>Modern Languages,</td>
<td></td>
</tr>
</tbody>
</table>
The Language selected must be carried through the entire year.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Language</th>
<th>Language 18 or 57, French</th>
<th>Language 20 or 5a, German</th>
<th>Language 36 or 33, Spanish</th>
<th>Literature 15, English</th>
</tr>
</thead>
</table>

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

English 11, Exposition 3
Chemistry 41, General Chemistry 3
Civil Engineering 102, Field Work 2
Civil Engineering 141, Technical Lecture R†
Civil Engineering 181, Drawing 2
Physical Training 101, Military Drill R

Total semester hours 18

* Freshmen who after four weeks review of fundamentals, show deficient preparation in English or Mathematics may be assigned by the Dean of the Junior College and the Dean of Engineering, to special classes, with one hour more work than indicated above, and in case of clear indication of failure in either of these subjects, even with this arrangement, they will be dropped from the Freshmen work in this line until they have given proof of sufficient preparation to enable them to carry the work successfully.

† R indicates a subject which is required, but for which no credit is allowed.

SECOND SEMESTER

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42, Trigonometry 2</td>
</tr>
<tr>
<td>Mathematics 43, Analytical Geometry 3</td>
</tr>
<tr>
<td>Modern Languages,</td>
</tr>
</tbody>
</table>

The Language selected must be a continuation of the one chosen in the first semester.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Language</th>
<th>Language 19 or 58, French</th>
<th>Language 21 or 6a, German</th>
<th>Language 37 or 34, Spanish</th>
<th>Literature 16, English</th>
</tr>
</thead>
</table>

English 10, Narration and Description 3
Chemistry 49, General Chemistry 4
Civil Engineering 264, Descriptive Geometry 3
Physical Training 202, R
Civil Engineering 242, Technical Lecture R
Military 2, Military Drill R
Civil Engineering 231, Summer Surveying R

All students in Civil Engineering go into camp fourteen days each summer vacation for surveying practice.

Total semester hours 18
### Sophomore Year

#### THIRD SEMESTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 44,</td>
<td>5</td>
</tr>
<tr>
<td>Analytical Geometry and Calculus</td>
<td></td>
</tr>
<tr>
<td>English 12,</td>
<td>2</td>
</tr>
<tr>
<td>Argumentation</td>
<td></td>
</tr>
<tr>
<td>Physics 303,</td>
<td>5</td>
</tr>
<tr>
<td>Mechanics and Heat</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 365,</td>
<td>5</td>
</tr>
<tr>
<td>Surveying</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 307,</td>
<td>1</td>
</tr>
<tr>
<td>Drawing</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 343,</td>
<td>R</td>
</tr>
<tr>
<td>Technical Lecture</td>
<td></td>
</tr>
<tr>
<td>Military 3, or Physical Training 303,</td>
<td>R</td>
</tr>
<tr>
<td>Total Semester hours</td>
<td>18</td>
</tr>
</tbody>
</table>

#### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 45,</td>
<td>5</td>
</tr>
<tr>
<td>Differential and Integral Calculus</td>
<td></td>
</tr>
<tr>
<td>Physics 404,</td>
<td>5</td>
</tr>
<tr>
<td>Electricity and Magnetism and Light and Sound</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 401,</td>
<td>3</td>
</tr>
<tr>
<td>Analytical Mechanics</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 482,</td>
<td>3</td>
</tr>
<tr>
<td>Surveying</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 405,</td>
<td>1</td>
</tr>
<tr>
<td>Drawing</td>
<td></td>
</tr>
<tr>
<td>Economic Science 14</td>
<td>2</td>
</tr>
<tr>
<td>Outlines of Economics</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 444,</td>
<td>R</td>
</tr>
<tr>
<td>Technical Lecture</td>
<td></td>
</tr>
<tr>
<td>Military 4, or Physical Training 404,</td>
<td>R</td>
</tr>
<tr>
<td>Civil Engineering 432,</td>
<td></td>
</tr>
<tr>
<td>Summer Surveying</td>
<td>R</td>
</tr>
<tr>
<td>All students in Civil Engineering go into camp fourteen days each summer vacation for surveying practice.</td>
<td></td>
</tr>
<tr>
<td>Total semester hours</td>
<td>19</td>
</tr>
</tbody>
</table>

### Junior Year

#### FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 502,</td>
<td>5</td>
</tr>
<tr>
<td>Analytical Mechanics</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 510,</td>
<td>5</td>
</tr>
<tr>
<td>Railway Engineering</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 553,</td>
<td>2</td>
</tr>
<tr>
<td>Materials of Construction</td>
<td></td>
</tr>
<tr>
<td>Physics 523,</td>
<td>1</td>
</tr>
<tr>
<td>Physical Laboratory</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 524,</td>
<td>3</td>
</tr>
<tr>
<td>Practical Astronomy and Geodesy</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 514,</td>
<td>1</td>
</tr>
<tr>
<td>Civil Engineering Laboratory</td>
<td></td>
</tr>
<tr>
<td>Electives, to be chosen from list on page 218</td>
<td>2</td>
</tr>
<tr>
<td>Total semester hours</td>
<td>19</td>
</tr>
</tbody>
</table>
SIXTH SEMESTER

Required Semester Hours

Mechanical Engineering 686, Hydraulics 4
Civil Engineering 611, Railway Engineering 4
Engineering 603, Conservation of Natural Resources 1
Civil Engineering 617, Structural Engineering 4
Civil Engineering 615, Civil Engineering Laboratory 1
Civil Engineering 633, Summer Surveying R
English 15, Engineering English 2
Electives, to be chosen from list on page 218. 3

Total semester hours 19

All students in Civil Engineering go into camp fourteen days each summer vacation and conduct an organized topographical survey. In place of the two weeks' summer surveying for any year, except one, 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. Each student is required to attend at least one summer surveying camp. A student may not receive credit, upon the basis of one summer's outside engineering work, for more than one summer surveying camp.

Senior Year

SEVENTH SEMESTER

Required Semester Hours

Civil Engineering 767, Structural Engineering 3
Civil Engineering 720, Reinforced Concrete Structures 2
Civil Engineering 712, Roads and Pavements 2
Civil Engineering 768, Sanitary Engineering 2
Civil Engineering 716, Civil Engineering Laboratory 1
Civil Engineering 769, Rivers, Drainage and Irrigation 2
Civil Engineering 725, Specifications and Contracts 1
Engineering 702, Thesis begun R
Electrical Engineering 703, Electric-Power Transmission 2
Electives, to be chosen from list on page 218, 3

Total semester hours 18

EIGHTH SEMESTER

Required Semester Hours

Civil Engineering 870, Structural Engineering 3
Civil Engineering 855, Water Supply Engineering 2
Geology 803, Physics 801, Civil Engineering 871, Mechanical Engineering 884, Engineering 801, Civil Engineering 823, 
Electives, to be chosen from list on page 218,

<table>
<thead>
<tr>
<th>Course</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Geology</td>
<td></td>
</tr>
<tr>
<td>Illumination Engineering</td>
<td></td>
</tr>
<tr>
<td>Thesis</td>
<td>2</td>
</tr>
<tr>
<td>Steam Engines and Boilers</td>
<td></td>
</tr>
<tr>
<td>History of Engineering</td>
<td>1</td>
</tr>
<tr>
<td>Masonry</td>
<td>2</td>
</tr>
</tbody>
</table>

Total semester hours 18

**Suggested Junior Year Optionals**

(The number before the parenthesis indicates the course number.
The number in the parenthesis indicates the number of recitations per week).

<table>
<thead>
<tr>
<th>FALL SEMESTER</th>
<th>SPRING SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Journalism 8 (2), 10 (2).</td>
<td>Agricultural Journalism 8 (2), 10 (2).</td>
</tr>
<tr>
<td>History 20 (2).</td>
<td>History 20 (2).</td>
</tr>
<tr>
<td>Mechanical Engineering 140 (2).</td>
<td>Literature 18 (2), 19 (2).</td>
</tr>
<tr>
<td>Public Speaking 11 (2), 19 (1).</td>
<td>Mechanical Engineering 140 (2).</td>
</tr>
<tr>
<td></td>
<td>Public Speaking 11 (2), 19 (1).</td>
</tr>
</tbody>
</table>

**Suggested Senior Year Optionals**

(The number before the parenthesis indicates the course number.
The number in the parenthesis indicates the number of recitations per week).

<table>
<thead>
<tr>
<th>FALL SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 13 (2).</td>
</tr>
<tr>
<td>Bacteriology (3).</td>
</tr>
<tr>
<td>Civil Engineering 754 (1), 760 (2), 761 (2), 773 (1), 774 (3), 775 (2), 776 (1), 777 (1), 778 (2), 779 (1).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPRING SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering 13 (2).</td>
</tr>
<tr>
<td>Bacteriology (3).</td>
</tr>
<tr>
<td>Civil Engineering 776 (1), 777 (1), 862 (3), 880 (1), 881 (2), 882 (3), 883 (1), 884 (1), 885 (1), 887 (2).</td>
</tr>
</tbody>
</table>

**FIVE YEAR COURSE IN CIVIL ENGINEERING**

The Five Year Course in Civil Engineering includes all of the work of the four year course plus much general culture and elective culture and science work and some elective advance engineering work. All such engineers as can do so are urged to take this five year course instead of the four year course. It leads to the degree of Bachelor of Science in Civil Engineering as in the case of the four year course, but graduates of
the five year course can secure the advanced Civil Engineering degree on
the completion of only one year of successful professional work and the
presentation of a satisfactory thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates
the semester in which the subject is taught. If the subject is also taught in a
previous semester, the true course number is followed by the descriptive course
number in parenthesis.

Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40, Algebra</td>
</tr>
<tr>
<td>Mathematics 41, Plane Trigonometry</td>
</tr>
<tr>
<td>Modern Language,</td>
</tr>
<tr>
<td>The Language selected must be carried through the entire year.</td>
</tr>
<tr>
<td>Language 18 or 57, French</td>
</tr>
<tr>
<td>Language 20 or 5a, German</td>
</tr>
<tr>
<td>Language 36 or 33, Spanish</td>
</tr>
<tr>
<td>Language 15, English</td>
</tr>
</tbody>
</table>

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages.

Beginning German is not offered in the Freshman year.

English 11, Exposition 3
History 5, History of Modern Europe 3
Civil Engineering 181, Drawing 2
Civil Engineering 102, Field Work 2
Civil Engineering 141, Technical Lecture R
Military 1, Drill R

Total semester hours 18

SECOND SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42, Trigonometry</td>
</tr>
<tr>
<td>Mathematics 43, Analytical Geometry</td>
</tr>
<tr>
<td>Modern Language,</td>
</tr>
<tr>
<td>The Language selected must be a continuation of the one chosen in the first semester.</td>
</tr>
<tr>
<td>Language 19 or 58, French</td>
</tr>
<tr>
<td>Language 21 or 6a, German</td>
</tr>
<tr>
<td>Language 37 or 34, Spanish</td>
</tr>
<tr>
<td>Language 16, English</td>
</tr>
</tbody>
</table>


English 10, Narration and Description 3
History 8, History of the United States, 1763-1912 3
Civil Engineering 204, Descriptive Geometry 2
Civil Engineering 203, Field Work 1
Civil Engineering 206, Drawing 1
Civil Engineering 242, Technical Lecture R
Military 2, Drill R
Civil Engineering 231, Summer Surveying R

All students in Civil Engineering go into camp fourteen days each summer vacation for surveying practice.

Total semester hours 18

Sophomore Year

THIRD SEMESTER

Required Semester Hours
Mathematics 44, Analytical Geometry and Calculus 5
English 12, Argumentation 2
Chemistry 2, General Chemistry 5
Civil Engineering 308, Surveying 4
Civil Engineering 343, Technical Lecture R
Elective, Non-technical Work 2
Military 3, or Athletics, R

Total semester hours 18

FOURTH SEMESTER

Required Semester Hours
Mathematics 45, Differential and Integral Calculus 5
English 13, Advanced Composition 2
Chemistry 5, Qualitative Analysis 5
Civil Engineering 409, Surveying 4
Civil Engineering 444, Technical Lecture R
Elective, Non-technical Work 2
Military 4, or Athletics, R
Civil Engineering 432, Summer Surveying R

All students in Civil Engineering go into camp fourteen days each summer vacation for surveying practice.

Total semester hours 18

Junior Year

FIFTH SEMESTER

Required Semester Hours
Physics 503 (303), Mechanics and Heat 5
Economic Science 9, Outlines of Economics 3
Civil Engineering 524,  
Civil Engineering 507 (307),  
Civil Engineering 549 (349),  
Elective,  
Practical Astronomy and Geodesy 3  
Drawing 1  
Advanced Descriptive Geometry 1  
Non-technical Work 5  
Total semester hours 18  

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 604 (404),</td>
<td>Electricity and Magnetism and Light and Sound 5</td>
</tr>
<tr>
<td>Mechanical Engineering 601 (401),</td>
<td>Analytical Mechanics 3</td>
</tr>
<tr>
<td>Civil Engineering 605 (405),</td>
<td>Drawing 1</td>
</tr>
<tr>
<td>Elective,</td>
<td>Non-technical Work 6</td>
</tr>
<tr>
<td>Civil Engineering 633,</td>
<td>Summer Camp R</td>
</tr>
</tbody>
</table>

All students in Civil Engineering go into camp fourteen days each summer vacation for surveying practice.

Total semester hours 18

**Senior Year**

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Mechanical Engineering 702 (502),</td>
<td>Analytical Mechanics 5</td>
</tr>
<tr>
<td>Civil Engineering 710 (510),</td>
<td>Railway Engineering 5</td>
</tr>
<tr>
<td>Electrical Engineering 703,</td>
<td>Electric Power Transmission 2.</td>
</tr>
<tr>
<td>Physics 723 (523),</td>
<td>Physical Laboratory 1</td>
</tr>
<tr>
<td>Civil Engineering 714 (514),</td>
<td>C. E. Laboratory 1</td>
</tr>
<tr>
<td>Elective,</td>
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</table>

Total semester hours 18

**EIGHTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
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<tbody>
<tr>
<td>Mechanical Engineering 886 (686),</td>
<td>Hydraulics 4</td>
</tr>
<tr>
<td>Civil Engineering 811 (611),</td>
<td>Railway Engineering 4</td>
</tr>
<tr>
<td>Civil Engineering 817 (617),</td>
<td>Structural Engineering 4</td>
</tr>
<tr>
<td>Civil Engineering 853 (653),</td>
<td>Materials of Construction 2</td>
</tr>
<tr>
<td>Civil Engineering 815 (615),</td>
<td>C. E. Laboratory 1</td>
</tr>
<tr>
<td>Engineering 803 (603),</td>
<td>Conservation of Natural Resources 1</td>
</tr>
<tr>
<td>Mechanical Engineering 887,</td>
<td>Gas Engines 2</td>
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Total semester hours 18
Post Senior Year

NINTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
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<tbody>
<tr>
<td>Civil Engineering 967 (767),</td>
<td>Structural Engineering  3</td>
</tr>
<tr>
<td>Civil Engineering 920 (720),</td>
<td>Arches and Reinforced Concrete 2</td>
</tr>
<tr>
<td>Civil Engineering 912 (712),</td>
<td>Roads and Pavements      2</td>
</tr>
<tr>
<td>Civil Engineering 968 (768),</td>
<td>Sanitary Engineering     2</td>
</tr>
<tr>
<td>Mechanical Engineering 984 (884),</td>
<td>Steam Engines and Boilers 2</td>
</tr>
<tr>
<td>Civil Engineering 916 (716),</td>
<td>C. E. Laboratory         1</td>
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<tr>
<td>Civil Engineering 925 (725),</td>
<td>Thesis begun             R</td>
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<tr>
<td>Engineering 902 (702),</td>
<td>Specifications and Contracts 1</td>
</tr>
<tr>
<td>Elective,</td>
<td>Civil Engineering Work   5</td>
</tr>
<tr>
<td></td>
<td>Total semester hours     18</td>
</tr>
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</table>

TENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Engineering 1001 (801),</td>
<td>History of Engineering  1</td>
</tr>
<tr>
<td>Civil Engineering 1070 (870),</td>
<td>Structural Engineering  3</td>
</tr>
<tr>
<td>Civil Engineering 1055 (855),</td>
<td>Water Supply Engineering 2</td>
</tr>
<tr>
<td>Geology 1003 (803),</td>
<td>Engineering Geology      3</td>
</tr>
<tr>
<td>Civil Engineering 1026 (826),</td>
<td>Thesis                  2</td>
</tr>
<tr>
<td>Civil Engineering 1023 (823),</td>
<td>Masonry                 2</td>
</tr>
<tr>
<td>Elective:</td>
<td>Civil Engineering Work   5</td>
</tr>
<tr>
<td></td>
<td>Total semester hours     18</td>
</tr>
</tbody>
</table>

COURSES IN CIVIL ENGINEERING

102. Field Work.

1S. Labs. 2, 3 hr.; credit 2; fee $1.00.

Course 102 is intended to train the student in the solution of the simple surveying problems and in the use of the simple surveying instruments; to give him a thorough preparation for the surveying work of the Sophomore year; and to give him sufficient experience to enable him to obtain a position as chainman or rodman during the summer vacation.

The class is divided into squads of three men each, the idea being to keep the number of men in a squad as low as is consistent with performing the work, in order that each man may become familiar with all parts of the work. Pence & Ketchum's "Surveying Manual" is used as a text book and the men are required to perform the problems in strict accordance with the instructions in the "Manual," to check their work within practical limits, and to keep, in a standard field book, complete notes of all problems. Office problems are given from time to time, and as the field work requires it recitations and lectures are given.

Note—The work in Course 102 is preparatory to the Field Work of the Sophomore and Junior years. Thus the student has the training to be obtained by three years' actual experience in the field.
141. **Technical Lecture.** Lectures on the Civil Engineering profession, including definitions and general discussion of engineering, the different branches of Civil Engineering and general discussion of each, the ideals of the profession, the reading of current literature, and other general Civil Engineering topics of interest to young men entering the profession.

1S. Recitation 1; required.

181. **Drawing.** Freehand lettering as applied to engineering drawing. Use and care of drafting instruments, with the preparation of exercises and simple drawings.

1S. Labs. 2, 3 hr.; credit 2.

206. **Free Hand Drawing.** Exercises in the rendering of free hand sketches.

2S. Lab. 1, 3 hr.; credit 1.

231. **Summer Surveying.** Fourteen days' work in the field. See course 633.

2S. Required.

242. **Technical Lecture.** A continuation of course C. E. 141. Lectures on subjects and incidents of general and current interest to students who are just taking up the study of Civil Engineering. Three lectures of this course are given by College Librarians in explanation of the card catalogue system and the use of reference books.

2S. Recitation 1; required.

264. **Theory of Engineering Drawing.** Principles of projection as applied to engineering drawing. Principles of descriptive geometry, including intersections, developments, shades and shadows, perspective and isometric projections, together with the application of these projections in the preparation of drawings of engineering structures from working drawings.

2S. Prerequisites 181, Math. 3 and 5; lab. 7 hrs. per week; credit 3.

307. **Working Drawings.** Drafting-room conventions, dimensioning, machine sketching, the preparation of detail and assembly drawings of small machines, and working drawings of engineering structures.

3S. Lab. 1, 3 hr.; credit 1.

343. **Technical Lecture.** Lectures covering the entire status of engineering in a general way.

3S. Recitation 1; required.

345. **Surveying.**

3S. Prerequisite Math. 17; recitation 1; lab. 1, 3 hr.; credit 2; fee 50 cents.

365. **Surveying.**

3S. Prerequisites 102 and Math. 222; recitations 2; lab. 3, 3 hr.; credit 5; fee $1.50.

Courses 365 and 482 are continuations of course 102. The same method of organizing squads is followed. The work takes up the care and adjustments of surveying instruments, various problems in surveying illustrating the measurement of angles, running traverses by several methods, differential and profile leveling, use of plane table, determination of the true meridian by both Polaris and Solar observations, taking
topography by various methods, and land surveying with special reference to the United States System of land subdivision and to the retracing of lines and location of lost corners. Office work in connection with the field work requires the calculation of areas and balancing of surveys, the calculation of quantities and estimates of cost in connection with paving and drain surveys. Mapping in connection with these courses is given in course C. E. 405. Pence & Ketchum’s "Surveying Manual" is used as a field manual.

The recitations cover Johnson’s “Theory and Practice of Surveying.”

The study of Drainage Engineering demands special attention in this state, and work along this line is given in course C. E. 482. The field work of land drainage and the preparation of maps and profiles are taken up and enough of the theory of land drainage and hydraulics to enable the student to plan and calculate drains for small drainage systems.

366. Topographical Drawing. Practice in the formation and use of topographical symbols, as rendered in ink and water colors, and the preparation of topographical maps.

35. Labs. 1; 3 hr.; credit 1.

405. Topographical Drawing. Practice in the formation and use of topographical symbols, and the preparation of profiles, plats, and topographical maps, which are worked up from data taken in the regular field work of courses C. E. 365 and C. E. 482.

4S. Prerequisite 181 and 365; lab. 1, 3 hr.; credit 1.

432. Summer Surveying. Fourteen days’ work in field. See course 633.

4S. Required.

444. Technical Lecture. Lectures on general engineering practice, and upon notable engineering works and structures.

4S. Recitation 1; required.

Courses 141, 242, 343, and 444, inclusive, are required of all Civil Engineers, and are designed to help inculcate the spirit of the engineering profession, and to permit the presentation of many things essential to the Civil Engineer which cannot readily be given in connection with the individual subjects of the course.

482. Surveying. For general explanation see course 365.

4S. Prerequisite 365; recitations 2; lab. 1, 3 hr.; credit 3; fee 50 cents.

488. Surveying.

4S. Prerequisite Math. 222; recitations 2, lab. 2, 3 hr.; credit 4; fee $1.00.

Course 488 is an abridgement of courses 365 and 482 and aims to cover only the most important uses of the tape, level and transit. Text book, Pence and Ketchum’s “Surveying Manual.”

489. Surveying. Course 451 is designed to give students in Electrical Engineering a good working knowledge of the engineer’s transit and level and their common uses, sufficient to enable them to perform such elementary surveying problems as they are likely to meet in connection with their electrical work. Text book, Pence & Ketchum’s “Sur-
veying Manual." Open to any student wishing a course in Surveying, lasting only one semester.

4S. Prerequisite Math 222; recitation 1; lab. 1, 3 hr.; credit 2; fee $1.00.

510. Railway Location. Organization and engineering equipment for a locating party; duties of each member of the party; camp and camp supplies; methods of reconnaissance, of preliminary, and of location surveys; methods of staking out and calculating earthwork; determination of haul by the mass diagram.

Some time is spent on the economic theory of steam railway location including train, grade, and curve resistance; rise and fall; pusher grades; tonnage ratings; virtual profile.

During the term, reconnaissance, preliminary, and location surveys are made for a short line of railroad. The located line is cross-sectioned and estimates of cost are prepared for grading, structures, and right-of-way. Class and field exercises are given in simple, reverse, and transition curves, and in wyes and yards.

Textbooks, Allen's "Railroad Curves and Earthwork," Talbot's "Railway Transition Spiral," and Instructor's Notes on Railway Economics.

5S. Prerequisites 181 and 365; recitations 5; credit 5; fee $1.50.

514. Cement and Masonry Laboratory. Testing and use of sand, cement, concrete and brick. The standard tests for these materials as given by the various national societies are taught, and various experimental tests are made to show the properties and behavior of the materials under varying conditions. Must be accompanied by Mechanical Engineering 502.

5S. Prerequisite M. E. 401; recitation 1; credit 1; fee $3.00.

524. Practical Astronomy and Geodesy. A brief course in Astronomy and Geodetic Surveying and a study of ordinary methods of determining latitude, longitude, azimuth, and time with their application to Geodetic Surveying.

5S. Prerequisites 181 and 482; recitations 3; credit 3.

553. Materials of Construction. Use, manufacture and testing of the various materials of construction, including sand, gravel, cement, stone, brick, concrete, iron, steel, and other metals.

5S. Prerequisite M. E. 502; recitations 2; credit 2.

557. Surveying. Open to those students only, who will also take course C. E. 658.

5S. Prerequisite Math. 17; recitations 2; lab. 2, 3 hr.; credit 4; fee $1.00.

Courses 557 and 658 are designed primarily for forestry students, but will fill the needs of students in any course, other than Civil Engineering, who wish a thorough course in Surveying, without spending time upon those branches which are of interest to the Civil Engineer alone. The work takes up pacing, chaining, ranging, the uses of the pocket-compass, the surveyor's compass, the hand-level, the aneroid barometer, the engineer's level and transit, and the plane table. Special attention will be given to approximate methods and the uses of approximate instruments such as the pocket compass and aneroid barometer, the taking of topography and making of topographic maps by various methods, ranging from approximate and rapid surveys, which are often sufficiently accurate, to the more detailed transit and stadia, and plane table surveys. Pence & Ketchum's "Surveying Manual" will be used as a text-book, and will be supplemented by lectures. The field work will be organized and carried on as in Course 102, and will cover principles studied in the class room.
564. Surveying. Open only to students who will also take course C. E. 686.

Courses 564 and 686 are designed primarily to fill the needs of the Agricultural Engineering student, but are available for any student wishing a good working knowledge of Surveying. The work is similar to that given in Courses C. E. 365 and 482, omitting those matters which are of interest primarily to the Civil Engineer. Pence & Ketchum’s “Surveying Manual” is used as a text.

589. Railway. Course especially designed for the students in Architectural Engineering. Based on the work given in C. E. 510.

551. Railway Construction and Maintenance. Duties of the resident engineer on construction; monthly and final estimates; specifications for grading; methods and costs of handling earthwork; tunneling; timber and trestle bridges; methods and costs of laying track; tie and timber treating processes; rails and rail fastenings; track accessories; drainage and other track work connected with maintenance of way. Practice is given in drawing up estimates for cost of construction of track and structures in making and plotting bridge and station surveys, in relining curves, and in settling ballast stakes. Text books, Crandall and Barnes’ “Railroad Construction,” and Instructor’s Notes on Track Work.

585. Prerequisite, C. E. 611; recitations 4; credit 4; fee $1.00.

615. Structural Laboratory. A study of the physical properties and the action of the materials of construction, under stress. The course is especially concerned with the study of iron, steel and wood. Standard tests as well as experiments to verify the theoretical laws are made. Must be accompanied by C. E. 653.

617. Structural Engineering. The class room work of the first few periods covers the manufacture of steel sections and the fabrication of the distinctive parts of steel structures and the next few weeks are devoted to the elements of Structural Mechanics. In the meantime the drawing room work consists of the reproduction of standard detail drawings. This drawing room work is intended to train the student in structural drafting and at the same time familiarize him with the manufacturers' hand books. After this preliminary work is completed the designing of railroad bridges, including beam bridges, deck and through plate girder spans, and viaducts, is taken up. The recitations are devoted to the theory, and the drawing room work consists in making stress sheets and complete detail drawings, shop bills, etc., of these structures.

617. Recitation 4; credit 4.

633. Summer Surveying. Fourteen days’ work in field. In the work of Courses 231, 432, and 633, several of the professors of Civil Engineering and the students in Civil Engineering go into camp for fourteen days each summer vacation beginning the Friday 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 Lake Okoboji and surrounding territory are being mapped. Lower classmen will serve in
subordinate positions. Upper classmen will take responsible charge of parties, and will do the triangulating and final mapping. Students must pay their own traveling and living expenses. Every student in Civil Engineering is required to attend at least one Summer Camp. For the other two, outside work satisfactory to the proper member of the faculty may be substituted. A student may not obtain credit, on the basis of one summer's outside engineering work, for more than one summer camp.

6S. No credit.


6S. Prerequisite M. E. 502; recitations 2; credit 2.

656. Structural Engineering. For students taking Mining, Mechanical, and Electrical Engineering. Designing of structures of special interest to the Mining, Mechanical and Electrical Engineers. The first few weeks of the semester are devoted to the study of Structural Mechanics and to the making of some simple working drawings of steel beams and girders. The remainder of the semester is devoted to study of the theory and designing of ordinary steel and reinforced concrete mill buildings, machine supports, transmission towers, head frames, highway bridges, etc. General drawings showing the designs are made by the students, and for some of the problems complete working drawings are required.

6S. Recitations 3; credit 3.

658. Surveying. For general explanation see course 557, of which course 658 is a continuation.

6S. Prerequisite 557; recitations 2; lab. 2, 3 hr.; credit 4; fee $1.00.

659. Timber Testing. A lecture and laboratory course for the students of Forestry. Tests of the properties of timber, considered as a material of construction, and comparative tests of different species. The work in general will be along the lines of the U. S. Timber Testing service.

6S. Recitation 1; lab. 1, 2 hr.; credit 1½; fee $3.00.

686. Surveying. See course C. E. 564.

6S. Prerequisite 564; recitation 1; lab. 2, 3 hr.; credit 3; fee $1.00.

712. Roads and Pavements. Good roads problem, traffic over country roads, tractive resistance, the best methods of constructing and maintaining earth, gravel, and broken stone roads, and the cost 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 State Highway Commission of Iowa is by law located at the college. All its data, plans, maps and publications are available. Among the topics studied in connection with pavements are city streets and grades, classes and methods of construction of pavements, and the cost of various kinds of paving. Text book, Baker's "Roads and Pavements."

7S. Recitations 2; credit 2.
716. Hydraulic Laboratory. Experiments to verify the laws of theoretical hydraulics, determination of the coefficients to apply to the theoretical formulae for discharge, pressure and velocity. Efficiency tests of hydraulic machines, including, hydraulic rams, pumps, water motors, etc.

7S. Prerequisite M. E. 686; recitation 1; credit 1; fee $1.00.

720. Reinforced Concrete Structures. The recitations are devoted to the mechanics of reinforced concrete construction and masonry, analyzing the stresses in reinforced concrete slabs, beams, floors, roofs, retaining walls, and also masonry and reinforced concrete arches. The work in the drawing room consists of: Designing a reinforced concrete beam highway bridge; beams, columns, and floor for an office building; designing of a masonry and a reinforced concrete arch, and also a retaining wall, making complete tracings of most of the designs. Text book, "Principles of Reinforced Concrete Construction," by Turneaure and Maurer, supplemented by instructor's Notes.

7S. Recitations 2; credit 2.

7S. Required.

754. Railway Signaling. Required of Seniors who elect special work in Railway Engineering. Design and methods of operation of block and interlocking signals on single and double track roads; systems of signaling and interlocking in yards and terminals.

7S. Prerequisites 510 and 611; recitation 1; credit 1.

760. Railway Engineering. For students who elect special work in Railway Engineering. Economics of electric railways; schedules, equipment, and run-curves; terminal electrification; subway construction and operation; tunnel construction and operation.

7S. Prerequisite 611; credit 2.

761. Railway Administration. Optional for seniors who elect special work in Railway Engineering. The railway corporation and its charter; railway capital; organizations for small and large roads; divisional versus departmental systems; duties of officers; freight and passenger service; express and mail service; accounts; railway competition; pools and traffic associations; theory of rates and fares; taxation; the courts and railway regulation; state and interstate commerce commissions; government control and operation.

7S. Credit 2.

767. Structural Engineering. This work is really a continuation of the work given in the Junior year (C. E. 617). It consists of the theory and design of railroad and highway truss bridges.

7S. Recitations 3; credit 3.

768. Sanitary Engineering. The principles and methods involved in the design, construction and maintenance of sewerage systems.

7S. Prerequisite M. E. 686, recitations 2; credit 2.

769. Rivers, Drainage, and Irrigation. The principles and methods involved in the improvement of internal waterways, drainage of agricul-
tural lands, and the application of water to land for irrigation purposes.

75. Prerequisite M. E. 686, recitations 2; credit 2.

773. Structural Engineering. For students who elect additional work in Structural Engineering. Prerequisite C. E. 767. The work is given in the drawing room, and consists of practical designing.

75. Credit 1.

774. Structural Engineering. For students who elect major work in Structural Engineering. This course is taught in conjunction with C. E. 767 in a special class to the students taking Structural Engineering. The work is very much more thorough and complete than in C. E. 767 alone.

75. Credit 3.

775. Water Power. The theory, investigation, and economic development of water powers.

75. Prerequisite M. E. 686; credit 2.

776. Hydraulic Design. The practical application of the principles followed in the investigation of a surface water supply, and the application of the information so acquired to a water power or irrigation project. Design of various features of hydraulic works. Must be preceded or accompanied by C. E. 769 or 775.

75. Prerequisite M. E. 686; lab. 1, 3 hr.; credit 1.

777. Sanitary Design. The application of engineering principles to actual problems, practice in detailed design, preparation of plans, and such other subjects as are essential to the general field of water works or sewerage engineering. Must be preceded or accompanied by C. E. 768 or 855.

75. Prerequisite M. E. 686; lab. 1, 3 hr.; credit 1.

778. Highway Engineering. Economic grades and proper location for different soils and surfacing materials; surface and sub-surface drainage; construction and maintenance of earth, sand-clay, oiled earth, gravel, macadam, concrete and bituminous roads; dust preventatives and road binders; preliminary surveys and estimates; specifications; forms of contracts.

75. Prerequisite C. E. 712; credit 2.

779. Road Materials Laboratory. Elective for Senior Civil Engineers, especially for those who elect special work in Highway Engineering. Physical properties and testing of the materials used in the construction of all classes of roads and pavements. The standard tests are taught, and special experiments performed, to show the action of the materials under varying conditions.

75. Prerequisites M. E. 401 and 502; credit 1.


85. Prerequisite C. E. 553; recitations 2; credit 2.

855. Water Supply. The principles and methods involved in the design, construction and maintenance of water works systems.

85. Prerequisite M. E. 686; recitations 2; credit 2.
862. Railway Design. Required of seniors who elect special work in Railway Engineering. Problems are assigned in connection with railway location, construction, and maintenance of way. Some time is given to yards and terminals, and partial designs are made for coal and water stations, engine houses, track elevation, and subways.

8S. Prerequisites C. E. 510 and 511; credit 3.

863. Railway Operation. Optional for seniors who elect special work in Railway Engineering. Duties and office force of the division superintendent, division engineer, and master mechanic; the unit system; duties of the trainmaster, despatchers, roadmasters, and master carpenter; train crews, train rules, and time tables; passenger, freight, and work train movements; round house and yard crews; section and extra gangs.

8S. Credit 2.

870. Structural Engineering. The theory and design of mill buildings, office buildings, draw bridges, cantilever, suspension, and arch bridges.

8S. Recitations 3; credit 3.

871. Thesis. Original research on some chosen subjects, as the study and design of some engineering project (including the surveys), the investigation of some engineering question, or an experimental investigation. Nine hours per week, 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 write-up of the results.

8S. Credit 2.

880. Structural Engineering. For students who elect additional work in C. E. 870. The work is given in the drawing room and consists of practical designing.

8S. Credit 1.

881. Structural Engineering. For students who elect two hours of additional work in C. E. 870. This course is taught in conjunction with C. E. 870.

8S. Recitation 1; lab. 1, 3 hr.; credit 2.

882. Structural Engineering. For students who elect major work in Structural Engineering. This work is taught in conjunction with C. E. 870 in a special class.

8S. Credit 3.

883. Road Materials Laboratory. A continuation of C. E. 779. Special attention will be given to tests and analyses of asphaltic and bituminous materials.

8S. Prerequisites C. E. 779 and Chem.; credit 1.

884. Civil Engineering Laboratory. Advanced work in problems of interest to civil engineers. The work may be made largely research and several lines will be available depending upon the preference of the class. Hydraulic and other machinery, research work in cement and concrete materials, etc.

8S. Prerequisites C. E. 514, 615 and 716; credit 1.
8S. Credit 1.

887. Highway Engineering. Economic and social advantages of improved roads; the traffic census; local and centralized systems of control; highway laws of different states; organization of construction and engineering forces; cost data; methods of handling work, etc. 
8S. Credit 2.

890. Road Surveying and Design. Methods of making surveys and resurveys of roads. Lectures, field work, inspection trips and design. 
8S. Credit 2.

Department of Electrical Engineering

FRED ALAN FISH, PROFESSOR
HAROLD C. BARTHOLOMEW, ASSOCIATE PROFESSOR
FRANK ANSON ROBBINS, ASSISTANT PROFESSOR
FRANK D. PAINE, INSTRUCTOR
BRUCE A. COLE, MECHANICIAN

It is recognized that the successful engineer of today must not only be well grounded in the fundamental principles of the sciences which underlie the practice of his profession, but he must possess also a sound training in language and literature, especially in the English language, and at least a working knowledge of history and the principles of economics. Training in these non-technical and cultural subjects is necessary, not only to give the engineer breadth of mind and the ability to meet, direct, and co-operate with men intelligently and with good effect, but also to enable him to express himself accurately and clearly and to make his technical training and knowledge of the greatest value to himself and his fellowmen. There seems to be a strong feeling among young men entering college that their course of study should be such as to enable them as soon as possible to command a good salary. While it may be admitted that for a short time after graduation the man who has given much the greater amount of his time to technical matters may secure larger financial rewards, it is believed that he can neither continue to cope successfully with the man who has had the broader training, nor come to be considered a really successful engineer.

Nevertheless, in response to the strong demand for technical work, a large part of the time in the course given here is devoted to such work. However, it is strongly urged that at least as much time and energy, hour for hour, be given to the non-technical studies as to the technical studies.

As a basis for those studies dealing directly with engineering, the sciences of Mathematics, Physics, and Chemistry are absolutely essential and must be given careful attention. Following these subjects, Mechanics
and Materials of Construction are given before Electrical Machinery and Electrical Engineering are taken up. In the earlier part of the course some time is given to Mechanical Drawing and Shop Work. During the last year and one-half, the greatest portion of the time is given to the theory, design, and operation of Electrical Machinery, and to Power Plants, Railways, and Electric Transmission; but, in recognition of the close alliance between Mechanical Engineering and Electrical Engineering, considerable time is also devoted to the former. Also, a course is given in Surveying.

**Equipment**

The Electrical Laboratory is on the ground floor of the central portion of the New Engineering Annex. It occupies a space of 50x70 feet, is fireproof throughout and is provided with a system of covered trenches which carry all wires. The scheme of the laboratory has been carefully worked out with a view of obtaining the maximum amount of usefulness, with a minimum amount of waste time on the part of the student. Few, if any, similar installations are superior in equipment and system. For experimental purposes there are twenty-eight generators and motors of various manufacture, several transformers, over one hundred accurate instruments, besides mounted lamp banks, rheostats, choke coils and other apparatus.

The principal machines are distributed as follows: The Substation Set, which, together with its switchboard, is situated in the center of the laboratory, consists of four machines on one base; a 100 horse-power, 3-phase, 60 cycle, 1,100-volt, 1,200-r. p. m. induction motor directly coupled to and driving the other three. The power for this machine comes in tunnels from the Central College power plant. On one end of the motor is coupled a 60-kilowatt, 125-volt, compound wound, direct current generator, supplying the necessary direct current power for the laboratory. On the other end is a 50-kilowatt, 3-phase, 60-cycle, 220- and 110-volt revolving field alternator with direct connected exciter, supplying the alternating current power.

Arranged around the laboratory are the smaller experimental machines, ranging from 6-kilowatt capacity to 7½-kilowatt or 10 horse-power. These are belted in sets of two, one of each acting as a driver for the other. They consist of direct current shunt, series, and compound wound machines, alternating current induction motors, a combination revolving field alternator and induction motor, either two, three, six or twelve-phase, double current generators, or rotary converters, arc light machines, etc. Controlling these sets are individual switchboards, mounted with instruments and control apparatus, but not connected up; the object being to put such practice into the hands of the students. In order to diminish waste of time in connecting up, the terminals of all machines and apparatus are brought to jacks of special form, devised at the Iowa State College, and circuits are made by plugs and cords of appropriate size.

In order to secure the necessary constant laboratory pressure, alter-
nating and direct current Tirrill regulators are mounted on the Substation Switchboard. These are rather recent devices to obtain this end and serve the purpose admirably. To prevent one experimental machine from being influenced by changing load on another, the above scheme of individual drives has been adopted as distinguished from the line shaft method.

Nearly all the machines are of the latest design to insure a more nearly correct perspective of modern practice.

Connected with the laboratory at one end is a small workshop equipped with a motor driven engine lathe, a workbench, a grinder, and a complete set of carpenter and machinist tools for the repair and construction of apparatus. At the other end of the laboratory is the instrument room in which are kept the portable measuring instruments and other small apparatus.

In addition to the laboratory equipment, the department possesses a reflectoscope for the presentation of lantern slides and illustrations in the lecture room, also considerable number of samples and models of electrical apparatus suitable for class room demonstrations.

FOUR YEAR COURSE IN ELECTRICAL ENGINEERING

This course leads to the degree of Bachelor of Science in Electrical Engineering. Graduates from this course may receive the full professional degree of Electrical Engineer by devoting one year to resident study and one year to a responsible engineering position and presentation of a satisfactory thesis or by five years' service in responsible engineering work and presentation of thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

*Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40</td>
<td>Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 41</td>
<td>Plane Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>Modern Languages:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Language selected must be continued through the entire year.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language 18 or 57, =French</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Language 20 or 5a, =German</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Language 36 or 33, =Spanish</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Literature 15, =English</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

* Freshmen who, after four weeks review of fundamentals, show deficient preparation in English or Mathematics may be assigned by the Dean of the Junior College and the Dean of Engineering, to special classes, with one hour more work than indicated above, and in case of clear indication of failure in either of these subjects, even with this arrangement, they will be dropped from the Freshman work in this line until they have given proof of sufficient preparation to enable them to carry the work successfully.
IOWA STATE COLLEGE

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

English 11, Exposition 3
Chemistry 41, General Chemistry 3
Mechanical Engineering 130, Forge Shop 2
Electrical Engineering 101, Technical Lecture R
Mechanical Engineering 121, Mechanical Drawing 2
Military 1, Military Drill R
Physical Training 101, Gymnasium Work R

Total semester hours 18

SECOND SEMESTER

Required
Semester Hours
Mathematics 42, Trigonometry 2
Mathematics 43, Analytical Geometry 3
Modern Languages:
The Language selected must be a continuation of the one chosen in the first semester.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Language</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19 or 58</td>
<td>French 3</td>
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<tr>
<td>2</td>
<td>21 or 6a</td>
<td>German 3</td>
</tr>
<tr>
<td>3</td>
<td>37 or 34</td>
<td>Spanish 3</td>
</tr>
<tr>
<td>4</td>
<td>Literature 16</td>
<td>English 3</td>
</tr>
</tbody>
</table>

English 10, Narration and Description 3
Chemistry 42, General Chemistry 3
Mechanical Engineering 232, Foundry Work 2
Electrical Engineering 202, Technical Lecture R
Mechanical Engineering 220, Descriptive Geometry 2
Military 2, Military Drill R
Physical Training 202, Gymnasium Work R

Total semester hours 18

Sophomore Year

THIRD SEMESTER

Required
Semester Hours
Mathematics 44, Analytical Geometry and Calculus 5
English 12, Argumentation 2
Chemistry 45, Quantitative Analysis 2
Physics 303, Mechanics and Heat 5
Mechanical Engineering 331, Pattern Shop 2
Mechanical Engineering 382, Mechanical Drawing 2
Military 3, or Physical Training 303,

Total semester hours 18

<table>
<thead>
<tr>
<th>FOURTH SEMESTER</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Mathematics 45,</td>
<td>Differential and Integral Calculus 5</td>
</tr>
<tr>
<td>Physics 404,</td>
<td>Electricity and Magnetism and Light and Sound 5</td>
</tr>
<tr>
<td>Mechanical Engineering 401,</td>
<td>Analytical Mechanics 3</td>
</tr>
<tr>
<td>Mechanical Engineering 433,</td>
<td>Machine Shop 2</td>
</tr>
<tr>
<td>Mechanical Engineering 423,</td>
<td>Mechanical Drawing 1</td>
</tr>
<tr>
<td>Civil Engineering 489,</td>
<td>Surveying 2</td>
</tr>
<tr>
<td>Military 4 or Physical Training 404,</td>
<td>R</td>
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</table>

Total semester hours 18

Junior Year

<table>
<thead>
<tr>
<th>FIFTH SEMESTER</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering 506,</td>
<td>Principles of Electrical Engineering 3</td>
</tr>
<tr>
<td>Physics 514,</td>
<td>Physical Laboratory 2</td>
</tr>
<tr>
<td>Mechanical Engineering 502,</td>
<td>Analytical Mechanics 5</td>
</tr>
<tr>
<td>Mechanical Engineering 503,</td>
<td>Materials of Construction 2</td>
</tr>
<tr>
<td>Mechanical Engineering 584,</td>
<td>Steam Engines and Boilers 2</td>
</tr>
<tr>
<td>Mechanical Engineering 512,</td>
<td>Mechanical Engineering Laboratory 1</td>
</tr>
<tr>
<td>Engineering English 15,</td>
<td>Extempore Speech 1</td>
</tr>
</tbody>
</table>

Total semester hours 18

<table>
<thead>
<tr>
<th>SIXTH SEMESTER</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering 604,</td>
<td>Direct Current Machinery 4</td>
</tr>
<tr>
<td>Electrical Engineering 607,</td>
<td>Alternating Current Circuits 3</td>
</tr>
<tr>
<td>Electrical Engineering 619,</td>
<td>Electrical Engineering Laboratory 1</td>
</tr>
<tr>
<td>Physics 617,</td>
<td>Physical Laboratory 2</td>
</tr>
<tr>
<td>Mechanical Engineering 686,</td>
<td>Hydraulics 4</td>
</tr>
<tr>
<td>Mechanical Engineering 613,</td>
<td>Mechanical Engineering Laboratory 1</td>
</tr>
<tr>
<td>Engineering 603,</td>
<td>Conservation of Natural Resources 1</td>
</tr>
<tr>
<td>Economic Science 14,</td>
<td>Outlines of Economics 2</td>
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</table>

Total semester hours 18
### Senior Year

#### SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering 711</td>
<td>Alternating Current Machinery 5</td>
</tr>
<tr>
<td>Electrical Engineering 720</td>
<td>Electrical Engineering Laboratory 3</td>
</tr>
<tr>
<td>Electrical Engineering 724</td>
<td>Electrical Engineering Design 1</td>
</tr>
<tr>
<td>Electrical Engineering 729</td>
<td>Seminar R</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>Selection of Thesis Subject R</td>
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<tr>
<td>Mechanical Engineering 785</td>
<td>Machine Design 2</td>
</tr>
<tr>
<td>Mechanical Engineering 714</td>
<td>Mechanical Engineering Laboratory 1</td>
</tr>
<tr>
<td>Physics 708, Engineering 702</td>
<td>Theory of Illumination 2</td>
</tr>
<tr>
<td>[Economic Science 12, Agricultural Journalism 10, History 20,]</td>
<td>[Public Utilities 2, Engineering Journalism 1, Industrial History of the United States 2]</td>
</tr>
</tbody>
</table>

Total semester hours 18

#### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Engineering 831</td>
<td>Alternating Current Machinery and Power Plants 3</td>
</tr>
<tr>
<td>Electrical Engineering 809</td>
<td>Electric Railways 2</td>
</tr>
<tr>
<td>Electrical Engineering 816</td>
<td>Electric Power Transmission 2</td>
</tr>
<tr>
<td>Electrical Engineering 821</td>
<td>Electrical Engineering Laboratory 3</td>
</tr>
<tr>
<td>Electrical Engineering 825</td>
<td>Electrical Engineering Design 1</td>
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<tr>
<td>Electrical Engineering 830</td>
<td>Seminar R</td>
</tr>
<tr>
<td>Electrical Engineering 840</td>
<td>Thesis 3</td>
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<tr>
<td>Engineering 801, [Physics 809 or Illumination 3]</td>
<td>[Mechanical Engineering 809 Constructive Engineering 3]</td>
</tr>
</tbody>
</table>

Total semester hours 18

### Suggested Senior College Optionals

(The number before the parenthesis indicates the course number. The number in the parenthesis indicates the number of recitations per week.)

#### FALL SEMESTER

- Civil Engineering 723 (2)
- Economic Science 12 (2)
- English 13 (2)
- History 5 (3), 20 (2)
- Literature 18 (2)
- Physics 527 (1), 528 (1)

#### SPRING SEMESTER

- Chemistry 811 (2)
- English 14 (2)
- History 8 (3)
- Literature 19 (2)
- Mechanical Engineering 887 (2)
- Photography 1 (1)
FIVE YEAR COURSE IN ELECTRICAL ENGINEERING

The following five year course in Electrical Engineering is offered in response to a demand for an engineering course giving the student a better education in the culture studies in natural sciences, together with an opportunity to specialize along certain engineering lines not possible in the time available in the four year course of study. The course includes all of the work given in the four year course and in addition thirty hours of culture and scientific studies, together with four hours of work given in the engineering departments.

This course leads to the same degree granted to graduates of the four year course, but a graduate may obtain the full professional degree of Electrical Engineer after one year of responsible professional work in the presentation of a satisfactory thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Mathematics 40, Mathematics 41,</td>
<td>3</td>
</tr>
<tr>
<td>Modern Language:</td>
<td>2</td>
</tr>
<tr>
<td>Language 18 or 57, Language 20 or 5a,</td>
<td>3</td>
</tr>
<tr>
<td>Language 36 or 33, Literature 15,</td>
<td>3</td>
</tr>
</tbody>
</table>

The Language selected must be continued through the entire year.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>3</td>
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<tr>
<td>German</td>
<td>3</td>
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<tr>
<td>Spanish</td>
<td>3</td>
</tr>
<tr>
<td>English</td>
<td>3</td>
</tr>
</tbody>
</table>

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>English 11, Exposition</td>
<td>3</td>
</tr>
<tr>
<td>History 5, History of Modern Europe</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 121, Mechanical Drawing</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering 130, Forge Work</td>
<td>2</td>
</tr>
<tr>
<td>Electrical Engineering 101, Technical Lecture</td>
<td>R</td>
</tr>
<tr>
<td>Military 1, Drill</td>
<td>R</td>
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</table>

Total semester hours 18
## SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Mathematics 42,</td>
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<td>Mathematics 43,</td>
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<td>Modern Language:</td>
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<tr>
<td>Language 19 or 58, Language 21 or 6a,</td>
<td>3</td>
</tr>
<tr>
<td>Language 37 or 34, Literature 16,</td>
<td></td>
</tr>
<tr>
<td>English 10,</td>
<td>3</td>
</tr>
<tr>
<td>History 8,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 220,</td>
<td>2</td>
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<tr>
<td>Mechanical Engineering 232,</td>
<td>2</td>
</tr>
<tr>
<td>Electrical Engineering 202,</td>
<td>R</td>
</tr>
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<td>Military 2,</td>
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Total semester hours: 18

## Sophomore Year

### THIRD SEMESTER

<table>
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<th>Course</th>
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<tbody>
<tr>
<td>Mathematics 44,</td>
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<tr>
<td>English 12,</td>
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<tr>
<td>Chemistry 2,</td>
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</tr>
<tr>
<td>Mechanical Engineering 382,</td>
<td></td>
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<tr>
<td>Mechanical Engineering 331,</td>
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<tr>
<td>Elective:</td>
<td></td>
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<tr>
<td>Military 3, or Athletics,</td>
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Total semester hours: 18

### FOURTH SEMESTER

<table>
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<tr>
<td>Mathematics 45,</td>
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<td>English 13,</td>
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<td>Chemistry 5,</td>
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<tr>
<td>Mechanical Engineering 423,</td>
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<tr>
<td>Mechanical Engineering 437,</td>
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<tr>
<td>Mechanical Engineering 439,</td>
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<tr>
<td>Economic Science 16,</td>
<td></td>
</tr>
<tr>
<td>Military 4, or Athletics,</td>
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</table>

Total semester hours: 18
**Junior Year**

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total semester hours 18</td>
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</table>

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Physics 604 (404), Economic Science 12, Literature 14, Mechanical Engineering 601 (401), Mechanical Engineering 634, Elective</td>
<td>Electricity and Magnetism, Light and Sound 5, Public Utilities 2, Literature 2, Analytical Mechanics 3, Machine Work 2,</td>
</tr>
<tr>
<td></td>
<td>Total semester hours 18</td>
</tr>
</tbody>
</table>

**Senior Year**

**SEVENTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Mechanical Engineering 784, Electrical Engineering 706 (506), Physics 714 (514), Mechanical Engineering 702 (502), Mechanical Engineering 703 (503), Mechanical Engineering 712 (512), Elective:</td>
<td>Steam Engines and Boilers 2, Principles of Electrical Engineering 3, Physical Laboratory 2, Analytical Mechanics 5, Materials of Construction 2, Mechanical Engineering Laboratory 1, Non-technical Work 3,</td>
</tr>
<tr>
<td></td>
<td>Total semester hours 18</td>
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</table>

**EIGHTH SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Electrical Engineering 807 (607), Physics 817 (617), Elective:</td>
<td>Theory of Alternating Currents 3, Physical Laboratory 2,</td>
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<tr>
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<td>Total semester hours 18</td>
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</tbody>
</table>
### Electrical Engineering 804 (604),
#### Electrical Engineering 819 (619),
#### Mechanical Engineering 885 (685),
#### Mechanical Engineering 886 (686),
#### Mechanical Engineering 813 (613),
#### Engineering 803 (603),

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Direct Current Machinery</td>
<td>4</td>
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<tr>
<td>Electrical Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Machine Design</td>
<td>2</td>
</tr>
<tr>
<td>Electrical Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Analytical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Conservation of Natural Resources</td>
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</table>

**Total semester hours**: 18

### Post Senior Year

#### NINTH SEMESTER

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Electrical Engineering 911 (711),</td>
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<tr>
<td>Electrical Engineering 920 (720),</td>
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<td>Electrical Engineering 924 (724),</td>
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<td>Electrical Engineering 929 (729),</td>
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<tr>
<td>Physics 908 (708),</td>
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<td>Engineering 902 (702),</td>
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<td>Geology 901 (501),</td>
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<td>Elective:</td>
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<tr>
<td>Electrical Engineering,</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Alternating Current Machinery</td>
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<tr>
<td>Electrical Engineering Laboratory</td>
<td>3</td>
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<tr>
<td>Electrical Engineering Design</td>
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<tr>
<td>Electrical Engineering Seminar</td>
<td>R</td>
</tr>
<tr>
<td>Theory of Illumination</td>
<td>2</td>
</tr>
<tr>
<td>Specifications and Contracts</td>
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</tr>
<tr>
<td>General Geology</td>
<td>4</td>
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<td>Thesis begun</td>
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**Total semester hours**: 18

#### TENTH SEMESTER

<table>
<thead>
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<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Electrical Engineering 1009 (809),</td>
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<td>Electrical Engineering 1016 (816),</td>
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<tr>
<td>Electrical Engineering 1031 (831),</td>
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<tr>
<td>Electrical Engineering 1021 (821),</td>
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<tr>
<td>Electrical Engineering 1025 (825),</td>
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</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Railways</td>
<td>2</td>
</tr>
<tr>
<td>Power Plants and Transmission</td>
<td>2</td>
</tr>
<tr>
<td>Alternating Current Machinery and Power Plants</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Engineering Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Engineering Design</td>
<td>1</td>
</tr>
</tbody>
</table>
DIVISION OF ENGINEERING

Electrical Engineering 1030 (830),
Electrical Engineering 1040 (840),
Engineering 1001 (801),
Elective:

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Electrical Engineering Seminar R
Electrical Engineering Thesis 3
History of Engineering 1

Total semester hours 18

COURSES IN ELECTRICAL ENGINEERING

50. Small Electric Plants. Application of small electric plants to the lighting of residences and other buildings and to the driving of small machinery. Information and data, to enable one to plan small electric power plants and to install and care for the wiring and electrical apparatus.

5, 6, 7 or 8S. Recitations 2; credit 2.

101. Technical Lecture. Elementary principles of Electrical Engineering. Three lectures of this course are given by the College Librarian in explanation of the catalogue system and the use of the reference books.

1S. Recitation 1; required.


2S. Recitation 1; required.


5S. Prerequisites Physics 404 and Math. 426; recitations 3; credit 3.

604. Direct Current Machinery. General theory of the direct current dynamo, armature windings, characteristic curves, and the adaptation of the different types of direct-current machinery to various commercial purposes.

6S. Prerequisite E. E. 506; recitations 4; credit 4.


6S. Prerequisite E. E. 506; recitations 3; credit 3.

610. Direct Current Machinery. Same topics as in Electrical Engineering 604, but with less detail.

6S. Prerequisite E. E. 506; recitations 3; credit 3.

619. Electrical Engineering Laboratory. Elementary practice with direct current circuits, machines and instruments. Accompanied or preceded by Physics 617 or 615 and Electrical Engineering 604 or 610.

6S. Prerequisites Physics 514 or 523; lab. 1, 3 hr.; credit 1; fee $3.00.


75S. Prerequisites, Physics 303 and 404 and Math. 426; recitations 2; credit 2.
711. Alternating Current Machinery. Theory and operation of alternating current generators, motors, and transformers.
75. Prerequisites E. E. 607 and E. E. 604 or 610; recitations 5; credit 5.

712. Electrical Machinery. Elementary principles of electrical machinery and its application to industrial purposes, including transmission and mining.
75. Prerequisites, Physics 303 and 304 and Math. 426; recitations 3; credit 3.

715. Alternating Current Machinery. Same topics as Electrical Engineering 711, but with less detail.
75. Prerequisite E. E. 711; recitations 3; credit 3.

717. Electrical Engineering Laboratory. Practice with direct current circuits and machinery.
75. Prerequisite E. E. 604 or 610; lab. 1, 3 hr.; credit 1; fee $3.00.

720. Electrical Engineering Laboratory. Practice with direct current machinery and alternating current circuits and instruments.
75. Prerequisites E. E. 619 and 604 or 610, and 607; labs. 2, 3 hr.; credit 3; fee $5.00.

816. Electric Power Transmission. The principles underlying the design and construction of transmission and distributing systems.
85. Prerequisite E. E. 711; recitations 2; credit 2.

818. Electrical Engineering Laboratory. Practice with alternating current circuits and machinery.
85. Prerequisite E. E. 715; lab. 1, 3 hr.; credit 3; fee $3.00.

821. Electrical Engineering Laboratory. Continuation of Course 720. Practice with alternating current generators, motors, and transformers. Three hours' outside work in preparation and writing up results per week.
85. Lab. 2, 3 hr.; credit 3; fee $5.00.

85. Prerequisites E. E. 711 and 724; lab. 1, 3 hr.; credit 1.

830. Electrical Engineering Seminar. Continuation of Course 729.
85. Required.

831. A. C. Machinery and Power Plants. A continuation of E. E. 711, and a study of the problems involved in the design, construction and operation of electric power plants.
85. Prerequisite E. E. 711; recitations 3; credit 3.
840. Electrical Engineering Thesis. Preparation of a thesis on some Electrical Engineering subject—the designing and construction of some electrical machine or measuring instrument, the efficiency test and critical study of some dynamo-electric machine or power plant, or electrical research work in special direction.

8S. Credit 3.

Department of Mining Engineering

SAMUEL WALKER BEYER, PROFESSOR
IRA A. WILLIAMS, LAWRENCE C. HodSON, ASSOCIATE PROFESSORS
GEORGE A. GABRIEL, ASSISTANT PROFESSOR
MILTON F. BEECHER, INSTRUCTOR

The courses in Mining Engineering are planned to give the student a ready familiarity with the branches which form the ground work of science of Mining and Metallurgy. The Department of Mining Engineering aims to give to 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 course requires four years, and 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 Science in Mining Engineering. The requirements for admission are the same as those for admission to the 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," and become familiar with the principles involved and the methods employed in good mining engineering practice in general.

ROOMS AND EQUIPMENT

The Department of Mining Engineering occupies six rooms on the third floor of Engineering Hall and shares in common with the other Engineering departments the blue print, photographic, Engineering Museum and Assembly rooms. In addition to the rooms in Engineering Hall which are used for office, lecture, and museum purposes, the department has six rooms in the Engineering Annex and the Ceramics Building providing rooms for the work in fire and wet assaying, dry and wet metallurgy, ceramics and clay working, ceramic and industrial chemistry, Engineering Experiment Station work along chemical, ceramic, mining, and metallurgical lines, stock and preparation rooms, offices, and a designing room.

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.

**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 192 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 the partition wall space.

**Map Drawing and Designing Room.** This room is 23 x 25 feet on the second floor of Engineering Annex. It is well equipped with mine maps and working drawings covering the most important machines and apparatus used in mining and reduction works. General drawings showing the surface arrangements at a number of important mine and metallurgical plants are important parts of the equipment. The student furnishes his own drawing instruments, but such conveniences and necessities to mapping and designing as large steel straight edges, beam compasses, slide rules, and calculating machines, works of reference, and trade catalogues are furnished by the department.

**Surveying.** For field work in surveying the equipment is complete, comprising all the instruments and equipment necessary in making a complete surface and underground survey. An incomplete list includes a Queen Light Mountain Transit, two Berger No. 4 Light Mountain Transits with interchangeable side and top telescopes, an equatorial adaptor, enabling either instrument with its auxiliary telescope to be used as a solar compass, a Brunton and a Verschoyle Pocket Transit, lamps, tapes, etc.

**Mine Investigation.** For this purpose the department is supplied with a complete Sullivan Diamond Drill prospecting outfit, a Water Leyner Air Drill, a complete set of miner’s drills and tools, prospector’s pans, picks, anemometers, barometers, clinometers, etc., and mine, geological, and topographical maps of the most important mining districts.
Wet Metallurgical Laboratory. This laboratory is 24x30 feet on the second floor of Engineering Annex. A partial list of the equipment includes a Vizen Jig, Richards Pulsator Jig, classifiers of various kinds, screens, wet, dry, and vibratory, small Wilfley table, Magnetic Separator, Buddles, etc. In addition there is a good supply of tables, tanks, hose, glassware funnels, measuring apparatus, etc., so that temporary apparatus to illustrate the laws of settling and separation can be set up. This laboratory shares in the use of grinding machines and drying ovens placed for convenience elsewhere. With the apparatus listed and minor supplementary equipment, almost any problem in ore-dressing can be studied.

Dry Metallurgical Laboratory. This laboratory is 13x25 feet, on the second floor of Engineering Annex. The main equipment embraces electric furnaces, electric pyrometers, calorimeters, and a small desk equipment. It is intended to furnish this laboratory complete for the investigation of slags and their formation point, heat treatment of steels, and the behavior of metals, alloys, and ores so far as they can be studied on a comparatively small laboratory scale.

Rooms for Assaying. Two rooms in the new Engineering Annex, each 24x18 feet, and a smaller room for balances and stores, have been set aside for the use of students in Mining Engineering. These rooms are fully equipped for all kinds of assay work. One room will be equipped with experiment desks and lockers for twenty-eight students with complete chemical equipment for ore analysis and blow-piping. The second room is thoroughly equipped with everything required for fire assaying. This equipment consists of one large wind furnace, one Bosworth muffle furnace, one multiple muffle furnace, three crucible furnaces, and three two-multiple furnaces, all for coal or coke, five Cary Combination gasoline furnaces, and one Cary Crucible furnace. The weighing room contains assay and analytical balances mounted upon brick piers for the use of the two laboratories.

Coal Washing. The department has begun the equipment of a laboratory for Coal Washing. One New Century fast motion, 3 compartment jigging machine, is already in place. When completed this laboratory will be well equipped to study the problems involved in the washing of Iowa coals.

Location. Ames is located conveniently to the Iowa coal fields and students have 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 the 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.

Research Work. 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 co-operation 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 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 technical lecture is along mining engineering lines. 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 semesters. 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 Mining Engineering.

FOUR YEAR COURSE IN MINING ENGINEERING

This course leads to the degree of Bachelor of Science in Mining Engineering. Graduates from this course may receive the professional degree of Engineer of Mines by devoting an additional year to resident study and holding successfully a responsible engineering position for one
year, on the presentation of a satisfactory thesis; or by five years' service.
in responsible engineering work and presentation of thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates
the semester in which the subject is taught. If the subject is also taught in a
previous semester, the true course number is followed by a descriptive course num-
ber in parenthesis.

**COURSE IN MINING ENGINEERING**

*Freshman Year*

**FIRST SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40, Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 41, Plane Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>English 11, Exposition</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 2, General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Modern Language:</td>
<td></td>
</tr>
<tr>
<td>Language 18 or 57, French</td>
<td>3</td>
</tr>
<tr>
<td>Language 20 or 5a, German</td>
<td>3</td>
</tr>
<tr>
<td>Literature 15, English</td>
<td>3</td>
</tr>
</tbody>
</table>

Choice

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

Mechanical Engineering 121, Drawing 2
Mining Engineering 101, Principles of Mining 2 R
Military 1, Military Drill R
Physical Training 101, Gymnasium Work 2 R

Total semester hours 18

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42, Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 43, Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>English 10, Argumentation</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 5, Qualitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td>Modern Language:</td>
<td></td>
</tr>
</tbody>
</table>

The Language selected must be a continuation of the one chosen in the first semester.

* Freshmen who, after five weeks review of fundamentals, show deficient prepara-
tion in English or Mathematics may be assigned by the Dean of the Junior College and
the Dean of Engineering, to special classes, with one hour more work than indicated
above, and in case of clear indication of failure of these subjects, even with this ar-
rangement, they will be dropped from the Freshman work in this line until they have
given proof of sufficient preparation to enable them to carry the work successfully.
Sophomore Year

Students who secure remunerative 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 one month, subject to the approval of the head of the department.

THIRD SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 44,</td>
<td></td>
</tr>
<tr>
<td>Physics 303,</td>
<td></td>
</tr>
<tr>
<td>Chemistry 46,</td>
<td></td>
</tr>
<tr>
<td>English 12,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 382,</td>
<td></td>
</tr>
<tr>
<td>Mining Engineering 318,</td>
<td></td>
</tr>
<tr>
<td>Military 3 or</td>
<td></td>
</tr>
<tr>
<td>Physical Training 303,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 45,</td>
<td></td>
</tr>
<tr>
<td>Physics 404,</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering 488,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 401,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 423,</td>
<td></td>
</tr>
<tr>
<td>Mining Engineering 419,</td>
<td></td>
</tr>
<tr>
<td>Military 4 or</td>
<td></td>
</tr>
<tr>
<td>Physical Training 404,</td>
<td></td>
</tr>
<tr>
<td>Mining Engineering 423,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>
**FIRST SEMESTER**

**Junior Year**

Students who secure remunerative 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 one month, subject to the approval of the head of the department.

**FIFTH SEMESTER**

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 502</td>
<td>Analytical Mechanics 5</td>
</tr>
<tr>
<td>Mining Engineering 530</td>
<td>Assaying 3</td>
</tr>
<tr>
<td>Mining Engineering 510</td>
<td>Mine Surveying and Mining Law 3</td>
</tr>
<tr>
<td>Geology 501</td>
<td>General Geology 4</td>
</tr>
<tr>
<td>Mechanical Engineering 516</td>
<td>Mechanical Laboratory 1</td>
</tr>
<tr>
<td>English 15</td>
<td>Engineering English 2</td>
</tr>
<tr>
<td>Mining Engineering 506</td>
<td>Seminar R</td>
</tr>
</tbody>
</table>

Total semester hours 18

**SIXTH SEMESTER**

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 686</td>
<td>Hydraulics 4</td>
</tr>
<tr>
<td>Mining Engineering 614</td>
<td>Metallurgy 3</td>
</tr>
<tr>
<td>Geology 607</td>
<td>Mineralogy 3</td>
</tr>
<tr>
<td>Mining Engineering 602</td>
<td>Principles of Mining 3</td>
</tr>
<tr>
<td>Civil Engineering 656</td>
<td>Structural Engineering 3</td>
</tr>
<tr>
<td>Engineering 603</td>
<td>Conservation of Natural Resources 1</td>
</tr>
<tr>
<td>Elective in Literature, Economic Science, Public Speaking, Agricultural Journalism or History</td>
<td>1 to 2</td>
</tr>
<tr>
<td>Mining Engineering 607</td>
<td>Seminar R</td>
</tr>
<tr>
<td>Mining Engineering 613</td>
<td>Summer Field Work R</td>
</tr>
</tbody>
</table>

Junior students 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.

Total semester hours 18 or 19
### Senior Year

#### SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Engineering 715, Metallurgy</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Mining Engineering 703, Principles of Mining</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Geology 704, Advanced Geology</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Engineering 784, Steam Engines and Boilers</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Engineering 702, Specifications and Contracts</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Electrical Engineering, Electrical Machinery</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Elective in Literature, Economic Science, Public Speaking, Agricultural Journalism or History</td>
<td></td>
<td>1 to 2</td>
</tr>
<tr>
<td>Mining Engineering 708, Seminar</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Mining Engineering</td>
<td>Thesis begun</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18 or 19

#### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Engineering 804, Mining</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Geology 805, Economic Geology</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Engineering 801, History of Engineering</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Mechanical Engineering 809, Constructive Engineering</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Mining Engineering 816, Special Mining</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Mining Engineering 817, Special Metallurgy</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Geology 808, Special Geology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective in Literature, Economic Science, Public Speaking, Agricultural Journalism or History</td>
<td></td>
<td>1 to 2</td>
</tr>
<tr>
<td>Mining Engineering</td>
<td>Thesis</td>
<td>R</td>
</tr>
<tr>
<td>Mining Engineering 809, Seminar</td>
<td></td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18 or 19

### FIVE YEAR COURSE IN MINING ENGINEERING

The following five year course in Mining Engineering is offered in response to a demand for an engineering course giving the student a better education in the culture studies and the natural sciences together with an opportunity to specialize along certain engineering lines not possible in the time available in the four year course of study. The course includes all of the work given in the four year course, and in addition affords opportunity to do more work along cultural and scientific lines during the first three years and to elect additional subjects given in the engineering departments during the last two years.

This course leads to the same degree granted to graduates of the four year course. A graduate of the five year course may obtain the
full professional degree of Engineer of Mines after one year of responsible professional work and the presentation of a satisfactory thesis.

N. B. Engineering Course Numbers. The number in hundreds place indicates the semester in which the subject is taught. If the subject is also taught in a previous semester, the true course number is followed by the descriptive course number in parenthesis.

### Freshman Year

**FIRST SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40,</td>
<td>Algebra</td>
</tr>
<tr>
<td>Mathematics 41,</td>
<td>Plane Trigonometry</td>
</tr>
<tr>
<td>Modern Language,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The Language selected</td>
<td></td>
</tr>
<tr>
<td>must be continued</td>
<td></td>
</tr>
<tr>
<td>through the year.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Language 18 or 57,</td>
<td>French</td>
</tr>
<tr>
<td>Language 20 or 5a,</td>
<td>German</td>
</tr>
<tr>
<td>Language 36 or 33,</td>
<td>Spanish</td>
</tr>
<tr>
<td>Literature 15,</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 57 or Spanish 33 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages.

Beginning German is not offered in the Freshman year.

<table>
<thead>
<tr>
<th></th>
<th>Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 11,</td>
<td>3</td>
</tr>
<tr>
<td>History 5,</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 121,</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering 130,</td>
<td>2</td>
</tr>
<tr>
<td>Mining Engineering 101,</td>
<td>R</td>
</tr>
<tr>
<td>Military 1,</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42,</td>
<td>Trigonometry</td>
</tr>
<tr>
<td>Mathematics 43,</td>
<td>Analytical Geometry</td>
</tr>
<tr>
<td>Modern Language:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The Language selected</td>
<td></td>
</tr>
<tr>
<td>must be a continuation</td>
<td></td>
</tr>
<tr>
<td>of the one chosen in the</td>
<td></td>
</tr>
<tr>
<td>first semester.</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Language 19 or 58,</td>
<td>French</td>
</tr>
<tr>
<td>Language 21 or 6a,</td>
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<tr>
<td>Language 37 or 34,</td>
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<tr>
<td>Literature 16,</td>
<td>English</td>
</tr>
<tr>
<td>English 10,</td>
<td>Narration and Description</td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
### Mechanical Engineering 220, Descriptive Geometry 2
### Mechanical Engineering 229, Wood Shop 2
### History 8, History of the United States, 1763-1912 3
### Mining Engineering 220, Technical Lecture R
### Military 2, Drill R
### Mining Engineering 212, Summer Field Work R

**Total semester hours** 18

#### Sophomore Year

#### Third Semester

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
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</thead>
<tbody>
<tr>
<td><strong>Mathematics 44</strong></td>
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<tr>
<td><strong>English 12</strong></td>
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<tr>
<td><strong>Chemistry 2</strong></td>
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<tr>
<td><strong>Civil Engineering 308</strong></td>
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<tr>
<td><strong>Mechanical Engineering 382</strong></td>
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<tr>
<td><strong>Military 3, or Athletics,</strong></td>
</tr>
<tr>
<td><strong>Elective,</strong></td>
</tr>
<tr>
<td><strong>Analytical Geometry and Calculus</strong> 5</td>
</tr>
<tr>
<td><strong>Argumentation</strong>        2</td>
</tr>
<tr>
<td><strong>General Chemistry</strong>    5</td>
</tr>
<tr>
<td><strong>Surveying</strong>            4</td>
</tr>
<tr>
<td><strong>Mechanical Drawing</strong>   2</td>
</tr>
<tr>
<td><strong>Non-technical Work</strong>   R 1</td>
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**Total semester hours** 19

#### Fourth Semester

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td><strong>Mathematics 45</strong></td>
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<tr>
<td><strong>English 13</strong></td>
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<tr>
<td><strong>Chemistry 5</strong></td>
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<tr>
<td><strong>Mechanical Engineering 423</strong></td>
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<tr>
<td><strong>Civil Engineering 409</strong></td>
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<tr>
<td><strong>Military 4, or Athletics,</strong></td>
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<td><strong>Elective,</strong></td>
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<tr>
<td><strong>Mining Engineering 423</strong></td>
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<tr>
<td><strong>Differential and Integral Calculus</strong> 5</td>
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<tr>
<td><strong>Advanced Composition</strong> 2</td>
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<td><strong>Qualitative Analysis</strong> 5</td>
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<tr>
<td><strong>Mechanical Drawing</strong>   1</td>
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<td><strong>Surveying</strong>            4</td>
</tr>
<tr>
<td><strong>Non-technical Work</strong>   R 1</td>
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<tr>
<td><strong>Summer Field Work</strong>    R</td>
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</table>

**Total semester hours** 18

#### Junior Year

#### Fifth Semester

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td><strong>Physics 503 (303)</strong></td>
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<tr>
<td><strong>Economic Science 9</strong></td>
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<tr>
<td><strong>Mining Engineering 510</strong></td>
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<tr>
<td><strong>Chemistry 50,</strong></td>
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<tr>
<td><strong>Mechanics and Heat</strong>   5</td>
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<tr>
<td><strong>Outlines of Economics</strong> 3</td>
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<tr>
<td><strong>Mine Surveying</strong>       4</td>
</tr>
<tr>
<td><strong>Analytic Chemistry</strong>   5</td>
</tr>
</tbody>
</table>

**Total semester hours**
Mechanical Engineering 519,  
Mining Engineering 506,  
Drawing  
Seminar  
Total semester hours 18 

SIXTH SEMESTER  
Required Semester Hours  
Physics 604 (404),  
Economic Science 12,  
Mechanical Engineering 601 (401),  
Geology 607 (501),  
Mining Engineering 618,  
Mining Engineering 607 (507),  
Mining Engineering 613,  
Electricity and Magnetism and  
Light and Sound  
Engineering Economics  
Analytical Mechanics  
Mineralogy  
Assaying  
Seminar  
Summer Field Work  
Total semester hours 18  

Senior Year  
SEVENTH SEMESTER  
Required Semester Hours  
Mechanical Engineering 702 (502),  
Electrical Engineering 712,  
Physics 723 (523),  
Geology 701 (501),  
Mining Engineering 708,  
Elective,  
Analytical Mechanics  
Electrical Machinery  
Physical Laboratory  
General Geology  
Seminar  
Total semester hours 18  

EIGHTH SEMESTER  
Required Semester Hours  
Mechanical Engineering 886 (686),  
Civil Engineering 811 (611),  
Geology 2,  
Mining Engineering 802 (602),  
Mining Engineering 814 (614),  
Mining Engineering 809,  
Engineering 803 (603),  
Analytical Mechanics  
Structural Engineering  
Stratigraphic and Historical Geology  
Mining Engineering  
Metallurgy  
Seminar  
Conservation of Natural Resources  
Total semester hours 19
### Post Senior Year

#### NINTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Hours</th>
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</thead>
<tbody>
<tr>
<td>Mining Engineering 903 (703)</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Engineering 984 (784)</td>
<td></td>
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<tr>
<td>Engineering 902 (702), Geology 904 (704), Mining Engineering 915 (715), Elective, Mining Engineering 919,</td>
<td>2</td>
</tr>
<tr>
<td>Mining Engineering 919, Seminar</td>
<td>R</td>
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</tbody>
</table>

Total semester hours 18

#### TENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Hours</th>
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<tbody>
<tr>
<td>Engineering 1001 (801)</td>
<td>1</td>
</tr>
<tr>
<td>Civil Engineering 1022 (822), Geology 1005 (805), Mining Engineering 1017 (817), Elective, Mining Engineering 1020,</td>
<td>4</td>
</tr>
<tr>
<td>History of Engineering</td>
<td></td>
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<tr>
<td>Water Supply Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Economic Geology</td>
<td>4</td>
</tr>
<tr>
<td>Special Work in Mining, Metallurgy or Geology</td>
<td>5</td>
</tr>
</tbody>
</table>

Total semester hours 18

### COURSES IN MINING ENGINEERING

101. **Principles of Mining** is taken in connection with the required Shop Work. The student receives instruction in 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, exploration, mining methods, and the various subjects included in Courses 602, 703 and 804. Special attention is given to mining terms and local mining methods. Three lectures of this course are given by the College Librarian in explanation of the catalogue system and the use of reference books.

18. **Required.**

212. **Summer Field Work in Mine Surveying.** Two weeks’ work required at the close of the Freshman year. 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.

2S. Required.

220. **Principles of Mining.** A continuation of Course 101, taken in connection with the required Shop Work. The Mining and Metallurgical operations to be seen while on the succeeding Summer Field Trip are studied with as much detail as the time and student's preparation permit.

2S. Required.

318. **Journal Club** consists of weekly conferences with one or more of the instructors in the department, in which the leading mining journals receive principal attention. Lectures are given occasionally on current topics and the students are encouraged to acquire the habit of reading the technical journals which are to be found on the library shelves.

3S. Required.

419. **Journal Club.** See Course 318. Continuation of 318.

4S. Required.

423. **Summer Field Work in Mine Surveying.** Two weeks' work required at the close of the Sophomore year. 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.

4S. Required.

506. **Seminar.** For the purpose of bringing together the Junior and Senior students and the members of the instructing corps for weekly conferences. A discussion of timely topics by the students.

5S. Required.

510. **Mine Surveying and Mining Law.** Supplements the work in surveying taken in the Civil Engineering Department. Methods of surveying especially adapted to mines and tunnels. The use of the auxiliary telescope and the various problems met with in underground surveying are illustrated by means of problems taken from actual practice. Also Mineral Land Surveying. As the subject of Mineral Land Surveying necessarily requires some knowledge of the law relating to mining claims, the whole subject of Mining, Mineral and Geological Law is given a rapid review. While an exhaustive study of such laws is impossible 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.

5S. Recitations 3; credit 3.


5S. Recitations, lab.; credit 3.
602. **Principles of Mining.** Study of methods employed in excavating, boring and shaft sinking, mining and the support of mine excavations; also critical study of methods employed in exploration, development and mine working in general.

6S. Recitations 3; credit 3.

607. **Seminar.** Continuation of Course 506.

6S. Required.

613. **Summer Field Work in the Study of Mine Operation and Equipment, and of Concentrating Plants.** Four weeks' work required of students who have completed the Junior year. 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.

6S. Required.

614. **Metallurgy.** Study of refractory materials, fluxes, fuels and furnaces; also pyrometry, calorimetry, fire clays and coke; the various metallurgical furnaces studied from working drawings; also an introduction to the science of metallography.

6S. Recitations; lab.; credit 3.

618. **Assaying.**

6S. Credit 3.

703. **Principles of Mining.** Continuation of Course 602, with special reference to Mining Machinery. The subject of Haulage, Hoisting, Ventilation, Air Compressors, etc., are studied with as much detail as time permits.

7S. Recitations 3; credit 3.

708. **Seminar.** Continuation of Courses 506 and 607.

7S. Required.

715. **Metallurgy.** Study of processes relating to copper, gold, lead, silver and zinc. In the time alloted to the work, a study of 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.

7S. Recitations 4; credit 4.

804. **Mining Engineering.** Ore dressing, amalgamation, cyanidation, mine buildings and general equipment and administration of mines.

8S. Recitations 5; credit 5.

809. **Seminar.** Continuation of Courses 506, 607 and 708.

8S. Required.

816. **Mining Engineering.** Mine Examinations and Reports, Mine Accounting, Mine Plant Design. A comparative study of Mine Plants, New Concentration Methods, etc. These and kindred subjects will be taken up, though not all during any one year. Instruction by means of lectures, assigned reading and reports. After preliminary work of this character, the student will be required to make designs and reports.
covering given problems. Students electing this work will be expected to write their graduating theses on subjects introduced in this course.

817. Metallurgy. Intended for students who desire to specialize as much as possible in metallurgy. The subjects will be varied from year to year to suit the needs of the individual students. Instruction given by means of assigned readings, conferences and reports carried on simultaneously with work in the laboratory. Those electing this work will be required to write their graduating theses on subjects introduced in this course.

8S. Credit 4.

919. Seminar.

1020. Seminar.

COURSES IN GEOLOGY

501. General Geology: Dynamic, Structural and Physiographic Geology. Includes a study of the principles which form the groundwork of the Science and is given by means of recitations, lectures, laboratory and field work. Counts four hours per week, three of which are devoted to recitations and lectures, and one to laboratory and field work. Prerequisites, one or more semesters each of Chemistry and Physics.

607. Mineralogy. The first half of the term is devoted to a study of the morphological and physical characters of crystalline substances, while the last half is devoted to descriptive and determinative mineralogy.

6S. Prerequisites Math., Chem. and Physics.; labs. 4, 2 hr; credit 3.

704. Petrologic and Advanced Structural Geology. The first ten weeks of the term are devoted to the study of rocks, their origin, occurrence and association, and the last six weeks to a discussion of principles and problems in Structural Geology.

7S. Prerequisites Geol. 501 or 803; recitations 3, lab. 1, 3 hr.; credit 4.

803. Engineering Geology. Includes a discussion of the fundamental principles of dynamic and structural geology and a study of the common minerals and rocks, especially those important in structural materials.

6S. Credit 2 or 3.

805. Economic Geology. The first ten weeks includes a study of the non-metallics, while the remainder of the term is devoted to a study of the ore deposits of the United States, Canada, and Mexico. Especial stress is put upon the principles which govern the mode of occurrence, association and origin of the leading economic products.

8S. Prerequisites Geol. 501 or 803, and 704; recitations 3, lab. 1, 3 hr.; credit 4.

808. Thesis. Students in Mining Engineering electing to write a thesis in geology are required to take four hour's special work in geology during the second semester Senior year. This special work may be along any one of the following lines: Economic Geology, Petrology, Dynamic Geology, Structural Geology, Metamorphism, Historical Geology or Stratigraphic Geology.

8S. Credit 4.
Department of Physics and Illuminating Engineering

LOUIS BEVIER SPINNEY, PROFESSOR
ARTHUR HENRY HOFFMAN AND WILLIAM BALLANTYNE ANDERSON, ASSOCIATE PROFESSORS
WILLIAM KUNERTH, ASSISTANT PROFESSOR
HERBERT JOHN FLAGGE, AND JOHN CALVIN POMEROY, INSTRUCTORS

This department occupies ten rooms on the first floor and five rooms on the second floor of Engineering Hall. These rooms include six laboratories, two class rooms, and two apparatus rooms.

The Engineering Assembly is used as a Physics lecture room. This room is modern in its equipment for lecture purposes. It is fitted with two lanterns, a projectoscope and screens, gas, compressed air and water connections, and electric connections to storage batteries, and direct and alternating current dynamos. There is also a good equipment in apparatus for demonstration purposes, which is stored in the physical cabinet and apparatus rooms.

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.

The photometry and illumination 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 and other sources of illumination.

The equipment includes three Reichsanstalt photometers, a Matthew’s Integrating Photometer, an Ulbricht sphere, a Sharp-Millar universal photometer, a Holophane lumeter, an Ives’ colorimeter, a storage battery of sixty 15 amperet cells, recording voltmeters, Weston standard and portable voltmeters and ammeters.

The repair shop is fitted with an engine lathe, a circular saw with tilting table, 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.

COURSES IN PHYSICS


Prerequisite Math. 17; recitations 3; credit 3; fee for mimeograph notes $1.50.

2S. Recitations 3; credit 3; fee for mimeograph notes $1.50.


3S. Recitations 3; credit 3; fee for mimeograph notes $1.50.
303. Mechanics and Heat. Mass, force, work and energy and power, general mechanics and heat, also study of vector quantities and their treatment. The mathematical aspect of the subject is not emphasized but the student is urged to familiarize himself with the theoretical side of the question, as it is believed that such a foundation is essential to the work which follows.

3S. Prerequisites Math. 120 and 222; recitations 5, lab. 1, 2 hr.; credit 5; fee $2.00.

402. Electricity and Magnetism, Light and Sound. This course together with 301, of which it is a continuation, is designed to meet the needs of students in the course in Home Economics.

4S. Prerequisite 301; recitations 3; credit 3; fee for mimeograph notes $1.50.

404. Electricity and Magnetism and Light and Sound.

4S. Prerequisite Physics 303; recitations 5, lab. 1, 2 hr.; credit 5; fee $2.00.

508. Sound. Theory of Sound with special reference to music. Nature of sound, the physics of the musical scale, and those topics, such as tone quality, resonance, etc., which are of special interest and importance to the student of music. Lectures, one hour per week.

514. Physical Laboratory. Experiments in the mechanics, heat, and light, comprising accurate determinations of length, mass, time, density, energy, and moment of inertia, and also work in elasticity, calorimetry, photometry and spectroscopy.

5S. Prerequisites Physics 303 and 404 and Math. 426; labs. 2, 2 hr.; credit 2; fee $5.00.

523. Physical Laboratory. General laboratory work in mechanics, heat, and light.

5S. Prerequisites 303, 404, and Math. 426; lab. 1, 3 hr.; credit 1; fee $3.00.


5 or 7S. Prerequisites Physics 303 and 404, 301 and 402, or 205; credit 3; elective.

525. Heat. Laboratory Course to accompany 524.

5 or 7S. Credit 1; fee $3.00; elective.


5 or 7S. Prerequisite Physics 404; credit 1; elective in all engineering and science courses.

528. Wireless Telegraphy. Laboratory to accompany 527. Practice in the design, manufacture, adjustment, testing, and use of wireless transmitting and receiving apparatus. Calculation and measurements of capacities, inductances, wavelengths, decrements, etc.

5 or 7S. Lab. 1, 3 hr.; credit 1; elective; fee $3.00.

615. Physical Laboratory. A shorter course similar to Physics 617.

6S. Prerequisites 514 or 523; lab. 1, 1 hr.; credit 1; fee $3.00.

617. Physical Laboratory. Measurements of current, resistance, electromotive force, capacity and inductance. Experimental study of the earth's magnetism, magnetic hysteresis and other magnetic properties of iron, and the efficiency of incandescent lamps at various voltages. In-
sulation tests, instrument tests, battery tests, and the location of line faults. The electrolytic rectifier and other alternating current studies.

6S. Prerequisites 514 or 523; lab. 2, 2 hr.; credit 2; fee $5.00.


6 or 8S. Prerequisites 303 and 404, or 301 and 402; elective.

619. Light. Laboratory Course to accompany 618.

6 or 8S. Recitation 1; credit 1; elective; fee $3.00.


7S. Prerequisites 504 and 514 or 523; recitations 2; credit 2.

511. Photography. A discussion of the theory of the formation of images by lenses, the defects of lenses and their correction, the methods used in testing lenses and shutters, determining times of exposure, etc. The course includes such dark room work and manipulation as is required to illustrate the principles involved. Optional in all courses. Lectures and laboratory, one hour per week. Prerequisites, Physics 205, or 402, or 404.

809. Theory of Illumination. A continuation of Physics 708, including the theory and use of the integrating photometer and the illuminometer. This course also includes the principles of design of interior and exterior illumination.

8S. Prerequisite 708; credit 3; fee $3.00.

810. Illumination. A briefer course in illumination covering the following general topics: The physical basis of the production of light, light standards, photometry, efficiencies, color and distribution characteristics, measurements of mean spherical candle-power and interior and exterior illumination.

8S. Prerequisites 404 and 514, or 523; credit 3; fee $3.00.

CERAMICS AND CLAY WORKING

AMOS P. POTTER, ACTING ASSISTANT PROFESSOR
MILTON BEECHER, INSTRUCTOR

The Department of Ceramics was established in the College in response to a growing demand for instruction in the silicate industries. The continued development of the clay working interests and the notable recent expansion along all lines of the cement industry have created a demand for technically educated men who are equipped to take the lead in the utilization of the silicate raw materials. Inquiries for qualified men along these lines have come from various sources, but at the present time the demand is far greater than the supply.
The term "Ceramics" has come to include within its scope the several phases of that branch of engineering which has to do with the investigation and development of all materials which enter into any of the silicate products. Besides clay and cement, therefore, glass-making, sand-lime brick manufacture, and all mortar work into which natural silicates or silicate forming processes enter are properly embraced in the definition of the word.

The ceramic processes proper are pre-eminently a phase of chemical engineering and depend upon the principles of technical chemistry. Along with this application of chemical principles must go, however, a thorough familiarity with good mechanical engineering practice and in this line a knowledge of surveying and the principles of electricity is also essential. Indeed, a course leading to a Degree in Mechanical Engineering may be considered the ideal preparation for a course Ceramic Engineering. The ceramist must likewise possess a knowledge of geology which will enable him to intelligently prospect for raw materials and to take advantage of geological features in their utilization. An acquaintance with metallurgical principles especially those relating to the value of fuels and their combustion and the properties of slags is indispensable, for upon the application of this knowledge may frequently depend the success or failure of large enterprises.

It is the design of the course in Ceramics to prepare and equip engineers to (a) intelligently exploit deposit of suitable raw materials, (b) to comprehend and apply economical methods to the winning of such materials, (c) to design and put into operation plants for their utilization and, (d) to take responsible charge of any and all technical processes connected with the manufacture of the finished products. To accomplish this, not only are the principles laid down in the class room and the theories explained, but these principles and theories are verified and applied in the laboratory and in the field. Students are also required to study the methods employed in some of the leading establishments of the state and are encouraged to spend their vacations in practical work at some of these plants.

Ceramics Building

The ceramics building, erected in conjunction with the recently completed Engineering Annex, is designed to meet the immediate needs of the ceramic work. It is a substantial brick building 50 x 70 feet and two and one-half stories in height, forming a right angle with the Annex which it joins at the south end. This structure, with two floors of equal width in the Annex proper, render available for the work in ceramics, metallurgy and industrial chemistry, practically a two and one-half story, building 120 x 50 feet.

On the first floor of the ceramics addition, laboratories are provided for ceramic and industrial chemistry and for the physical testing of clays, cement, and other ceramic raw materials; also rooms for kilns, dryers, packing and storage of supplies, and a room for dry grinding and crush-
ing. There is also an office on this floor. On the second floor are set apart rooms for pyrometry, gas, fuel and water analysis, besides laboratories for clay and cement research, and for the temporary use of the Engineering Experiment Station. The ceramic museum, a room for dry metallurgical work, and an office are also on the second floor.

The individual laboratories are being thoroughly equipped with the necessary apparatus for carrying on all lines of ceramic instruction and investigation. The main clay working room is located in the Engineering Annex and is 30 × 23 feet. This laboratory is equipped with a small auger machine for making brick and block, drain, roofing and floor tile, a potter's turning wheel, filter press, double blunger, hand power press for dry press brick and floor and wall tile, a series of ball mills, and a complete clay testing outfit. As an adjunct to the main ceramic laboratory and for the preparation of dry materials for assaying and metallurgy as well, the dry grinding room contains a dry pan, laboratory crushers, and a Sturtevant grinder.

The kiln room, in the northwest corner of the first floor is a little over 14 × 20 feet and affords space for both an up and down draft experimental kiln using solid fuel, and a pottery kiln in which oil is burned. Separate outside concrete bins opening into this room are provided for coal, coke, and wood. Next to the kilns is the dryer and physical testing room in which are a small gas heated drying oven and benches, equipped with the necessary utensils for making up and testing the physical properties of clays and other ceramic materials. The dimensions of this room are 20 feet, 7 inches, by 14 feet. Investigations of special technical problems in the ceramic fields are carried on in the research laboratories which are provided with the usual pieces of chemical apparatus and furniture, besides special equipment for specific investigations.

The laboratory for pyrometry and gas and fuel testing is in the northwest corner of the second floor directly above the kiln room. This location is convenient also for sampling and testing the flue gases from the kilns below and for making temperature observations. The equipment for this work includes an improved Elliott apparatus for gas analysis, Parr calorimeter for solid fuels, Junker calorimeter for gas and oils, Le Chateliers electric, a Wanner optical and a Brown metallic pyrometer.

The ceramic museum is for the display of representative raw materials and finished products from all of the ceramic industries.

Rooms have been provided in the new Ceramics Addition for the temporary use of the Engineering Experiment Station. These consist of one large laboratory for general chemical analysis, special rooms for water and fuel analysis, and an office room for the chemist in charge. These rooms are fitted with all the apparatus necessary for carrying on the chemical work of the Experiment Station, and the special rooms, while primarily for station work, will be open for use by advanced students. A room for ceramic chemistry is provided with desks and all necessary laboratory equipment for the analysis of clay, cement, and ceramic products, and will be open only to students in ceramics. A balance room is attached to this laboratory.
A large, well-lighted room in the Ceramics Addition has been reserved for industrial chemistry. It is planned to fit this room with the mechanical appliances necessary for the student in technical chemistry, as well as such regular laboratory apparatus as is found in industrial laboratories.

**COURSE IN CERAMICS**

*Freshman Year*

**FIRST SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Mathematics 40,</td>
<td>Algebra</td>
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<tr>
<td>Mathematics 41,</td>
<td>Plane Trigonometry</td>
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<tr>
<td>English 11,</td>
<td>Exposition</td>
</tr>
<tr>
<td>Chemistry 2,</td>
<td>General Chemistry</td>
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</table>

**Modern Language:**

The Language selected must be continued through the year.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language 18 or 57,</td>
<td>French</td>
<td>3</td>
</tr>
<tr>
<td>Language 20 or 5a,</td>
<td>German</td>
<td>3</td>
</tr>
<tr>
<td>Literature 15,</td>
<td>English</td>
<td>3</td>
</tr>
</tbody>
</table>

Students choosing Modern Foreign Language should continue the language offered for entrance, but may take French 67 provided that satisfactory reasons for the change are presented to the Dean of the Junior College and the Professor of Modern Languages. Beginning German is not offered in the Freshman year.

Mechanical Engineering 121, Drawing | 2
Mining Engineering 101, Principles of Mining | R
Military 1, Military Drill | R
Physical Training 101, Gymnasium Work | R

Total semester hours | 18

* Freshmen who, after five weeks review of fundamentals, show deficient preparation in English or Mathematics may be assigned by the Dean of the Junior College and the Dean of Engineering, to special classes, with one hour more work than indicated above, and in case of clear indication of failure of these subjects, even with this arrangement, they will be dropped from the Freshman work in this line until they have given proof of sufficient preparation to enable them to carry the work successfully.

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42,</td>
<td>Trigonometry</td>
</tr>
<tr>
<td>Mathematics 43,</td>
<td>Analytical Geometry</td>
</tr>
<tr>
<td>English 12,</td>
<td>Argumentative Analysis</td>
</tr>
<tr>
<td>Chemistry 5,</td>
<td>Quantitative Analysis</td>
</tr>
</tbody>
</table>

**Modern Language,**

The Language selected must be a continuation of the one chosen in the first semester.
Students who secure remunerative 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 one month, subject to the approval of the head of the department.

### Sophomore Year

#### Third Semester

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 44,</td>
<td></td>
</tr>
<tr>
<td>English 12,</td>
<td></td>
</tr>
<tr>
<td>Ceramics 301,</td>
<td></td>
</tr>
<tr>
<td>Physics 303,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 382</td>
<td></td>
</tr>
<tr>
<td>Military 3, or Physical Training 303,</td>
<td></td>
</tr>
</tbody>
</table>

**Total semester hours** 18

#### Fourth Semester

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 45,</td>
<td></td>
</tr>
<tr>
<td>Ceramics 403,</td>
<td></td>
</tr>
<tr>
<td>Ceramics 408</td>
<td></td>
</tr>
<tr>
<td>Physics 404,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 401</td>
<td></td>
</tr>
<tr>
<td>Mining Engineering 419,</td>
<td></td>
</tr>
<tr>
<td>Military 4, or Physical Training 404,</td>
<td></td>
</tr>
</tbody>
</table>

**Total semester hours** 18
Students who secure remunerative employment in the silicate industries during their summer vacation will be excused from summer field work, providing they are so employed for one month, subject to the approval of the head of the department.

Junior Year

FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 502</td>
<td>5</td>
</tr>
<tr>
<td>Ceramics 502</td>
<td>5</td>
</tr>
<tr>
<td>Geology 501</td>
<td>4</td>
</tr>
<tr>
<td>Physics 523</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>2</td>
</tr>
<tr>
<td>Mining Engineering 506</td>
<td>R</td>
</tr>
<tr>
<td>Mechanical Engineering 512</td>
<td>1</td>
</tr>
</tbody>
</table>

Total semester hours 18

SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 686</td>
<td>4</td>
</tr>
<tr>
<td>Ceramics 604</td>
<td>5</td>
</tr>
<tr>
<td>Civil Engineering 656</td>
<td>3</td>
</tr>
<tr>
<td>Mining Engineering 614</td>
<td>3</td>
</tr>
<tr>
<td>Engineering 603</td>
<td>1</td>
</tr>
<tr>
<td>Physics 615</td>
<td>1</td>
</tr>
<tr>
<td>Mechanical Engineering 613</td>
<td>1</td>
</tr>
<tr>
<td>Mining Engineering 607</td>
<td>R</td>
</tr>
<tr>
<td>Mining Engineering 613</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours 18

Junior students who secure instructive employment in one of the great clay working or cement manufacturing 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.

Senior Year

SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramics 709</td>
<td>4</td>
</tr>
<tr>
<td>Ceramics 710</td>
<td>4</td>
</tr>
<tr>
<td>Geology 704</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Engineering 784</td>
<td>2</td>
</tr>
<tr>
<td>Ceramic Design</td>
<td></td>
</tr>
<tr>
<td>Ceramics Laboratory</td>
<td></td>
</tr>
<tr>
<td>Geology</td>
<td></td>
</tr>
<tr>
<td>Steam Engines and Boilers</td>
<td></td>
</tr>
</tbody>
</table>
### EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective in Literature, Economic Science, Public Speaking, Agricultural Journalism or History</td>
<td>1 to 2</td>
<td></td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td>18 or 19</td>
<td></td>
</tr>
</tbody>
</table>

#### COURSES IN CERAMICS

**301. Ceramic Chemistry.** Quantitative analysis of raw materials used in the clay and cement industries. Special attention is given to silicate minerals, beginning with those of simple composition and progressing as far as possible in the analysis of the more complex clays, feldspars.

3S. Labs. 4, 3 hr.; credit 4.

**403. Ceramic Chemistry.** Course 301 continued. Rational analysis of clays; proximate analysis of coal; flue gas analysis, determination of $\text{B}_2\text{O}_3$, $\text{PbO}$ and $\text{ZnO}$ in glaze.

4S. Recitation 1; labs. 3, 3 hr.; credit 4.

**408. Ceramic Calculations.** Problems in the calculation of batches and charges of glasses, glazes, bodies and cement.

4S. Recitation 1; credit 1.

**502. Ceramic Lectures.** Classification, properties and methods of winning clays and other minerals used in the Ceramic industries.

5S. Recitations 5; credit 5.

**604. Ceramic Lectures.** Manufacture of clay wares, including preparation of clay, formation of the ware, drying and burning.

6S. Recitations 5; credit 5.

**705. Ceramics.** Visits to important clay and cement working centers. Careful study and written reports on the plants inspected.

7S. Credit 1.

**709. Ceramic Design.** Design and laying out of structures and plants for the manufacture of the various ceramic products.

7S. Recitations 1, lab. 3, 3 hr.; credit 4.
710. **Ceramics.** Clay-working laboratory. Commercial testing, washing, refining of raw clays, compounding of artificial bodies and formation of wares.

7S. Recitations 2, lab. 2, 2 hr.; credit 4.

806. **Ceramics.** Manufacture and technique of glass, glazes, enamels, cements and cement products.

8S. Recitations 1, lab. 3, 3 hr.; credit 4.

807. **Ceramics.** Special problems and thesis.

8S. Recitations 1, lab. 3, 3 hr.; credit 4.

**FIVE YEAR COURSE IN CERAMIC ENGINEERING**

No special five year course in Ceramic Engineering is offered, but those students who can afford to spend five years in preparation for this work, are earnestly advised to pursue to completion, a course in Mechanical Engineering and then to take a year of work, consisting of not less than thirty hours and subject to the approval of the Professor in charge of this department.

Such a course would lead to the same degree as the four year course, and the Professional Degree will be awarded subject to the same conditions as held in the four year Engineering Courses.

When it is appreciated that the Ceramic Engineer is called upon to solve ten problems of a mechanical nature, to one that is purely ceramic in character, the value of this course will be recognized.

**CHEMICAL ENGINEERING**

**GEORGE A. GABRIEL, PROFESSOR**

The increasing importance of Chemical Chemistry has led to the bringing together here of the courses offered to students under the title Chemical Engineering. These courses are intended to prepare the student pursuing them to fill positions as chemists in the various manufacturing industries.

The following described courses are open for election to students who are candidates for the degrees in the Divisions of Science and Engineering. Students who complete the required number of courses in connection with the required credits in other courses will receive the degree of Bachelor of Science in Chemical Engineering.

Students who are candidates for this degree will apply to the Dean of the Engineering Division, and the professor in charge of the work in Chemical Engineering, who will arrange the course required.

The work in Chemical Engineering has been established in response to the increasing demand for instruction in the various manufacturing industries. A complete revolution is now proceeding in American industries, and the opportunities offered to technically trained men who are properly equipped are numerous and varied. Inquiries for men trained along industrial lines come in from various sources from time to time, but the demand is greater than the supply.

The term "Chemical Engineer" has come to mean a man who has,
besides a knowledge of the fundamental principles of chemistry, skill to apply those principles to practical work on a commercial scale, and ability to superintend intelligently the processes of manufacture, and also, along with this application of the principles of chemistry, he must have a good knowledge of mechanical, as well as electrical engineering, so as to be able to erect and properly care for machinery of various types.

It is the purpose of the course in Chemical Engineering to give the student a general theoretical and practical knowledge of the various activities of Industrial Chemistry, a large amount of pure chemistry, considerable engineering work, a large amount of laboratory and shop work, and to prepare and equip the student to assume responsible work in any technical process.

To accomplish this, not only are the principles and theories laid down and explained in the lecture room, but also the student is given the opportunity to verify and apply these principles in the laboratory on a scale of sufficient magnitude that he may obtain data of the cost and economy of manufacture.

A few of the industries which it is intended to give are as follows: soap manufacture, paint and varnish manufacture, oil refining, paper manufacture, starch, glucose, sugar, cement, heavy chemicals, coal, tar products, etc.

The course is intended to be of such a practical character that men graduating in this course will be able almost immediately to fill important positions in the various industries.

Students pursuing work in any of the engineering courses can enter the course in Chemical Engineering at any time up to the beginning of the Junior year, but, in addition to the Junior and Senior work given below, must take work in Chemistry equivalent to Chemistry Courses 2, 5, 51, 11, 17.

COURSE IN CHEMICAL ENGINEERING

*Freshman Year

**First Semester**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 40,</td>
<td></td>
</tr>
<tr>
<td>Mathematics 41,</td>
<td></td>
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<tr>
<td>Language 5a,</td>
<td></td>
</tr>
<tr>
<td>English 11,</td>
<td></td>
</tr>
<tr>
<td>Chemistry 2,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 121,</td>
<td></td>
</tr>
<tr>
<td>Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Plane Trigonometry</td>
<td>2</td>
</tr>
<tr>
<td>German</td>
<td>3</td>
</tr>
<tr>
<td>Exposition</td>
<td>3</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Mechanical Drawing</td>
<td>2</td>
</tr>
</tbody>
</table>

*Freshmen who, after five weeks review of fundamentals, show deficient preparation in English or Mathematics may be assigned by the Dean of the Junior College and the Dean of Engineering, to special classes, with one hour more work than indicated above, and in case of clear indication of failure in either of these subjects, even with this arrangement, they will be dropped from the Freshman work in this line until they have given proof of sufficient preparation to enable them to carry the work successfully.
Military, 1, Military Drill \[ R \]
Physical Training 101, Physical Training 202 \[ R \]

**Total semester hours** 18

### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
<th>Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 42,</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 43,</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Language 6a,</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>English 10,</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 5,</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Mechanical Engineering 220,</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Military 2,</td>
<td></td>
<td></td>
<td>R</td>
</tr>
<tr>
<td>Physical Training 202</td>
<td></td>
<td></td>
<td>R</td>
</tr>
</tbody>
</table>

**Total semester hours** 18

### Sophomore Year

### THIRD SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
<th>Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 44,</td>
<td>Plane Analytic Geometry and Calculus</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Chemistry 26,</td>
<td>Extra Laboratory, 2 Recitations, 2 Laboratories</td>
<td>3½</td>
<td></td>
</tr>
<tr>
<td>Physics 303,</td>
<td>Mechanics and Heat</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 382,</td>
<td>Mechanical Drawing</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Language 20,</td>
<td>German</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Military 3, or Physical Training 303,</td>
<td></td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

**Total semester hours** 18½

### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required</th>
<th>Semester</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 45,</td>
<td>Calculus</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Chemistry 27,</td>
<td>2 Laboratories and 2 Recitations</td>
<td>3½</td>
<td></td>
</tr>
<tr>
<td>Physics 404,</td>
<td>Electricity and Magnetism</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 401,</td>
<td>Analytical Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Language 21,</td>
<td>German</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Military 4, or Physical Training 404,</td>
<td></td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

**Total semester hours** 19½

Summer Practice in Chemistry Required 170 Hours
Junior Year.

FIFTH SEMESTER

Required  
Semester Hours  
Mechanical Engineering 502, Analytical Mechanics 5  
Organic Chemistry 25, 2 Lectures, 1 Laboratory 3½  
Chemical Engineering 502, Topic Reading R  
Chemical Engineering 501, Advanced Chemical Analysis 4  
Chemical Engineering 503, Physical Chemistry 2  
English 15, Engineering English 2  
Elective in Literature, Economic Science, Public Speaking, Agricultural Journalism, Physics 523, or History 1 to 2  
Total semester hours 17½ or 18½  

SIXTH SEMESTER

Required  
Semester Hours  
Mechanical Engineering 686, Analytical Mechanics 4  
Mining Engineering 614, Metallurgy 3  
Organic Chemistry 62, 3 Lectures, 2 Laboratories 4½  
Chemical Engineering 604, Advanced Chemical Analysis 4  
Chemical Engineering 605, Topic Reading R  
Engineering 603, Conservation of Natural Resources 1  
Elective in Geology 803, Economic Science, Public Speaking, or Agricultural Journalism 1 to 2  
Total semester hours 17½ or 18½  
Chemical Engineering 604a, Summer Practice 170 hours

Senior Year

SEVENTH SEMESTER

Required  
Semester Hours  
Mechanical Engineering 784, Steam Engines & Boilers 2  
Engineering 702, Specifications & Contracts 1  
Assaying (Mining Engineering 530), Laboratory and Recitations 3  
Chemical Engineering 706, Lectures, Laboratory & Recitations 4  
Chemical Engineering 707, Topic Reading R  
Chemical Engineering 708, Chemistry Manufactured Foods 3  
Mining Engineering 715, Metallurgy of Copper, etc. 4  
Elective in Public Speaking, or English 15, Agricultural Journalism 1 or 2  
Total semester hours 18 or 19
EIGHTH SEMESTER

Required  
Semester Hours

Mechanical Engineering 809,  Constructive Engineering 3
Chemical Engineering 809,  Lectures, Laboratory & Recitations 4
Chemical Engineering 810,  Chemical Machinery 2
Chemical Engineering 811,  Electro-Chemistry 2
Chemical Engineering 813,  Municipal Chemistry 2
Chemical Engineering 812,  Topic Reading R
Chemical Engineering,  Thesis 3
Engineering 801,  History of Engineering 1
Elective in Public Speaking,  1 or 2

Total semester hours 18 or 19

Students desiring to enter the work in Chemical Engineering at the end of the Sophomore Year, can obtain full information by applying to the professor in charge of Industrial Chemistry.

COURSES IN CHEMICAL ENGINEERING

501. **Advanced Chemical Analysis.** This course consists in the analysis of fuels, gases, waters, iron, steel, alloys, etc.

5S. Prerequisites Chem. 11 and 17; credit 4; fee $5.00.

502. **Topic Reading.** This course consists in the reading of timely topics from all magazines and journals of the various societies bearing upon the subject of chemistry. A good reading knowledge of French and German desirable, although not required.

5S. Required.

503. **Physical Chemistry.** This course consists of a series of lectures and recitations upon the principles and methods of Industrial Physical Chemistry.

5S. Recitations 2; credit 2.

604. **Advanced Chemical Analysis.** Continuation of Chemistry 501. Students are required to put in 170 hours summer practice in the chemical laboratory.

6S. Credit 4; fee $5.00.

605. Continuation of chemistry 502.

6S. Required.

706. **Industrial Chemistry.** This course consists of lectures and recitations upon the general operations common to many chemical industries, the types of apparatus used in carrying out such processes upon a commercial scale and some of the more important industries involving chemical processes such as the production of alkali, acids, fertilizers, glass, cement, soap, etc. A laboratory course based upon this work giving practice in the preparation and purification of chemical products on a scale such as to afford data for the determination of the cost and *All students taking these courses will be required to pay a rental of $2.00 per year for the use of the platinum crucibles, etc.*
economy of manufacture. The student is given problems of practical importance for the solution of which he obtains data from experiments with typical forms of manufacturing apparatus, with an opportunity to specialize in one of these industries if he so wishes.

7S. Recitations, lab.; credit 4; fee $10.00.

707. Continuation of chemistry 605.
7S. Required.

708. Chemistry of Manufacture of Foods. In this course the student makes a special study of the manufacture of foods of all kinds. Visits will be made to various food plants in the state.
7S. Recitations, labs.; credit 3; fee $5.00.

809. Industrial Chemistry. Continuation of 706.
8S. Recitations, labs.; credit 4; fee $10.00.

810. This course consists in the study and manipulation of chemical machinery. Visits will be made to chemical plants and the student will be required to give written reports upon all plants visited.
8S. Credit 2.

811. Electro-Chemistry. Lectures in the application of the electric current to chemical processes and chemical analysis.
8S. Recitations 2; credit 2.

812. Continuation of 707.
8S. Required.

813. Municipal Chemistry. This course consists of a series of lectures, recitations and laboratories during which the student becomes familiar with the chemistry of cement, bitumens, oils, fuels, gases, water, sewage, smoke, etc. Two hours' credit. Laboratory deposit, $5.00.
8S. Recitations, labs.; credit 2; fee $5.00.
Engineering Experiment Station
THE PURPOSE OF THE ENGINEERING EXPERIMENT STATION

The purpose of the Engineering Experiment Station is, first, to afford a service for the other industries of Iowa, similar to that afforded by the Agricultural Experiment Station to the agricultural industries; second, to assist the urban population of the State in solving the technical problems of urban life; third, to solve the purely engineering problems of the agricultural population and industries of the State.

The Manufacturing and Other Engineering Industries of Iowa

It is doubtless true that Iowa will always remain in the front rank of the agricultural states of the nation, but it is also true that unless she develops as a manufacturing state she must drop behind in the race for supremacy. It is well known that the population of the State has been stationary for the last decade, and in fact Iowa has suffered the disgrace of being the only state in the Union which did not increase its population during that time. The fact is that with improvements in agricultural machinery, one man accomplishes more than was formerly possible on the farm, and rural population shows a tendency not to increase in density. If Iowa continues as a purely agricultural state, she must expect to drop behind the other states of the Union in their onward progress in wealth and population.

With our great deposits of coal, clays, cement materials and other resources, and with the greatest hydro-electric power plant in the world far advanced in construction on our borders, there is no good reason why agricultural implements should be manufactured in other states, nor why our agricultural products should be forwarded to such states as Michigan for transformation into manufactured forms for consumption. Iowa should develop its own manufacturing industries, in the immediate proximity of the source of supply of raw material and of the ultimate users of the products. Already such industries are springing up in many towns. The development of manufacturing industries in Iowa must, in this modern day, depend largely upon scientific research and investigation under Iowa conditions in each industry. There is a great field for possible good open here to the Engineering Experiment Station.

Besides the manufacturing industries of the State, the transportation interests are of very great importance. A large number of people are employed in them, and they are of vital importance to every other in-
industry. There are many technical problems in connection with transporta-
tion in Iowa which are proper subjects for study and investigation by
the Engineering Experiment Station.

The Urban Interests of Iowa

In addition to its importance in connection with the manufacturing
developments of our State, the purpose of the Engineering Experiment
Station is to serve the urban population of Iowa. It is certain that over
40 per cent of the entire population of the State, probably 45 per cent,
live in cities and incorporated towns and villages. Our urban population
has many important problems of life to solve in which the Engineering
Experiment Station can be of the utmost service. There must be de-
veloped, for example, proper methods of sewage disposal; their paving
materials must be tested and the properties thereof ascertained; pure and
economical water supplies must be furnished; electric light plants, heating
and ventilating systems, power plants, telephone services, etc., must be
furnished. In all these lines, the work of the Engineering Experiment
Station can be of the utmost value.

The Engineering Problems of Agricultural Industries and Life

It is also the purpose of the Engineering Experiment Station to solve
the purely engineering questions of agricultural industries and life. It
is fortunate for the State that a strong engineering school is associated
with the agricultural school, and that both work together in the utmost
harmony and unity of purpose. The engineering problems of Iowa must
be of especial importance along agricultural lines, and it is only by the
united efforts of engineers and agriculturists that they can properly be
solved. As an illustration may be mentioned the drainage engineering
work which is reclaiming a portion of the State of Iowa sufficiently large
to exceed in area that of several individual states of the Union. There
are also the problems of water supply, sewage disposal, etc., on the farm.
One of the most important engineering problems is that of good roads.
With the establishment of the State Highway Commission by the 35th
General Assembly, and their intention to accomplish a large work, this
problem assumes a much more definite shape, and requires immediate
steps to determine the best methods and the best forms of construction
to employ. This is a proper field for the Engineering Experiment Sta-
tion. It is expected that active work will be started at once toward the
solution of the various problems involved.

ENGINEERING EXTENSION DEPARTMENT

During the past year the Iowa Manufacturers' Association requested
the College to establish Engineering Extension work including Cor-
respondence School study for the purpose of extending the same kind
of assistance to those who are employed in the mechanical industries
that is now enjoyed by those who are engaged in agricultural pursuits.
This request also received the endorsement of the officials of organized labor in the State.

The Thirty-fifth General Assembly of Iowa provided an appropriation to establish a two year trade school course in Engineering lines at Ames, extension work and correspondence study along Engineering lines, and trade school extension work in as many of the industrial centers of the State, as the funds available will permit. The department hopes to articulate closely with the Engineering Division at Ames on the one hand, through the two year course, and with the Vocational High Schools authorized by the recent legislature, on the other, by means of trade school extension courses.

The Engineering Extension Department is organized as a department in the Engineering Division and while it has a separate instructional force, bears the same relation to the division and College as a whole, as the other departments in the division.
Division of Science as Related to the Industries
Division of Science as Related to the Industries

EDGAR WILLIAM STANTON, DEAN

This Division offers a single outlined course to the student, the Course in Science as Related to the Industries.

This division gives to every student of the institution his fundamental training in those sciences whose practical applications are largely worked out in the various courses of study. It has two important functions:—

1. To furnish instruction in the basic sciences underlying the various industries and professions taught in the other departments and divisions of the institution, and

2. To train men and women for efficient service in certain limited fields of industrial science that are not provided for in the other courses of the institution, particularly those fields in which certain professional applications of the sciences Bacteriology, Botany, Chemistry, Economics, Geology, Mathematics, Physics, and Zoology are made, or, in the language of the second Morrill act in “the various branches of mathematical, physical, natural and economic science with special reference to their applications in the industries of life.”

The “Course in Science as related to the Industries” is not a liberal arts course in the generally accepted meaning of “cultural.” Opportunity is afforded for the election of an amount of such work approximately equal to that allowed or required in the other technical courses of the institution. It must be remembered that scientific and technical studies are, however, to be regarded as having a real cultural value quite as truly as do the so-called “humanities.” Nor is this course to be regarded as a general science course, for as soon as the scientific and linguistic foundation of the Freshman and part of the Sophomore years has been secured, the student is required to specialize in some science, and to relate it definitely to its industrial and professional phases. Opportunity is given, upon approval of the head of the department in which the student is taking his work, and the dean of the division, to elect a limited amount of work taught by departments in other divisions of the College, such work to be that which will serve as supporting subjects to the major line of work. In the discussions under the various scientific departmental headings will be found lists of subjects in which the student is invited to specialize, likewise statements as to the opportunities open to graduates in these various fields.
COURSE IN SCIENCE AS RELATED TO THE INDUSTRIES

Freshman Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics, Algebra and Trigonometry</td>
<td>5</td>
</tr>
<tr>
<td>Modern Language, 20 or 5, German</td>
<td>3 or 5</td>
</tr>
<tr>
<td>(Students who have presented for admission less than one year's work in German will take Modern Language 5.)</td>
<td></td>
</tr>
<tr>
<td>English 11, Exposition</td>
<td>3</td>
</tr>
<tr>
<td>Botany,</td>
<td></td>
</tr>
<tr>
<td>Choice,</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>Zoology</td>
<td></td>
</tr>
<tr>
<td>Total for men</td>
<td>14 to 18</td>
</tr>
<tr>
<td>For women, Home Economics 41, Personal Sanitation and Hygiene</td>
<td>1</td>
</tr>
<tr>
<td>Total for women</td>
<td>15 to 19</td>
</tr>
<tr>
<td>Electives for men</td>
<td>4 to 0</td>
</tr>
<tr>
<td>Electives for women</td>
<td>3 to 0</td>
</tr>
</tbody>
</table>

(These elective hours must be chosen from the following):

1. **Sciences**: Either of the two sciences not already chosen from the above list of three sciences.

2. **General Subjects**:
   - History 5 2 hours
   - History 20 2 hours
   - History 22 2 hours
   - History 24 2 hours
   - Literature 22 2 hours
   - Literature 23 1 hour
   - Literature 8 2 hours
   - Literature 15 3 hours
   - French 57 3 hours
   - Psychology 7 3 hours
   - Public Speaking 2 1 hour

3. Also any subject offered in the first semester of the Freshman year of any of the four year courses in any other Division.

4. The student should consult with the Dean of Science before choosing electives in the other semesters of this course.

Total semester hours 18 to 18
### Freshman Year

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics, Trigonometry and Analytics</td>
<td>5</td>
</tr>
<tr>
<td>English 10, Narration and Description</td>
<td>3</td>
</tr>
<tr>
<td>Modern Language, German</td>
<td>3</td>
</tr>
<tr>
<td>History 20 or 24, Industrial History of U. S., or History of Public Domain</td>
<td>2</td>
</tr>
<tr>
<td>Choice of Botany, or Chemistry, or Zoology</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Electives</td>
<td>2 to 0</td>
</tr>
</tbody>
</table>

**Total semester hours** 18 to 18

### Sophomore Year

**FIRST SEMESTER**

The student is advised to choose a major department in Science at the beginning of the Sophomore year, before the classification, and plan his course after consultation with the head of such department. This must be done before the beginning of the Junior year. For rules governing choice of major and electives, see Junior year.

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Language, German</td>
<td>3</td>
</tr>
<tr>
<td>(Upon certification of the head of the department of Modern Languages that the student has a reading knowledge of German, French may be substituted.) Science Electives, (to be chosen from courses offered in Science departments)</td>
<td>8</td>
</tr>
</tbody>
</table>
### Electives

(To be chosen either from courses offered by Science departments, or from those offered by other departments.)

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military, or Physical Training, or Physical Culture</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18

### SECOND SEMESTER

**Required Semester Hours**

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Language, German</td>
<td>3</td>
</tr>
<tr>
<td>(To be a continuation of the language taken in the preceding semester.)</td>
<td></td>
</tr>
<tr>
<td>English 12, Argumentation</td>
<td>2</td>
</tr>
<tr>
<td>Science Electives</td>
<td>8</td>
</tr>
<tr>
<td>(To be chosen from courses offered in Science departments.)</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>5</td>
</tr>
<tr>
<td>(To be chosen either from courses offered by Science department or from those offered by other departments.)</td>
<td></td>
</tr>
<tr>
<td>Military, or Physical Training, or Physical Culture</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours: 18

**Note:** Science departments are Bacteriology, Botany, Zoology, Physics, Economics, Mathematics, Geology and Chemistry.

### Junior and Senior Years

*Before classification* the student must choose a major science subject, and outline his complete course of study for Junior and Senior years, guided by the following rules:

1. A minimum of 16 hours; maximum of 18 hours, shall be taken during each semester.

2. A major subject shall be chosen in one of the Science departments,—Bacteriology, Botany, Chemistry, Economics, Mathematics, Geology, Physics, or Zoology, and the complete course of study for the Junior and Senior years outlined in consultation with the head of the department concerned. Such outline shall bear the signature of approval of the head of such department, and shall be filed with and be approved by the Dean of Industrial Science, and a copy shall also be filed with the Registrar.

3. The course of study as outlined under 2 shall not be amended or changed, except by approval of the head of the department, and any such changes shall be in writing, shall bear the signature of approval of department head and be filed with original course of study.

4. This outline may be filed at any time during the Sophomore year.
5. At least 20 hours shall be chosen from the department in which the major is taken.

6. At least 20 hours in addition to the major shall be chosen from courses offered in Science and industrial departments. These courses shall be those requisite to the proper development of the major line of work.

7. Not more than 24 hours may be taken in any Division of the College other than the Division of Science.

8. Courses duplicating in whole or in part courses already taken, when elected, will entitle students only to credit in course for which the more credit is given.

Department of Mathematics

EDGAR WILLIAMS STANTON, PROFESSOR
MARIA M. ROBERTS, ASSOCIATE PROFESSOR
ERNEST ALANSON PATTENGILL, JULIA TRUEMAN COLPITTS, WARD MURRAY JONES, ASSISTANT PROFESSORS
ANNIE WILSON FLEMING, HELEN FLORENCE SMITH, AGNES GINA MOSHER, 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 Acquisition of Such Command of the Subject Matter of Mathematics as will make it a Valuable Instrument in Higher Sci-
entific 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.

4. The Specialized Application of Mathematics to Industry and Industrial Education. The courses offered in the Senior College are intended to be especially helpful to students who are seeking to become investigators and specialists in industrial lines involving higher Mathematics, and also to those who wish to take such technical studies as will give them knowledge of the application of Mathematics, and thus prepare them to teach to advantage in Engineering and other technical courses of study.

COURSES IN MATHEMATICS

4. College Algebra. Includes study of ratio, proportion, variation, the progressions, permutations, binomial theorem, convergency and divergency of series, theorem of undetermined coefficients including partial fractions, principles and use of logarithms, and the theory of equations. Open to graduates of fully accredited high schools. The first four weeks of the semester are devoted to review of algebra up to and including quadratics. Students failing in this test will be assigned to such work as they are fitted to pursue.

Graduates of accredited schools are earnestly urged to carefully review their work in algebra before entering this course.

15. Prerequisite, entrance Algebra; recitation 5; credit 5.

6. Solid Geometry. Looking forward to this work the student immediately, before leaving home should carefully go over the whole subject of plane geometry. The subjects considered in the course are the properties of planes, of diedral and polyedral angles, of prisms, of pyramids and other polygons, of cylinders, cones and spheres, of spherical triangles and spherical polygons.

6 or 8S. Prerequisite, entrance Plane Geometry; recitations 2; credit 2.

11. Differential Equations. Includes formation of differential equations; solution of equations of the first order with applications to geometry, and physics, the study of 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.

5 or 7S. Prerequisite 45 or 46; recitations 5; credit 5.
17. Algebra and Trigonometry. The main object is to so ground the student in the principles of trigonometry as to enable him to carry successfully his work in surveying, drainage and allied subjects. The course is intended to give the student sufficient knowledge of the subject to enable him to elect analytical geometry and calculus which are fundamental to certain lines of work in the agronomy course. 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.

18. Prerequisite, entrance Algebra; recitations 3; credit 3.

19. College Algebra. Designed for students who after trial show lack of preparation sufficient to enable them to carry Course 120. By devoting an additional hour to Mathematics these students are enabled to thoroughly review the elementary algebraic processes, and at the same time complete the regular college algebra.

18. Recitations 6; credit 5.

30. Plane Trigonometry. The subjects covered are the same as those included in Course 17, with the exception that since the students taking this course have had considerable previous work in logarithms, more time is devoted to identities and the solution of trigonometric equations.

25. Prerequisite 4; recitations 3; credit 3.

40. College Algebra. Ratio, proportion, variation, permutations, the progressions, binomial theorem, principles and use of logarithms, and theory of equations. The first four weeks of the semester are devoted to review of Algebra up to and including quadratics. Students failing in this text will be assigned to such work as they are fitted to pursue. Graduates of accredited schools are earnestly urged to carefully review their work in algebra before entering this course.

15. Prerequisite, entrance Algebra; recitations 5; credit 3.

41. Plane Trigonometry. Includes study of definitions; positive and negative angles; circular measure of angles, functions of angles, their relation and varying values; determination of functions of different angles expressed in terms of those of a basal angle; solution of trigonometric equations in the proving of identities.

15. Prerequisite 40; recitations 5; credit 2.

42. Plane and Spherical Trigonometry. Includes those subjects of the usual courses in trigonometry not included in Course 121; namely, the derivation of the formulas relating to the sum of difference of two angles, functions of double angles and of half angles with identities and equations.
based upon these formulas and the solution of right and oblique triangles, also the elements of spherical trigonometry.

2S. Prerequisite 41; recitation 5; credit 2.

43. **Plane Analytic Geometry.** Includes the representation of points, lines and curves in a plane, the careful study of the graphs of equations, and a thorough investigation of the line, the circle, and the conic sections.

2S. Prerequisite 30, or 42; recitations 5; credit 3.

44. **Analytic Geometry and Calculus.** Rules of differentiation, together with numerous examples illustrating their use and a large number of problems showing the close relation of differential calculus to physics and mechanics. In integral calculus, the rules of integration are derived and enforced by a sufficient number of examples to make this most efficient tool of the engineer thoroughly ready for his later use. Integral calculus is then applied to plane areas and lengths of curves. Throughout the course, special attention is given to curve plotting, and to the applications of analytic geometry in determining the nature of curves studied.

3S. Prerequisite 43; recitations 5; credit 5.

45. **Calculus.** In differential calculus includes expansion of functions, indeterminate forms, tangents; normals, asymptotes, direction of curvature, points of inflection, radius of curvature, order of contact, osculating circle, envelopes, singular points, and maxima and minima; in integral calculus, applications are made to obtaining surfaces of revolution, volumes of solids of revolution and other solids. Applications of double integration to areas, surfaces, centers of gravity, etc., also the elements of differential equations.

4S. Prerequisite 44; recitations 5; credit 5.

46. **Calculus.** Includes all the subjects of Course 45, except differential equations, the time thus gained being devoted to more thorough drill on elementary principles of calculus.

4S. Prerequisite 44; recitations 5; credit 5.

47. **Vector Analysis.** Elements of vector analysis with applications to various problems.

6 or 8S. Prerequisite 45 or 46; recitations 2; credit 2.

48. **Determinants and Theory of Equations.** Includes, in determinants, the evaluation of determinants, solution of equations by determinants, and multiplication of determinants; in theory of equations the subjects covered are limits of roots, location of roots, multiple roots, Sturm's Theorem and solution of higher equations.

6 or 8S. Prerequisite 30 or 42; recitations 3; credit 3.

49. **Advanced Analytical Geometry.** The general equation of the second degree, higher plane curves and analytical geometry of three dimensions.

5 or 7S. Prerequisite 43; recitations 3; credit 3.

50. **Advanced Calculus.** Deals with the application of differential
Calculus to the discussion of the properties of curves; the application of both differential and integral calculus to functions of a complex variable; and the subject of definite integrals and the use of double integration in measuring surfaces. The principles involved are illustrated by numerous examples.

6 or 8S. Prerequisites 45 or 46 and 49; recitations 5; credit 5.

51. History of Mathematics. The development of mathematics from the earliest times to the present, together with brief histories of the lives of those mathematicians who have contributed most to the advancement of the science. Special attention is given to the reciprocal influence upon each other of mathematics and the industries.

5 or 7S. Prerequisite 46; recitations 2; credit 2.

Department of Chemistry

ALFRED ALLEN BENNETT, PROFESSOR

Agricultural and Home Economics Chemistry.

WINFRED FORREST COOVER, ASSOCIATE PROFESSOR

CHESTER C. FOWLER, ASSISTANT PROFESSOR

JOHN H. BUCHANAN, INSTRUCTOR

BURLEIGH B. REED, INSTRUCTOR

EARL E. BISBEE, ASSISTANT

General Chemistry and Chemical Analysis

LOLA A. PLACEWAY, ASSOCIATE PROFESSOR

LOLA STEPHENS, INSTRUCTOR

LAURA MAY TAGGART, INSTRUCTOR

NELLIE M. NAYLOR, INSTRUCTOR

HELEN HUNTING, INSTRUCTOR

AVIS TALCOTT, INSTRUCTOR

ZELMA ZENTMIRE, INSTRUCTOR

Chemical Engineering Chemistry

GEORGE A. GABRIEL, ACTING ASSISTANT PROFESSOR

The courses of study in this department are arranged to meet the needs of the students of the other departments of the college. The preliminary, or first year, courses are essentially alike and have for their main purpose the teaching of the elementary principles of the science, thus laying the foundations for technical, or applied Chemistry, which is studied later. The term chemistry implies an art and a science, i.e., the art of manipulating apparatus, the art of using fundamental principles in studying matter and in pushing forward the science itself. The
highest development of the art and of the science is realized in applied chemistry, whether it is applied to the problems of civilization or to the growth and development of the science itself.

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 recitation. This proportion of time for the two divisions of work is especially carried out in the earlier part of the class study. The classroom work fixes 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.

After the preliminary courses are completed the student's work leads along one of six lines of study, namely, to courses that are adapted to students who are candidates for degrees in Agriculture, Engineering, Veterinary Medicine, Chemical Engineering, Science as Related to the Industries, and Home Economics.

Equipment and Accommodations

The Chemical Department will move into a large new building, specially designed for chemical work sometime during the coming year. The building when completed will be modern in every way when considered from the standpoint of the requirements. Large laboratories accommodating all students in the elementary courses have been designed for the first and second floors in order that the climbing of stairs may be reduced to a minimum. The smaller laboratories for the smaller classes and for special work will occupy the top floor of the building.

The equipment of the laboratories in elementary and advanced chemistry will be very complete and will meet the requirements of every phase of the work relating to Agriculture, Engineering, Home Economics and the Sciences with reference to their industrial application. Special laboratories and equipment will be provided for special and research work.

Special Courses Leading to a Degree in Chemistry

Students wishing to specialize in chemistry can select their chemical courses so as to fit themselves for positions as food chemists, plant, animal, soil or dairy chemists, physiological or bacteriological chemists, as chemists in charge of manufacturing industries, or as teachers of chemistry, in the various fields just mentioned. Experiment Station work is also another open field closely allied to teaching work.

As an example of how courses may be grouped, a good selection for an undergraduate wishing to specialize in food chemistry follows: freshman year, courses 2 and 5; sophomore year, courses 9, 11 and 51; junior year, courses 14, 27, 36 and 52; senior year, courses 56, 34, 66 and thesis.

Students completing the required number of credits will be given a degree of Bachelor of Science in Chemistry.
AGRICULTURAL CHEMISTRY

21. General Chemistry. Introductory work. Study of non-metallic elements present in air and soil. Recitations review the work of the laboratory.

1S. Recitations 3, lab. 2, 2 hr.; credit 4½; fee $5.00.

23. Qualitative Analysis. Continuation of course 21. Study of the metallic or base forming elements, their relation to non-metallic or the acid forming elements, and their place in formation of salts; the separation and recognition of these elements and their compounds preparatory to determining them quantitatively.

2S. Prerequisite 21; recitations 3, labs. 2, 2 hr.; credit 4½; fee $8.00.

25. Organic Chemistry. Elementary principles of organic chemistry. Lectures and recitations. Followed by a study of the chemical changes which occur during digestion, assimilation and metabolism. Laboratory work includes the preparation of a limited number of organic compounds and a study of the carbohydrates, fats and proteins.

3S. Prerequisite, Chem. 23; recitations 3, lab. 1, 2 hr.; credit 3½; fee $8.00.

26. Agricultural Analysis. The preliminary work involves the principles of gravimetric and volumetric analysis. Followed by the analysis of fertilizers and soils or by the analysis of grain and mill feeds and fodders.

4S. Prerequisite, Chem. 25; recitations 2, labs. 2, 2 hr.; credit 3½; fee $10.00.

27. Agricultural Analysis. Continuation of courses 26 or 60. Offered to those who wish to continue chemistry along analytical or industrial agricultural lines. Special work may be taken up, or work necessary for the required credits may be selected from the groups which follow. (a) Analysis of fruits and fruit products such as juices, jellies, jams, marmalades, canned fruits, etc.; (b) analysis of baking powders and baking powder chemicals; (c) analysis of coffee, cocoa, and cocoa products; (d) analysis of oils, fats, waxes, lubricants and soaps; (e) chemical and microscopical analysis of stock foods; (f) analysis and calorimetry of solid, liquid and gaseous fuels and analysis of water for sanitary and boiler purposes; (g) analysis of sugar and saccharine products with lectures on cane and beet sugar manufacture and methods of chemical control.

5 or 7S. Prerequisites, Chem. 26 or 60; recitations 2 or 3, labs. 2 or 3, 2 hrs.; credit 3½ or 5; fee $10.00.

28. Dairy Chemistry. Elementary course arranged to meet the needs of the students in the one year course in dairying.

1S. Recitation 1, lab. 1, 1½ hr.; credit 2; fee $3.00.

29. Dairy Chemistry.

2S. Prerequisite, Chem. 28; recitation 1, lab. 1, 1½ hr.; credit 2; fee $3.00.

34. Advanced Agricultural Analysis. Student may do research work, continue any special work begun in course 27 or select from the groups outlined the amount of work necessary. (a) Analysis of meats and meat products; (b) detection and determination of food preservatives and coloring matters; (c) analysis of flavoring extracts, spices, etc.;
(d) analysis of insecticides and fungicides; (e) analysis of inorganic plant constituents; (f) analysis of paints and varnishes. May be taken as a major for graduate work.

6 or 8S. Prerequisite 27 or 40; recitations 2 or 3, labs. 2 or 3, 2 hr.; credit 3½ or 5; fee $10.00.

40. **Dairy Chemistry.** Analysis of pure dairy products; also a qualitative and quantitative analysis of adulterated products and the detection of the preservatives and coloring matters commonly used.

55. Prerequisite 26; recitations 2, labs. 2, 2 hr.; credit 3½; fee $10.00.

56. **Food Inspection and Analysis.** The purpose is to familiarize the student with methods and food inspection and to continue the analytical work along more advanced lines so that he may be prepared to take up government or other food inspection work. Leach's Food Inspection and Analysis will be used as a guide with references to Winton's Microscopy of Vegetable Foods and Hanausek's Microscopy of Technical Products. Major for undergraduate or minor for graduate work.

6 or 8S. Prerequisite 27 or 40; recitations 3, labs. 3, 2 hr.; credit 5; fee $10.00.

62. **Organic Chemistry.** Continuation of course 25 or 58. Deals largely with the aromatic series. Laboratory work consists of a preparation of some of the bodies discussed in lectures.

5 or 7S. Prerequisite 25 or 58; recitations 3, labs. 2, 2 hr.; credit 4½; fee $8.00.

63. **Physiological Chemistry.** For students who wish to specialize in nutrition, or feeds and feeding.

55. Prerequisite 25; recitation 1, labs. 2, 2 hr.; credit 2½; fee $8.00.

64. **Physiological Chemistry.**

65. **Advanced Dairy Chemistry.** Continuation of course 40. The work will complete that already begun including the complete analysis of ice creams. The chemical changes which occur during the process of manufacture of the various dairy products will be discussed in lectures.

6S. Prerequisite 40; recitations 2, labs. 2, 2 hr.; credit 3½; fee $10.00.

66. **Advanced Organic Chemistry.** Course for graduate students majoring in agricultural chemistry.

6 or 8S. Prerequisite 62; recitations 2, labs. 3, 2 hr.; credit 4; fee $8.00.

67. **Research Chemistry.** Course for graduate students in analytical research.

7 or 8S. Prerequisite 34 or 56 or equivalent work; credit as arranged; fee $10.00.

**HOME ECONOMICS CHEMISTRY**

22. **General Chemistry.** Introductory work which includes a study of the non-metallic elements. Recitations review the work of the laboratory.

1S. Recitations 3, labs. 2, 2 hr.; credit 4½; fee $5.00.

24. **Qualitative Analysis.** Continuation of course 22. Study of the metallic elements, their relation to the non-metallic elements and the separation and recognition of both qualitatively.

25. Prerequisite 22; recitations 3; labs. 2, 2 hr.; credit 4½; fee $8.00.
58. Organic Chemistry. Principles of organic chemistry, and their application to the related work in Home Economics. Special emphasis is placed upon the chemistry of the carbohydrates, fats and proteins in order to prepare the student for physiological chemistry. Laboratory work consists of the preparation of some typical organic bodies, followed by work on the carbohydrates, fats and proteins.

3S. Prerequisite 24; recitations 3, labs. 2, 2 hr.; credit 4½; fee $8.00.

59. Food Chemistry. Elementary work in gravimetric and volumetric analysis is given as a foundation. The analysis of milk, butter, oleomargarine, ice cream and cereal foods is then studied.

4S. Prerequisite 58; recitations 3, labs. 2, 2 hr.; credit 4½, fee $10.00.

60. Physiological Chemistry. The chemistry of digestion, assimilation and metabolism is taken up during the first part of the semester. Later the chemistry of the blood, tissues and secretions is studied.

5S. Prerequisite 59; recitations 2, lab. 2, 2 hr.; credit 3½; fee $8.00.


5S. Prerequisite 59; recitations 2, lab. 2, 2 hr.; credit 3½; fee $8.00.

ENGINEERING CHEMISTRY

Students in this division are required to take courses 41, 42, 43 and 45, excepting candidates for the C. E. degree, who take courses 41 and 49, and Mining Engineers who take 41, 42, 43, 46. The courses described under the Science division and under Industrial Chemistry are open for election to the students in this division, if they present credits for the prerequisite courses.

41. General Chemistry. A short course dealing with the non-metallic elements.

1S. Recitations 2, lab. 1, 3 hr.; credit 3; fee $5.00.

42. General Chemistry. A continuation of course 41 which deals with the metallic elements.

2S. Prerequisite 41; recitations 2, lab. 1, 3 hr.; credit 3 hr.; fee $5.00.

43. Qualitative Analysis. A continuation of course 42 which completes the work on the metallic elements and takes up an elementary course in qualitative analysis.

3S. Prerequisite 42; recitation 1, labs. 2, 3 hr.; credit 3 hr.; fee $8.00.

45. Elementary Quantitative Analysis. The general principles of gravimetric and volumetric methods of analysis and the applications of these methods to some practical question in Engineering are taken up. The analysis of clays, limestones and cements represent some of the substances studied.

4S. Prerequisite 43; recitation 1, lab. 1, 3 hr.; credit 2; fee $10.00.

49. Inorganic Chemistry. For Civil Engineering students. The study of metals is completed and a short time is devoted to qualitative analysis.

2S. Prerequisite 41; recitations 2, lab. 2, 3 hr.; credit 4; fee $8.00.
46. **Quantitative Analysis.** Two hours per week are devoted to stoichiometrical relations in reviewing fundamental laws of chemistry and applying these to quantitative methods. After the necessary preliminary work is done, the laboratory study applies gravimetric and volumetric methods to the analysis of ores, coal, slags and other minerals and mineral products.

4S. Prerequisite 43; recitations 2, labs. 2, 3 hr.; credit 4; fee $10.00.

**CHEMICAL ENGINEERING CHEMISTRY**

**ALFRED ALLEN BENNETT, PROFESSOR**

**GEORGE A. GABRIEL, ACTING ASSISTANT PROFESSOR**

The increasing importance of Industrial Chemistry has led to the bringing together here of the courses offered to students under the title Industrial Chemistry. These courses are intended to prepare the student pursuing them to fill positions as chemists in the various manufacturing industries.

The following described courses are open for election by students who are candidates for the degrees in the Divisions of Science and Engineering. Students who complete the required number of courses in connection with the required credits in other courses will receive the degree of Bachelor of Science in Industrial Chemistry.

Students who are candidates for this degree will apply to the Dean of the Engineering Division, and the professor in charge of the work in Industrial Chemistry, who will arrange the course required. See under Division of Engineering, page 255.

**COURSES IN INDUSTRIAL CHEMISTRY**

501. **Advanced Chemical Analysis.** This course consists in the analysis of fuels, gases, waters, iron, steel, alloys, etc.

5S. Prerequisites 11 and 17; recitations, lectures and labs.; credit 4; fee $10.00.

502. **Topic Reading.** This course consists in the reading of timely topics from all magazines and journals of the various societies bearing upon the subject of chemistry. A good reading knowledge of French and German desirable, although not required.

5S. Required.

503. **Industrial Physical Chemistry.** This course consists of a series of lectures and recitations upon the principles and methods of Industrial Physical Chemistry.

5S. Prerequisite Chem. 5; recitations 2; credit 2.

604. **Advanced Chemical Analysis.** Continuation of chemistry 501. Students are required to put in 170 hours summer practice in the chemical laboratory.

6S. Prerequisite 501; lab.; credit 4; fee $10.00.

605. Continuation of chemistry 502.

6S. Prerequisite 502.
**706. Industrial Chemistry.** This course consists of lectures and recitations upon the general operations common to many chemical industries, the types of apparatus used in carrying out such processes upon a commercial scale and some of the more important industries involving chemical processes, such as the production of alkali, acids, fertilizers, glass, cement, soap, etc. A laboratory course based upon this work giving practice in the preparation and purification of chemical products on a scale such as to afford data for the determination of the cost and economy of manufacture. The student is given problems of practical importance for the solution of which he obtains data from experiments with typical forms of manufacturing apparatus, with an opportunity to specialize in one of these industries if he so wishes. Lectures, recitations and laboratories.

7S. Prerequisites 604 and 503; recitations, lectures, and labs.; credit 4; fee $10.00.

**707. Continuation of chemistry 605.**

**708. Chemistry of Manufacture of Foods.** In this course the student makes a special study of the manufacture of foods of all kinds. Visits will be made to various food plants in the state. Lectures, recitations and laboratory.

7S. Prerequisites 62 and 604; lectures, recitations and labs.; credit 3; fee $10.00.

**809. Industrial Chemistry.** Continuation of 706.

8S. Prerequisite 706; recitations 2, labs. 2, 3 hr.; fee $10.00.

**810.** This course consists in the study and manipulation of chemical machinery. Visits will be made to chemical plants, and the student will be required to give written reports upon all plants visited.

8S. Prerequisite 809; lectures and recitations 2; credit 2.

**811. Electro-Chemistry.** Lectures and laboratory practice in the application of the electric current to chemical processes and chemical analysis.

8S. Prerequisite 706; lectures and lab.; credit 2.

**812. Continuation of 707.**

8S. Prerequisite 707.

**813. Municipal Chemistry.** This course consists of a series of lectures, recitations and laboratories during which the student becomes familiar with the chemistry of cement, bitumens, oils, fuels, gases, water, sewage, smoke, etc.

8S. Prerequisite 604; lectures, recitations and labs.; credit 2; fee $5.00.

**SCIENCE CHEMISTRY**

A student in this division may elect Chemistry for each semester of the four years of undergraduate work. The courses described under Chemical Engineering are elective for students of this division.

**2. Inorganic Chemistry.** This course is chiefly devoted to the study of the non-metallic elements, having in view qualitative analysis.

1S. Recitations 3, labs. 2, 3 hr.; credit 5; fee $5.00.
5. **Inorganic Chemistry.** A continuation of course 2. Devoted to the study of the metallic elements and qualitative analysis.

2S. Prerequisite 2; recitations 3, labs. 2, 3 hr.; fee $8.00.


4S. Prerequisites 2 and 5; recitation 4, lab. 1, 3 hr.; credit 5; fee $8.00.

11. **Quantitative Analysis.** An application and illustration of the fundamental principles of Chemistry adapted to gravimetric and volumetric analysis. In the class room, chemical problems are solved, and the methods of analysis studied and explained. After sufficient preliminary practice the analytical work is applied to common substances, both organic and inorganic.

3S. Prerequisites 2 and 5; recitations 3, labs. 2, 3 hr.; credit 5; fee $10.00.

14. **Organic Chemistry.** It especially considers the isocyclic and heterocyclic compounds. The course may be varied considerably by making arrangements with the head of the Department.

5S. Prerequisites 9 and 11; credit 5; fee $8.00.

17. **Fuel and Gas Analysis.** A study of the methods of gas analysis, both by technical and exact methods, and the determination of the calorific values of gaseous, liquid and solid fuels and the calculation of their values as fuels.

4S. Prerequisite 11; recitations and lab.; credit 3; fee $5.00.

31. **Inorganic Preparations.** The object of this course is the study and the explanation of the methods of preparing finished commercial products from the raw material. A practical laboratory study.

4S. Prerequisite 11; lab. 4; credit 4; fee $8.00.

35. **Organic Preparations.** A continuation of course 14, or it may be taken along with this course.

6S. Prerequisite 9; recitation and lab.; credit 4; fee $8.00.

36. **Physiological Chemistry.** Considers the chemical phase of physiology, only, and is designed to be an application of the fundamental principles of chemistry to the chemical changes characteristic of the animal body. It considers the digestion, assimilation, the metabolism and the catabolism of the chief food constituents, namely, proteins, carbohydrates and fats, a study of the enzymes and the various secretions and products of the body. The laboratory study will be made quantitative, as far as possible for the time devoted to it. The treatment will be helpful to the students who may take up the study of medicine later.

5S. Prerequisite 9; recitations 3, labs. 2, 3 hr.; credit 5; fee $8.00.

39. **Water and Sewage Analysis.** (Course 11 gives the best preparation for this work.) The laboratory study of three hours per week covers the analysis of water to determine the sanitary character and the value for industrial, boiler and domestic purposes. The recitations and
lectures, two hours per week, discusses the methods of analysis, the sources of contaminations, and standards of purity for sanitary water. Deposit, $5.00.

47. The Chemistry of Foods and Food Adulteration. A special study of the essential constituents of a complete food. The proteins are carefully considered from the chemical standpoint, and that of their origin in plants and animals. The common adulterants of foods are studied, and the methods of their recognition. This course, when completed, may be followed by several lines of investigation, as to food adulterations, and means of preservation.

50. Quantitative Analysis. A continuation of course 11. Some line of quantitative investigation is selected by the student, and the work developed in this direction. The work may be in Organic or in Inorganic Chemistry.

51. Advanced Qualitative Analysis. For those students desiring to study the different methods of analysis, and to apply these methods to the analysis of the more difficult compounds and mixtures.

52. Elementary Physical Chemistry. Emphasizes the important principles and methods of physical chemistry and especially applies the conceptions formed to the explanation of Chemical Phenomena. Preparatory to a study of the application of the principles established to manufacturing problems.

VETERINARY CHEMISTRY

68. General Chemistry. Includes a study of the principal elements and their compounds and, in an elementary way, inorganic preparations.

69. Organic Chemistry, including Bio-Chemistry. After the introductory work in Organic Chemistry, the student devotes his time to Physiological Chemistry, and considers the chemical changes going on in the living animal body, the essential composition of animal foods and the changes through which they pass in the animal economy, the chemistry of the secretions and excretions. The laboratory study is devoted to the three principal food constituents and to urine analysis.
The Department of Botany occupies the major portion of the third
and several rooms on the fourth floor of the Central Building, sixteen
well lighted and well equipped rooms being devoted to the work of this
department.

The laboratories are all well supplied with apparatus of the most ap­
proved modern manufacture and with an abundance of working material,
the laboratories in Morphological, Histological and Pathological Botany
accommodating thirty students and those in Cytological and Physiological
Botany, sixteen students at each period.

The laboratory for Special Botanical Drawing is intended primarily
for students writing theses in this department and for Graduate students.

The laboratory for Economic Botany is equipped with the necessary
apparatus and with an excellent economic herbarium.

A well lighted room on the fourth floor, used as a greenhouse for
pathological and physiological botany, supplies an abundance of fresh
material for class and laboratory work.

The lecture room is equipped with a very complete outfit for lantern
demonstrations.

Herbarium. The department has about ninety thousand specimens of
which sixty thousand are catalogued. These comprise 60,000 in the gen­
eral Phanerogamic Collection; 25,000 in the Parry Collection, which hav­
ing been largely collected in the west before the advent of railroads,
are, often, type specimens and, therefore, invaluable; 5,000 in the general
Cryptogamic Collection; 15,000 in the Cryptogamic Exsiccati; and 1,200
in the Seed Collection.

These specimens have been collected in the Mississippi Valley, in
Iowa especially, and in various other parts of the United States, partic­
ularly in the Rocky Mountain Region; in Europe, South America, Cuba,
Africa, and other foreign countries and is very representative of the
world's flora. The collection of Phanerogams was begun under Dr. Bes­
sey and has been enlarged by his successors. The general collection also
includes the Holway Herbarium, excepting the Uredineae, the Fink
Herbarium, excepting the Lichens, and the Andrews Collection.

In addition to the above general Herbarium, there are special working
collections for the students in Agrostology, Dendrology, and Economic
Botany. The last named collection includes plants of economic import­
ance to man, whether considered as friends or foes, and comprises weeds, poisonous plants, food plants, medicinal plants, fiber plants, etc.

Cryptogamic Collection. This includes many very valuable exsiccati as: The Ravenel Fungi Americani, Ellis and Everhart's North American Fungi, The von Thuemen Mycotheca Universalis, Sydow's Uridineen, Briosi and Cavara's I Fungi Parasitici, Krieger's Fungi saxonicii, Seymour and Earle's Economic Fungi, Gottsche and Rabenhorst's Hepaticae Europaeae and others less expensive.

The Museum. The department has a large amount of material incorporated into an Economic Museum. The collections are systematically grouped, showing, in many cases, the evolution of the finished product from the crude material, this being especially true of the fibers. There is also a collection of various edible and poisonous fungi in formalin.

For graduate work, the department affords good facilities, major and minor work being offered to supplement that of various scientific and agricultural courses.

OPENINGS FOR TECHNICALLY TRAINED BOTANISTS

There are numerous openings in botanical work along the lines of weed problems, vegetable pathology, vegetable physiology, plant histology, systematic botany, agricultural ecology, and expert work in grass and forage plants, also for seed analysts, and pure food experts, state botanists, experiment station workers, mycologists, and teachers in colleges and high schools. The courses offered here will give the student an opportunity to specialize in his undergraduate work.

COURSES IN BOTANY

5. Vegetable Pathology. Plant diseases of the various horticultural, garden, and farm crops from the standpoint of the host plant; also, theories of prevention of disease, of rotation of crops, and the use of fungicides.

6 or 8S. Prerequisite, 27 for science students; recitations 2, lab. 1 or 3, 3 hr.; credit 3 or 5; fee $3.00.

6. Advanced Cryptogams. Thallophytes, various non-vascular cryptogams, particularly the fungi of our native flora; also investigation of a single group from both pathological and systematic point of view.

6 or 8S. Prerequisite 28; recitation 1, lab. 2, 3 hr.; credit 3; fee $3.00.

9. Structural Botany. Designed for Veterinary students, it being necessary that the well equipped Veterinarian have a knowledge of the terms used in morphological botany, and of the microscopic structure of plants. Vegetable drugs may consist of the whole plant, but more frequently of parts only, and hence the detection of adulterants is a subject for microscopic determination. Thus this course includes a study of parts of the plant from the roots to the reproductive
organs; with laboratory study of the histology of plants, especially from the standpoint of pharmacognosy, with a brief survey of more important groups from a systematic standpoint.

10. Economic Botany. A microscopic study of various plants and their food products and adulterants; the reserve food of plants, its form and use, and a systematic study by groups of the plants of economic value and a study of their origin and place of cultivation.

11. Vegetable Physiology. Lectures and laboratory practices on the functions, growth, nutrition, irritability, movements and reproduction of plants.

12. Vegetable Cytology. The plant cell and its activities, use of various reagents in staining, imbedding, mounting; various cell-like phenomena as they aid in an intelligent understanding of various problems in heredity and as illustrating DeVrie's Theory of Mutations and the relation in general of the hybrid and the cross to the parent.

13. Agrostology. The botanical position and economic uses of important grasses, as those used in meadows and pastures, cereal food products, grasses in medicine, as soil binders and for lawn making.

14. Seeds and Seed Testing. Principal agricultural seeds and weeds, methods of detection of weeds in commercial seeds, and structure and germinative energy of various seeds.

15. Systematic Phanerogams. The more important families of flowering plants; historical survey of various systems of classification; study of groups by means of some representative, the herbarium of the College affording material for this purpose.

16. Poisonous Plants. Poisonous plants from historical standpoint, with brief history of toxicology, ptomaine poisoning and poisoning by toxins and other agents—beginning with the poisonous fungi extending through the higher plants in systematic order. Is intended to acquaint veterinarians with the plants responsible for poisoning animals.

23. Thesis. Original research along line of any preceding courses, laboratory work, preparation of bibliographies, reviewing literature pertaining to the subject, and conferences with those in charge.
Credit 1 to 4; fee $3.00.

24. Plant Embryogeny. The phenomena of cell division, the nuclear changes of the cell at different stages in its growth, a survey of life history of various groups of plants beginning with liver-worts, the gradual development of the alternation of generations in various types, the homologies of the parts of flower and its various contained structures, processes of maturation of germ cells, growth of the gametophytic generation and the final process of fertilization and the consequent development of embryo, cytological explanations of the laws of Mendel, of parthenogenesis, of xenia, and polyembryony, also the verification of lectures by a study of a series of slides.
5 or 7S. Prerequisite 61 or 11 or 27; recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

25. Microscopical Examination of Foods. Vegetable foods from the standpoint of microscopy with especial reference to the adulteration of the same; the histological elements of plants such as tissues and cell contents; microscopic study of flour and meal, impurities and adulterations; weed seeds and screenings, oil seeds and oil cake. Lectures and laboratory work. Reference book, "The Microscopy of Vegetable Foods," by Winton and Moeller.
5 or 7S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.

26. Ecology. Relation of plants to their environment, under the factors water, heat, light, air, soil, and animals; considering the anatomical structures of plants, especially with reference to environment. The pollination of some economic plants like maize, wheat, clover, rosaceous and leguminous plants; the dissemination of plants. Symbiosis. Myrmecophytes.
4 or 6S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.

27. General Botany. General morphology with a short resume of the systematic arrangements of important members of five divisions of the plant kingdom; also a brief consideration of some of the functions of plants, under the head of the stability of plant bodies, the movements, nutrition, growth and reproduction. Reference book, Strasburger, Noll, Schenck, and Karsten.
1 S. Recitations 4, lab. 1, 3 hr.; credit 5; fee $3.00.

28. General Botany. Special morphology of the plant, beginning with the cell, its structure, parts, the inclusions of protoplasm, such as starch, aleurone, and crystalline matter; a brief account of the ontogeny of the cell and cell fusion; also a study of the tissues and tissue systems and their functions. Reference book same as course 27.
2S. Prerequisite 27, recitations 4, lab. 1; 3 hr.; credit 3; fee $3.00.

60. Botany of Weeds. Injury to farm, garden and horticultural crops, and the origin and distribution of weeds.
5 or 7S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.
61. **Morphology.** Lectures on the general and special Morphology of flowering plants with special reference to a study of the organ, cells and tissues of plants.
   1 or 2S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

62. **Dendrology of Gymnosperms.** Intended to give the student a more complete knowledge of the families, genera and species and the distribution of the North American Gymnosperms. A collection of thirty conifers will be required. Required of Forestry students.
   8S. Recitation 1, lab. 1, 2 hr.; credit 2%; fee $2.00.

   5S. Recitation 1, lab. 1, 2 hr.; credit 2%; fee $2.00.

64. **Ecology, Range and Poisonous Plants.** Important grasses, forage crops, and poisonous plants of the forest as applied to the range. Ecology from the standpoint of the plant community. To be considered from the atmospheric, hydrodynamic, and biotic factors. In short, the relation of plants to the soil, heat, air, light, wind, plant formations, plant rivalry, and pollination. Eight lectures on grasses and forage plants and eight laboratories. Required of Forestry students.
   8S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

65. **Mycology and Forest Pathology.** Relationship of fungi to other Thallophytes as well as to the more important divisions of fungi, followed by a study of the more important diseases of forest trees, such as blister disease of conifers, root diseases of forest trees, the tree destroying fungi like the bracket fungi, and phanerogamic parasites like the mistletoe. Required of Forestry students.
   8S. Recitation 1, lab. 2, 2 hr.; credit 2%; fee $2.00.

66. **Vegetable Pathology.** The same as course 5.
   8S. Recitation 2, lab. 1, 2 hr.; credit 2%; fee $3.00.

67. **Economic Botany.** Same as course 10.
   6S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $2.00.

68. **Vegetable Physiology.** The same as course 11.
   2, 3, or 6S. Prerequisites 61 and Chem. 21; recitations 2, labs. 2, 2 hr.; credit 3%; fee $3.00.

69. **Seeds and Seed Testing.** Same as course 14.
   6 or 8S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.

70. **Systematic Phanerogams.** Same as course 15.
   6 or 8S. Recitations 2, lab. 1, 2 hr.; credit 2%; fee $3.00.

71. **Evolution of Plants.** Same as course 19.
   8S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.

72. **Microscopical Examination of Foods.** The same as course 25.
   6 or 8S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $3.00.

81. **Botanical Seminar.** Recent literature and topics of botanical interest are reported and discussed by members of seminar, each member reporting on some assigned topic at least once every two weeks. Lec-
tures are also given by members or by some scientists under the auspices of the seminar.

Credit 1.

82, 83, 84, Continuation of course 81. One hour's credit in each course.

85. Experimental Morphology. Effects of light, temperature, moisture, nutrient, toxines, wounds, and parasites, upon the development and modification of plant tissues and plant organs.

Prerequisites 61, 68, 12, 5, or 66; recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.00.

86. Experimental Morphology. The same as 85, excepting a two hours' credit.

Prerequisite same as in 85. Recitation 1, lab. 1, 3 hr.; credit 2; fee $2.00.

Department of Geology

SAMUEL WALKER BEYER, PROFESSOR
IRA A. WILLIAMS, ASSOCIATE PROFESSOR

The work of this department is conducted by means of recitations, lectures, conferences, laboratory work, and field excursions. The student is thus afforded an opportunity not only to gain a familiarity with the principles and theories discussed in the leading text-books, but is also encouraged to test these theories and verify the principles discussed in the classroom. Field excursions, with carefully written reports are required in all the courses in Geology.

The department of Geology together with the department of Mining Engineering occupies quarters in Engineering Hall. The working equipment consists of museum materials, field and laboratory instruments.

The museum contains carefully selected series of fossils, minerals, rocks and ores, all available for study purposes. Among the more important collections 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 two hundred specimens and one hundred and fifty species; the Baltimore series of more than two hundred 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, the 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 map of the United States; one set of Kiepert's physical maps; numerous maps and charts of the United States Geological Survey and of the Mississippi River Commissions and an elaborate series of lantern slides and photographs.

COURSES IN GEOLOGY

All of the courses in Geology save numbers 2, 803 and 6 are designed especially to meet the requirements of students who elect the courses in Mining Engineering and Ceramics. At the same time the courses given will afford a good groundwork for students who expect to teach the subject or make Geology their profession. Course 803 is especially adapted for students in Civil Engineering who have not the time to take the more complete work. Course 6 is offered for those who desire a broad view of the world geography and it is hoped to make the course helpful to those who expect to teach History, Politics, Geography, or Geology.

2. General Geology continued: Historical and Stratigraphic geology.
   6 or 8S. Prerequisite 501; recitation 4; credit 4.

6. Advanced Physiographic Geology. Evolution of the physical features of the earth, and the leading agencies which influence their developments.
   6 or 8S. Prerequisites, Chem. and Phys.; recitations 3, labs. 1, 3 hr.; credit 4.

9. Meteorology and Climatology. Fundamental principles which
govern weather and climate. Principles of meteorology. Instruments used by the weather bureau, the principles upon which they are based, and their care and uses. Fundamental principles which control weather and climate. Charts and maps issued by the state and federal weather bureaus are used freely. Practice on the construction and interpretation of charts and in forecasting.

5 or 7S. Prerequisite 6; recitations 2; credit 2.

10. The work includes a careful consideration of the principles of dynamic and structural geology, with especial reference to the origin of soils and the surface features. Text-book, "Norton's Elements of Geology."

7S. Recitations 4; credit 4.


5S. Recitations 3, lab. 1, 3 hr.; credit 4.

607. Mineralogy. Morphological and physical characters of crystalline substances. Descriptive and determinative mineralogy. Prerequisites, elementary courses in Mathematics, Chemistry and Physics.

6S. Recitation 4; credit 4.


7S. Prerequisites 501 and 803; recitations 3; lab. 1, 3 hr.; credit 4.


8S. Prerequisites, Chem and Phys. 303; recitation 3, lab. 1, 3 hr.; credit 4.

805. Economic Geology. Non-metallics. Ore deposits of the United States, Canada and Mexico. Especial stress is put upon the principles which govern the mode of occurrence, association and origin of the leading economic products.

8S. Prerequisite 501 or 803, and 704; recitations 3, lab. 1, 3 hr.; credit 4.

808. Thesis. Students in Mining Engineering electing to write a thesis in geology are required to take five hours' special work in geology during the eighth semester. This special work may be along any one of the following lines: Economic Geology, Petrology, Dynamic Geology, Structural Geology, Metamorphism, Historical Geology or Stratigraphic Geology.

8S. Credit 5.
Department of Zoology

HENRY ELIJAH SUMMERS, PROFESSOR
JOSEPH EDWARD CUTHRIE, C. E. BARTHOLOMEW, ASSISTANT PROFESSORS
BRUCE MAGILL HARRISON, WILLIAM O. ELLIS, HERMAN A. SCULLEN, FLOYD E. BOWEN, INSTRUCTORS

Equipment. The laboratory is well supplied with the usual apparatus, including compound and dissecting microscopes, cameralucidas, 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 and formalin 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, echinodermata, arthropoda, mollusca and vertebrata are 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 about two hundred, and eggs of over two 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, including the types of 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; second, 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, third, to impart a knowledge of the facts and methods of investigation in the last of these practical subjects, namely, economic entomology.

COURSES IN ZOOLOGY

2. General Zoology. This together with Zoology 3, is designed to give an outline knowledge of the entire animal kingdom, as well as of the more important biological laws. The laboratory work includes a thorough
study of the structure of the cray-fish with comparative studies of other crustacea; and the grasshopper with brief comparative study of other insects. The related lectures deal with those facts in the physiology and life history of crustacea, and insects that will best serve as a foundation for a knowledge of the general laws of animal life. The earthworm is next studied, the lecture work dealing with the relation of animals to their environment. The study of vertebrates is begun.

1S. Recitations 3, labs. 2, 3 hr.; credit 5; fee $3.00.

3. General Zoology. Chiefly a study of vertebrates and protozoa. The dog-shark and necturus are the chief forms studied of the former, with accompanying lectures and general vertebrate physiology, including the fundamentals of embryology. The protozoa lectures deal with the origin of the physiological functions as exhibited in this group.

2S. Recitations 3, labs. 2, 3 hr.; credit 5; fee $3.00.

4. General Entomology. A study of the structure, habits, life history, and classification of insects, designed as an introduction to the subject for those intending to make a specialty of entomology and as a foundation for the practical work in economic entomology offered in Courses 17 and 18. Includes a detailed study of certain representative forms, beginning with the grasshopper, and the field study, collection and classification of as many species as possible representing different orders. The study of insects and the detailed life history of representatives of all the different orders.

5S. Prerequisites 3, 16 or 21; recitations 2, labs. 2, 2 hr.; credit 3½; fee $3.00.

5. 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 serial 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 different classes of vertebrates.

5S. Prerequisite 3; recitations 2, lab. 1, 3 hr.; credit 3; fee $3.00.


8S. Prerequisite 3; recitation 1; credit 1.

7. 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 lower vertebrates.

4 or 6S. Prerequisites 3 and 5, or 21 and 31; recitations 3, labs. 3, 2 hr.; credit 5; fee $3.00.

8. Animal Parasites. Study of the more injurious parasites of domestic animals.

6S. Prerequisite 2 or 5, or 20 or 31; recitations 2; credit 2.

9. Advanced Entomology. Lectures and laboratory work on the morphology and taxonomy of insects following Course 4.

8S. Recitations 2, lab. 3, 3 hr.; credit 5.
10. Morphology. Special individual work in continuation of Courses 2, 3, 5, and 7, or 4, 17, and 18, designed especially for those who expect to become teachers and investigators in Zoology, and who are writing their theses 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.

6, 7, 8 or 9S. Lab. 3 to 5; fee $3.


3 or 7S. Prerequisite 5; recitations 2, labs. 1 to 3 hr.; fee $3.00.

12. Human Physiology. Study of the chief functions of the human body, and the laws of health, preceded by a study of mammalian anatomy, including histology. Chemistry 60 must also be taken previously or simultaneously.

5S. Prerequisites, Zool. 3 or 19 and Chem. 59; recitations, 3 labs. 2, 2 hr.; credit 4%; fee $3.00.

13. Human Physiology. Continuation of Course 12.

6S. Recitations 3, labs. 2, 2 hr.; credit 4%; fee $3.00.

14. Advanced Invertebrate Zoology. Structure and development of representatives of invertebrate groups not fully discussed in previous courses; the embryology and anatomy of Echinodermata, the development of a marine worm, the types of Mollusca, Arachnida, and Ascidia. Special attention is paid to modes of respiration, kinds of respiratory apparatus, and also to special sense organs in Pecten, Loligo, etc.

6 or 8S. Prerequisite 5; recitations 2, lab. 1, 3 hr.; credit 3; fee $3.00.

15. General and Vertebrate Zoology. A study of the anatomy of the cray-fish gives a knowledge of zoological laboratory methods as well as the general structure of crustacea; a study of the anatomy of the shark serves as an introduction to methods of gross dissection, and of the general morphology of vertebrates. Other vertebrate types, especially the necturus, are studied. The lectures include general animal physiology, and an outline of the comparative anatomy of some of the chief organs of the vertebrates and of elementary vertebrate embryology.

Recitations 2; lab. 1, 3 hr.; credit 3; fee $3.00.

16. General Zoology. Intended particularly for the students in Horticulture and Agronomy. This course is intended to serve as an introduction both to general animal morphology and physiology, and to the more special work in Entomology required of the students in the above courses. The study of the grasshopper in the laboratory, followed by that of a fish, usually the shark, serves as a foundation for the lecture work on the general principles of Zoology, including physiology and development.

2 and 4S. Recitations 3, lab. 2, 2 hr.; credit 4%; fee $3.00.

17. Economic Entomology. Intended particularly for the students in Horticulture and Agronomy. A detailed study in field, insectary, and laboratory of the chief economic species of insects found in Iowa, accompanied by a study of the literature relating to the other more important American species.

6 or 8S. Prerequisite 4; recitations 2; labs. 1, 3 hr.; credit 3; fee $3.50.
18. **Economic Entomology.** A continuation of course 17.  
5 or 7S. Labs. 2, 3 hr.; credit 2; fee $3.00.

19. **General Zoology.** An introduction to general animal morphology and physiology. The cray-fish serving as a basis for general biological principles and the dog-shark as a basis for vertebrate morphology and physiology, are the forms to which chief attention is given.  
4S. Recitations 3; labs. 2, 2 hr.; credit 4%; fee $3.00.

20. **General Zoology.** Similar to 2.  
3S. Recitations 3, labs. 2, 2 hr.; credit 4%; fee $3.00.

21. **General Zoology.** Continuation of Course 2. Similar to Course 3.  
4S. Recitations 3, labs. 2, 2 hr.; credit 4%; fee $3.00.

30. **Embryology.** Similar to 5.  
5 or 7S. Credit 5; fee $3.00.

31. **Embryology.** Similar to 5.  
5S. Recitations 2, lab. 1, 2 hr.; prerequisite 21; credit 2/3.

36. **Forest Entomology.** Life histories and habits of the more important insects injurious to American forests and forest products. So far as possible the insects and their work will be studied in the field as well as in the laboratory.  
6 or 8S. Recitations 2, labs. 1, 2 hr.; credit 2/3; fee $3.00.

**SPECIAL COURSES**

In addition to the above, special courses will be offered to students intending to write a thesis in Zoology, and also to graduate students in continuation of the work pursued as undergraduates. Special facilities will be offered for such 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 or including Courses 7, or 3, 7 and 18, or 12 and 13, or 14.

**Department of Bacteriology**

R. E. BUCHANAN, PROFESSOR  
P. E. BROWN, ASSOCIATE PROFESSOR, SOIL BACTERIOLOGY  
B. W. HAMMER, ASSISTANT PROFESSOR, DAIRY BACTERIOLOGY  
CHARLES MURRAY, ASSISTANT PROFESSOR, VETERINARY BACTERIOLOGY  
ED. S. WELLES, INSTRUCTOR, GENERAL BACTERIOLOGY  
ANNA WOLFE, ASSISTANT, GENERAL BACTERIOLOGY

The laboratories for general bacteriology occupy eight rooms on the third floor of Central Hall. The general student laboratories are fitted with glass-topped tables, water and gas, wall and desk lockers, hoods, thermostats, microscopes, and microscope lockers. These laboratories will accommodate thirty-six students at one time, but by use of a system
of lockers, one hundred thirty may be accommodated. A separate room is used for the preparation and sterilization of all media. This is equipped with soap stone tables, gas and water, hoods, autoclaves, inspirator, Arnold steam sterilizer, hot air ovens, stoves, etc. A research laboratory, culture room, dispensary, and animal room are also provided. Two lecture rooms used jointly with the Department of Botany are equipped with a very complete outfit for lantern demonstrations and for the projection of microscopic slides. The laboratory also has sets of bacteriological wall charts.

The laboratories in soil bacteriology are housed with the Department of Soils on the first floor of Agricultural Hall. Student laboratories, accommodating thirty-six students, with laboratory furniture and apparatus, a dispensing room, and a room for thermostats and for storage purposes are provided. The research laboratory is well fitted for graduate work. The greenhouses of the Department of Agronomy, the experimental plats of the Experiment Station, and the soil research and analytic laboratories are all available for the advanced student. Exceptional opportunity is here offered for research work in Soil Bacteriology to those who are qualified to undertake it.

The laboratories in Dairy Bacteriology are situated on the third floor of the Dairy Building. They consist of a student laboratory accommodating thirty-two students, a preparation room, store room, and large research or station room. Each of the laboratories has four constant temperature rooms connected with a refrigeration plant and supplied with gas. The laboratory furniture and equipment is quite complete. There is here, also, an excellent opportunity for research work by the graduate student.

The laboratories in Veterinary Bacteriology are in the newly erected building for Veterinary Pathology and Bacteriology. The laboratories are well equipped for both undergraduate and graduate courses in bacteriology in its relationships to the diseases of animals. Hog cholera serum laboratories and laboratories for preparation of other biological products and for the diagnosis of animal diseases afford opportunities for advanced or graduate work to students.

**OPPORTUNITIES OPEN TO TECHNICAL BACTERIOLOGISTS**

The demand for men (and women) trained in Bacteriology in its applications to the various fields of industry far outruns the supply. Fundamental training in general and technical bacteriology will fit men as agricultural bacteriologists, soil bacteriologists, dairy bacteriologists, veterinary bacteriologists, sanitary experts and sanitary bacteriologists and experts in bacteriology as related to the home. Opportunities for such training are afforded by the Course in Science as Related to the Industries, in which not only the fundamental science work may be secured, but sufficient technical and industrial work to link science with
practice. Positions in the various Bureaus of the U. S. Department of Agriculture, the various Agricultural Experiment Stations, Engineering Experiment Stations, Colleges in which Sanitary Engineering, Agriculture and Home Economics are taught, Sanitary Experts for cities and Boards of Health are being created much more rapidly than men are being trained to fill such positions. The Iowa State College affords unusual opportunities for training for positions in Applied and Technical Bacteriology.

The courses offered in Bacteriology are grouped under four heads:

Courses in General and Sanitary Bacteriology.
Courses in Veterinary and Pathogenic Bacteriology.
Courses in Soil Bacteriology.
Courses in Dairy Bacteriology.

COURSES IN GENERAL AND SANITARY BACTERIOLOGY

1. **General Bacteriology.** Morphology, classification, physiology, and cultivation of bacteria, relation of bacteria to health of man and animals, to infection, contagion, immunity, and to other scientific and agricultural problems. Laboratory work on methods of cultivating bacteria and the study of bacterial functions and activities, the solution of specific problems, such as the bacterial content of air, water, and food, with interpretation of results reached.

5 or 6S. Prerequisite, Chem. 9; recitations 2, labs. 3, 2hr.; credit 4; fee $5.00.

19. **Technical Bacteriology.** A study of the morphology, relationships, and cultural characters of the bacteria of water and water supplies; including the algae which produce disagreeable odors and tastes, and methods used in their quantitative and qualitative determination.

5 or 6S. Recitations 2, labs. 3, 2 hr.; credit 4; fee $5.00.

5. **Advanced General Bacteriology.** Advanced work in the biology and physiology of bacteria, intended to fit students to do original or special work in experimental, general, or pathological bacteriology.

5 or 6S. Prerequisite 1, 18 or 19; recitations 2, labs. 3, 2 hr.; credit 4; fee $5.00.

7. **Advanced Sanitary Bacteriology.** Primarily a study of the bacteria of water and specific instances of pollution of water supplies, and of problems that have been solved in the disposal of sewage and other wastes by means of bacteria.

5 or 6S. Prerequisites 1, 15, 18 or 19; recitation 1, labs. 3, 2 hr.; credit 3; fee $5.00.

9. **Thesis.** Thesis work may be elected in this department and credit given in the Science Courses. The nature of the work to be undertaken should be decided after consultation.

5 or 6S. Prerequisite 5 or 7; recitations 1, labs. 3, 2 hr.; credit 3; fee $5.00.

15. **General Bacteriology for Students in Animal Husbandry.** A discussion of general bacteriology followed by a study of the relationship of bacteria to agriculture with particular reference to the live stock industry.

5S. Prerequisites, Chem. 9; recitations 2, lab. 1, 2 hr.; credits 2½; fee $4.00.
18. **General Bacteriology and Fermentations for Students in Home Economics.** Bacteria in their relations to the home, including a brief consideration of the pathogenic forms and the bacteria, yeasts and molds in their zymotic activities.

6S. Prerequisite, Organic Chemistry; recitations 2, labs. 2, 2 hr.; credit 3⅔; fee $5.00.

**COURSES IN VETERINARY AND PATHOGENIC BACTERIOLOGY**

328. **Veterinary Bacteriology.** Morphology, classification, cultivation, and physiological characters of bacteria; the principles of infection and contagion and a discussion of the various theories of immunity as related to bacterial infection.

4S. Prerequisite, Organic Chemistry; recitations 2, labs. 2, 2 hr.; credit 3⅔; fee $5.00.

429. **Veterinary Bacteriology.** Pathogenic micro-organisms, particularly those infecting domestic animals. In the class and laboratory, their cultural characters and theories of immunization will be considered.

5S. Prerequisite 328; recitations 2, labs. 2, 2 hr.; credits 3⅔; fee $5.00.

12. **Bacteriology of the Pathogenes.** Similar to Bacteriology 328, the extended time permitting the study of bacteria pathogenic to man as well as animals.

5 or 6S. Prerequisite 1, 15, 18, 19, or 328; recitations 2, labs. 3, 2 hr.; credit 4, fee $5.00.

16. **Special Poultry Bacteriology.** A study of the bacteria that produce disease in chickens, and of the relationships of bacteria to storage of poultry and poultry products, the decomposition of eggs and related problems.

8S. Prerequisite 1, 15, or 18; recitations 2 hr., labs. 2, 2 hr.; credit 3⅔; fee $4.00.

**COURSES IN SOIL BACTERIOLOGY**

8. **Soil Bacteriology.** Soil bacteria and their activities in their natural habitat, and a preliminary consideration of the influence which they exert on soil fertility. The work involves purely quantitative bacteriological examinations of soils followed by quantitative and qualitative studies of all the important bacterial processes occurring in the soil. Prerequisites, Organic Chemistry and General Bacteriology.

7S. Prerequisite 1; recitation 2, labs. 3, 2 hr.; fee ——.

14. **Advanced Soil Bacteriology.** Special problems are studied by means of laboratory and greenhouse experiments dealing with the fixation of atmospheric nitrogen; the transformation of the nitrogenous, carbonaceous, and mineral compounds in the soil; the effect of manurial and fertilizer treatment on the various bacterial activities; the adequacy of the bacteriological methods now used in the determination of the crop producing power of the soil.

8S. Prerequisite 8; recitations 1, labs. 3, 2 hr.; credit 3; fee ——.
DAIRY BACTERIOLOGY

17. Dairy Bacteriology. Bacteria in milk and its products; a considera­tion of mode of entry and subsequent changes produced; the production and handling of milk from a hygienic and economic viewpoint and its relation to the public health.

6S. Prerequisite 1; recitations 2, labs. 3, 2 hr.; credit 4; fee $5.00.

25. Advanced Dairy Bacteriology. Laboratory investigation of bacteriological problems relating to dairying; the nature of the work being adapted largely to the individual student.

7 or 8S. Prerequisite 17; labs. 3, 2 hr.; credit 3; fee $5.00.

Department of Applied Economics and Social Science

JOHN EDWIN BRINDLEY, PROFESSOR
C. B WILLIAMS, ASSISTANT PROFESSOR
OLE JOHN HENDERSON, NON-RESIDENT LECTURER

Economic Science has become a well recognized part of all scientific and technical education, because it has made itself useful in investigating and interpreting the material phenomena and facts of every day life. A special effort will be made to adapt the courses to the needs of students in all the departments of the College. This purpose is indicated by the work offered in Agricultural and Engineering Economics, Veterinary Law, and the Economics of Home Administration.

The liberal provision for electives under the new plan of organization also affords the department an excellent opportunity to train specialists in the important fields of agricultural economics, rural sociology and business engineering. Strong men with thorough training in the natural and social sciences as related to transportation, urban utilities, the manufacturing industries and agriculture will be in greater and greater demand as experts in dealing with the numerous complex questions incident to monopoly and large scale production on the one hand and the so-called country life movement on the other.

GENERAL COURSES


3, 5 or 7S. Recitations 5; credit 5.


5 or 7S. Prerequisite 1, 2, 9 or 14; recitations 3; credit 3.

4. Money and Banking.

6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 2; credit 2.
5. Public Finance.
6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 3; credit 3.

5 or 7S. Prerequisite 1, 2, 9 or 14; recitations 2; credit 2.

3, 5 or 7S. Recitations 3; credit 3.

6 or 8S. Recitations 2; credit 2.

4 or 6S. Recitations 3; credit 3.

RURAL ECONOMICS

2. The Economics of Home Administration. The elementary principles of economic science as related to those social and industrial problems of special interest to women will constitute the subject matter of this course. The production, distribution and marketing of foods and numerous other economic factors which determine the cost of living under present industrial conditions will be considered. Text, lectures and assigned readings.
5S. Recitations 2; credit 2.

10. Agricultural Economics. Historical and comparative agricultural systems; land tenure; size of farms; co-operation; taxation; prices; transportation; marketing; land credit; the relation of the state to agriculture.
6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 3; credit 3.

11. The State in Relation to the Home. The field of state regulation as related to women and their work will be critically examined. The relation of the home to the community or state involves such problems as the following: pure food laws, sanitary regulations, school laws, laws regulating labor of women and children, public amusements, nuisances, liquor traffic, poor relief, the rights and legal status of women, etc. Lectures and outside reading.
8S. Prerequisite 2; recitations 2; credit 2.

21. Economic Geography. Production, agricultural and manufacturing, as influenced by nature; that is to say, by climate, soil, mineral, and forest resources; next by social considerations; finally by economic factors such as machinery, transportation, and facilities of exchange.
6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 2; credit 2.

23. Forest Economics. Relation of forests and forestry to other industries; agriculture, manufacturing, commerce; the problem of state ownership; the value of forest land; taxation of forest land; forest education.
6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 3; credit 3.

24. Rural Sociology. A study of rural population; the density of
population; rural vital statistics, sanitation, migration, nationality. Social institutions; the rural church; rural schools, clubs, society, facilities for entertainment. Leadership in rural communities. Standards of living. Tenancy; relation of employee to employer. The agricultural community and community life.

6 or 8S. Prerequisite 1, 2, 9 or 14; recitations 3; credit 3.

BUSINESS LAW AND ACCOUNTANCY

20. Rural Law. Designed to make the student familiar with the ordinary legal and business operations. Adapted especially to those who expect to follow agriculture or business as a vocation. The following subjects will be treated: contracts, negotiable instruments, sales, and personal property. The laws of Iowa relating to highways, fences, water rights, ditching, drainage, live stock, trespassing, etc.

8S. Prerequisite 1, 2, 9 or 14; recitation 1; credit 1.

25. Veterinary Law. This course will deal with the elementary principles of business law as applied to the practice of Veterinary Medicine. Lectures and outside reading.

6S. Recitation 1; credit 1.


6 or 8S. Prerequisite 1, 9 or 14; recitations 2; credit 2.

27. Accountancy and Auditing. The purpose of this course is to prepare special students for work as accountants and auditors. Lectures, assigned readings and analysis of accounting systems.

7S. Prerequisites 1, 9 or 14 and 26; recitations 3; credit 3.

ENGINEERING ECONOMICS

12. Public Utilities. This course deals primarily with the telephone, telegraph and urban utilities; but a few introductory lectures will be given on railway transportation.

5 or 7S. Prerequisite 1, 9 or 14; recitations 2; credit 2.

19. Railway Transportation. A study will be made of railroads with special reference to their rates, consolidation, business organization, and relations to the public.

6 or 8S. Prerequisite 1, 9 or 14; recitations 2; credit 2.

RESEARCH

13. Seminar. Elective for students who have not less than two previous courses. The purpose of this course is to awaken interest in the general field of economics by following the current events and reading economic magazines.

6 or 8S. Prerequisite 1, 2, 9 or 14, and one other course approved by the head of the department; recitation 1; credit 1.

22. Research. Students desiring to do research work in Economics may do so to the extent of three credits per semester during the senior year.

7 or 8S. Prerequisite, at least five courses in Economics; credit 3.
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 the 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 by his study to 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 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 utility.

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**

10. **Narration and Description.** Expository and suggestive description; better vocabulary through search for the specific word; simple and complex narrative, with incidental description; plot and characterization; securing interest, as well as clearness and good order; analysis of good models. Themes almost daily, to train the student to apply the principles studied.

2, 3, or 4S. Prerequisite 11; recitations 3; credit 3; fee 25 cents.

11. **Exposition.** Principles and methods of expository writing; logical basis in definition and division; different types of exposition, with study of models; careful attention to the constructing of paragraphs and the making of plans and outlines; a short theme almost daily, with longer ones occasionally, constant emphasis on the application of the principles studied.

For students who need it, the term begins with a thorough review of grammar, followed by essays on everyday topics designed to test the student’s command of fundamental principles. Students who show by their first work that they do not need this review will be promoted to an
advanced section. Those who fail at the end of the review will take such additional work as the individual case may demand.

2, 3 or 4S. Prerequisite 11; recitations 3; credit 3; fee 25 cents.

12. **Argumentation.** Principles and methods of effective argument, with analysis of good models; abstracting and collating arguments on both sides of some live question of present importance; practice in making briefs and in writing forensics.

3, 4, 5, 6, 7, or 8S. Prerequisites 11 and 10; recitations 2; credit 2; fee 25 cents.

13. **Advanced Composition.** Composition in any of the forms of discourse, each student writing along the line of his chief interest. In part daily themes and in part longer papers based on reading and original research.

4, 5, 6, 7, or 8S. Prerequisites 11, 10 and 12; recitations 2; credit 2.

14. **Advanced Composition.** Continuation of 13.

5, 6, 7, or 8S. Prerequisite 13; recitations 2; credit 2.

15. **Engineering English.** Technical writing for engineering juniors.

5 or 6S. Prerequisite 12; recitations 2; credit 2.

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**COURSES IN LITERATURE**

1. **English Drama.** The study of Shakespeare, with a rapid survey by reports and informal lectures of the English drama before his time and after his time down to the nineteenth century. Character analysis, with grouping and contrast; foreshadowing and suspense; plot and analysis, with stages of complication and resolution. Certain plays will be studied carefully, and others read rapidly for general impressions. May be taken in two parts, as Literature 22 and 23.

1, 3, 5, or 7S. Recitations 3; credit 3.

2. **Epic and Lyric Poetry.** English poetry excluding the drama. Milton, Wordsworth, Tennyson, and Browning, with brief study of Dryden, Pope, Burns, Coleridge, Shelley, and Keats. Classification of the various forms of poetry; study of rime, rhythm, meter, tone-color, melody, harmony, principles of criticism, etc. May be taken in two parts, as Literature 10 and 11.

2, 4, 6, or 8S. Prerequisite, Eng. 11, Lit. 1 helpful; recitations 5; credit 5.

3. **Novel and Romance.** Study of the chief writers of fiction from the eighteenth century to the present time; differences between the two forms; comparison with the drama; plot and character analysis; study of style; an outline for systematic study.

3, 5, or 7S. Prerequisites, Eng. 11 and 10 and Lit. 1, Lit. 6 also helpful; recitations 3; credit 3.

4. **American Literature.** Our chief poets and essayists, with some consideration of historians and writers of fiction; comparison with English authors and works in the same class; interrelations of our literature and history.

3, 5, or 7S. Prerequisites, Eng. 11 and 10, Lit. 2 or 10 helpful; recitations 3; credit 3.
5. **Drama.** The ancient Greek drama and the English drama prior to the 19th century; a combination of courses 1 and 8.
   1, 3, 5, or 7S. Recitations 5; credit 5.

6. **The Short Story.** The short story from the time of its development as a distinct literary form to the present time; the various types, with principal attention to the product of the last fifty years in France, England, and the United States.
   3, 5, or 7S. Prerequisites, Eng. 11 and 10, Lit. 1 helpful; recitations 2; credit 2.

   4, 6, or 8S. Prerequisites, Eng. '11 and 10; recitations, 2; credit 2.

8. **Greek Drama.** Leading Greek dramas in an English translation.
   May be taken as a part of course 5 or independently.
   1, 3, 5, or 7S. Recitations 5; credit 5.

9. **Epic and Lyric Poetry, 19th Century.** Wordsworth, Tennyson, and Browning, with a brief study of Coleridge, Keats, and Shelley. May be taken as a part of course 2 or independently.
   2, 4, 6, or 8S. Prerequisite, Eng. 11, Lit. 1 or 5 helpful; recitations 3; credit 3.

10. **Epic and Lyric Poetry, 16th, 17th, and 18th Centuries.** Chief attention given to Milton, with brief study of Dryden, Pope, and Burns. May be taken as a part of Course 2 or independently.
    2, 4, 6 or 8S. Prerequisite, Eng. 11, Lit. 1 or 5 helpful; recitations 2; credit 2.

11. **General Course.** Study of the leading English authors in chronological order, with enough of the history of literature and the life of the author to give background. The aims are, to fix standards for determining what is and what is not good, to develop the power of interpreting literature, and to cultivate an appreciation of the best.
    1S. Recitations 3; credit 3.

12. **General Course.** A continuation of course 15.
    2S. Prerequisite 1S; recitations 3; credit 3.

13. **The Modern Drama.** Studies mainly in Ibsen, Hautmann, and Maeterlinck in English translation; rapid reading for thought content and broad survey, with occasional discussion of dramatic technique.
    5 or 7S. Prerequisites, Eng. 11 and 10, Lit. 1 helpful; recitations 2; credit 2.

    6 or 8S. Prerequisite 1S; recitations 2; credit 2.

15. **The Bible as Literature.** How we got the English Bible; the various manuscripts, versions, and translations; some study of form and structure; emphasis on content and literary quality and power. The historical books of the Old Testament, (narrative), Deuteronomy (oratory), Psalms (lyric poetry) and Job (drama).
    3, 5, or 7S. Prerequisites, Eng. 11 and 10, Lit. 1, 4, 6, 8, 10, or 11 helpful, though not necessary; recitations 2; credit 2.
21. **The Bible as Literature.** Continuation of 20. Proverbs, etc. (wisdom literature), the Prophets; the Gospels, the Acts, and the Epistles of the New Testament.

4, 6, or 8S. Prerequisite 20; recitations 2; credit 2.

22. **Shakespeare.** A careful study of some of the great dramas. May be taken as a part of course 1 or independently.

1, 3, 5, or 7S. Recitations 2; credit 2.

23. **Shakespeare.** Rapid reading of a number of dramas, for background, comparison, and broad survey. May be taken as a part of course 1 or independently.

1, 3, 5, or 7S. Recitations 1; credit 1.

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**Department of History**

**ORANGE HOWARD CESSNA, PROFESSOR**

**LOUIS BERNARD SCHMIDT, ASSOCIATE PROFESSOR**

**OTTO THEODORE HOKKAASEN, ASSISTANT PROFESSOR**

The courses in history deal almost entirely with the modern period and are largely along the line of applied history. They are developed in harmony with the nature and purpose of the institution. It is recognized that the students are here to specialize along the lines of agriculture, engineering, industrial science, and home economics, and the courses are arranged accordingly, e.g., the "History of Public Domain" is arranged especially for agricultural students, "Industrial History of the United States" for engineering and industrial science students, and "The West in American History" for students in home economics. A number of elective courses are offered which have a practical bearing upon present day affairs. In short, the work in history is regarded as an essential part of the preparation which young men and women should have who are to go out from the College to become leaders of public service by virtue of their technical training.

**COURSES IN HISTORY**

5. **History of Modern Europe.** Events ushering in the Modern Age; ascendancy of France under Louis XIV; rise of Prussia and Russia; England's Colonial Supremacy; French Revolution; Napoleonic era; period of reaction; Industrial Revolution; struggle of France for popular sovereignty; unification of Italy and Germany; extension of British Empire; revolution in Prussia; Near Eastern questions; problems of modern governments. Text-book, lectures, and topical reports.

1, 3, 5, 7S. Recitations 3; credit 3.

8. **History of the United States, 1763 to 1912.** Causes and results of union and independence; formation of the Constitution; Federalist supremacy; Jeffersonian Republicans; War of 1812; rise of the New
West; Jacksonian Democracy; Texas, Mexican War, and Oregon; parties and slavery; secession, civil war, and emancipation; reconstruction; new social and economic conditions; settlement of Far West; national industrial development; recent national and commercial expansion. Textbook, lectures, and topical reports.

2, 4, 6, 8S. Recitations 3; credit 3.

14. The West in American History. A study of the settlement and development of the West from 1763 to 1890. Causes of the westward movement; lines of advance; conditions of frontier life; growth of democracy; rise of new problems; development of new institutions; influence of the West on national development. Textbook, lectures, and assigned readings.

2S. Recitations 2; credit 2.


1, 3, 5S. Recitation 1; credit 1.

18. Political Parties and Party Leaders. Formation and growth of political parties in the United States. Special attention is given to party platforms and party problems and the influence of political leaders on party history. Textbook and lectures.

4, 6, 8S. Recitation 1; credit 1.

20. Industrial History of the United States. This course aims to show the manner and extent to which economic forces have determined the history of the country. Attention is given to colonial industry; economic aspects of the Revolution; early commerce and manufacturing; the settlement and development of the West; the public land system; internal improvements and the growth of transportation facilities; economic aspects of slavery; the negro problem; immigration; the merchant marine; our insular possessions and their economic problems. Attention is also given to the development of our resources; the growth of manufacturing industries; the tariff; and the industrial transformation of the South. Textbook, lectures, and topical reports.

2, 3, 4, 5, 6, 7, 8S. Recitations 2; credit 2.

24. History of Public Domain. A study of the acquisition by the Federal Government of public lands; the westward movement; the various plans by which the greater part of these lands have been transferred from public to private ownership; the good and evil results of such transfer; criticism of the plans and policies now in vogue; importance and extent of the remaining public lands; classification of these lands; recent governmental activities including conservation and reclamation. Textbook, lectures, and topical reports.

2, 3, 4, 5, 6, 8S. Recitations 2; credit 2.

26. Industrial History of England. A study of the development of English agriculture, industry, and commerce from the Anglo Saxon conquest to the present time. Special attention is given to early agriculture;
early town life; merchant and craft guilds; markets and fairs; rise of commerce, trade routes; the industrial revolution; and the great improvements in agricultural and manufacturing industries during the nineteenth century. Text-book, lectures, and topical reports.

5, 7S. Recitations 2; credit 2.

28. History of Commerce. A study of ancient medieval, and modern commerce. Special attention is given to the articles of commerce; the development of market places; the evolution of trade routes; the methods of transportation; and the causes which have promoted and retarded the growth of commerce in the leading countries. Text-book, lectures; and topical reports.

6, 8S. Recitations 2; credit 2.

32. History of Political Parties. A study of political parties in the United States from 1787 to the present time. Special attention is given to the formation and composition of parties; party leaders; platforms; presidential campaigns; election results; problems engaging the attention of the party in power. Third party movements and their influence on the history of the major parties will also be considered. Text-book, lectures, and topical reports.

5, 7S. Recitations 2; credit 2.

34. History of the Tariff. A study of tariff legislation in the United States from 1789 to the present time. Special attention is given to the principles underlying tariff legislation; the economic forces dominant in each period; analysis of tariff laws; arguments for and against; sectional and political character. Text-book, lectures, and assigned readings with topical reports.

6, 8S. Recitations 2; credit 2.

40. Recent Changes in the Far East. A rapid review of China and Japan in the nineteenth century followed by a somewhat detailed study of events since the Chino-Japanese War of 1895. Special attention is given to the relation of the United States to events in the Far East since the acquisition of the Philippines in 1898. Present day conditions and commercial opportunities in China will also be considered. Text-book, lectures, and assigned readings and reports.

5, 7S. Recitations 2; credit 2.

42. The United States as a World Power. A study of the evolution of the United States as a world power with special reference to the place the United States occupies among the nations. Text-book, lectures, and topical reports.

6, 8S. Recitations 2; credit 2.

46. Political History of Iowa. Early explorations of the Iowa country; Indian tribes; treaties and cession; territorial organization, laws, institutions and politics; movement for statehood; the making of the Constitutions of 1846 and 1857; the political evolution of Iowa as a state; present problems; and current legislation. Special attention is given to the bearing of the westward movement on the development of
institutional life in Iowa and to the relation of Iowa to national history.
Lectures, assigned readings, and reports.

5, 7S. Recitations 2; credit 2.

48. **Industrial History of Iowa.** Early trade, travel, and settlement; immigration; railroad building; agricultural development; rise of manufacturing industries; economic and political revolution; present day problems; the new Iowa. Lectures, assigned readings, and reports.
(Not given in 1913-1914.)

6, 8S. Recitations 2; credit 2.

### Department of Psychology

**Orange Howard Cessna, Professor**

**Note.** The following courses in the department of Psychology will count toward the state teacher's certificates:
Psychology 7 and 8 required. Psychology 6 and 2 may also be elected.
See under "State Teachers Certificate" in this catalogue.

2. **Ethics.** Covers both theoretic and practical ethics and is based on standard texts such as MacKenzie's, Muirhead's, and Dewey and Tuft's Manuals. The texts are supplemented by lectures and library work.

6 or 8S. Recitations 3; credit 3.

3. **Social Psychology.** A study of the popular mind and treats of the characteristic feelings, beliefs, and actions of men in consequence of their association. Some of the topics treated are as follows: The mind of the crowd, the mob mind, public opinion, mental characteristics of the audience, social psychology, social intelligence and feeling, suggestibility, conventionality, custom, etc. Prerequisite, Psychology 4, or 7 and 8. Lectures and library assignments. Three hours per week.

5 or 7S. Recitations 3; credit 3.

4. **Essentials in Psychology.** Covers the main facts of psychology, and is based on such texts as Titchener's Primer of Psychology, Betts's The Mind and Its Education, James's Talks to Teachers, Thorndike's The Human Nature Club. It is a briefer course than is required for the state teacher's certificate given in Courses 7 and 8. Text-books, lectures, and class demonstrations.

5 or 7S. Recitations 3; credit 3.

6. **Psychology of Childhood and Adolescence.** The various mental features of child growth; characteristics of childhood and the significant mental changes of the adolescent period, with special reference to the needs of teachers and parents; the individual, parental and social instincts; the adaptive instincts; imitation, curiosity, play. Special attention is given to the educational value of play; the regulative instinct: moral and religious; the collecting and constructive instincts, etc. The Montessori System and its application illustrated by simple apparatus. The Psychology of Adolescence: The Boy Scout Movement, the girls'
Campfire, and athletics, etc. The psychology of cooking clubs and corn-judging contests, etc. The instincts of childhood and adolescence and their place in the natural method of development. Text-book, lectures, and demonstrations.

6 or 8S. Recitations 3; credit 3.

7. **Descriptive Psychology.** The elements and outlines of psychology, and an introduction to the other courses in psychology and principles of education and child study. Standard texts are used, such as those of Angell, James, Titchener, Thorndike, together with Seashore's Elementary Experiments in Psychology, supplemented by lectures, and illustrative experiments before the class.

3, 5, or 7S. Recitations 3; credit 3.

8. **Descriptive Psychology.** A continuation of Course 7 which must precede it.

4, 6 or 8S. Recitations 3; credit 3.


A brief, concrete presentation of the main facts and laws of mind and their application to business-life problems.

The psychology of advertising: attention, memory, suggestion, the feelings and emotions, the direct command, the value of the return coupon, large and small spaces, etc., with practical applications.

The psychology of handling men: individual and group efficiency, interest, habit, attitude, motion-study, the psychology of the crowd, the strike, wages, piece-work, "task and bonus," etc. The psychology of Scientific Management. Epoch-making changes are taking place in the industrial world today along the line of applied psychology. An introduction to the principles of the newer efficiency movements; a study of the human elements in efficiency—"the man behind the machine."


Text-book, lectures, and assignments.

5, 6, 7, or 8S. Recitations 2; credit 2.

11. **The Animal Mind.** A study of animal intelligence and behaviour. The evidence of mind; sense discrimination; perception and the modification of conscious processes by experience; instinctive, intelligent, and social behaviour; the memory idea; the feelings and emotions as interest, play, etc.; animal "aesthetics" and "ethics," together with the evolution of behaviour along the main aspects of conduct. Text-books, lectures, and investigations.

5, 6, 7, or 8S. Recitations 2; credit 2.
2. The Declamation. Planned to help the student get command of himself. Attention is especially given to voice building and bodily expression.

1, 2, 3, 4S. Recitation 1; credit 1.

3. Interpretation. Methods of vocal interpretation; methods of criticism, methods of delivery. Beside the class lectures and class exercises on topics pertaining to interpretation, each student is instructed privately and personally at stated intervals throughout the semester.

2, 3, 4S. Prerequisite 2 or its equivalent; recitations 2; credit 2.

4. Interpretative Analysis. Character study, dramatic and analytical interpretation are begun. Methods of analyzing, clipping and arranging stories and other literary forms complete the term's work. Students are met for private rehearsals and criticisms.

4, 5, 6S. Prerequisite 3 or student may be admitted to this course upon the recommendation of the instructor in charge; recitations 2; credit 2.

5. The Lecture Recital and Monologue. Designed for the study of the Lecture Recital and Monologue. How to select, introduce, and arrange selections for the lecture recital, and the art of preparing and arranging a monologue from a play or work of fiction are the essential purposes of this course. It is presupposed that the student has some dramatic ability.

5 or 7S. Prerequisite 4; recitations 2; credit 2.

6. Lecture Recital and Monologue. The student is required to prepare and deliver one strong program, either a lecture recital or monologue during the semester. Private rehearsals are given the student in preparation for the program.

6 or 8S. Prerequisite 5; recitations 2; credit 2.

8. Orations and Orators. Optional with Course 11. A study of prepared and formal address, such as orations and speeches for special occasions. Historical masterpieces and winning orations are studied. At least one oration is required of each student during the semester.

4S. Recitation 1; credit 1.

10. Extempore Speech. The purpose is to develop the power of sincere and effective public speaking. The fundamental principles of speech organization and delivery are studied according to the true extemporaneous method. The assimilation of the essentials of effective speaking and the working out of these essentials into actual practice before the audience is the basis of the work. Each student is given the
opportunity to appear in an original speech before his fellow students at least once every two weeks.

5 or 7S. Recitations 2; credit 2.

11. Extempore Speech. Essentially the same methods are used as in Course 10, although the work is of a more advanced nature. Lectures are given by the Head of the Department at regular intervals during the semester, and each student is given the opportunity to appear before the class in a short address every ten days or two weeks.

6 or 8S. Prerequisite 10; recitations 2; credit 2.

15. H. E. Public Speaking. Designed to prepare women for Domestic Science demonstration work, and to fit them to appear in public address before women's clubs, institutes, and other organizations where women are called upon to discuss subjects of vital public interest. Practice in the organizing and rendering of speeches, before the student, audience, under the helpful criticism of the teacher is the keynote to the work.

7S. Recitations 2; credit 2.

16. Advanced Public Speaking. Designed for the training of those students who wish to prepare themselves for institute speaking or for other public speaking which should require special training and equipment. This work will be conducted under the special direction of the Head of the Department and will involve the advanced study of those principles of Public Speech the mastery of which will enable the speaker to acquit himself creditably before a public audience.

5 or 7S. Prerequisites 10 and 11; recitations 1; credit 1.

19. Extempore Speech. For the special accommodation of Engineering students who desire some training in Public Speaking. The work will be practically the same as in Course 10, the only difference being that this is a one hour instead of a two hour course.

5S. Recitation 1; credit 1.

18. The Art of Debate. Continuation of Course 17. One hour's credit.

Department of Modern Language

FLETCHER BRIGGS, PROFESSOR

GRACE ISABEL NORTON, INGEBORG G. LOMMEN, MARY PETERS FAIRFIELD, DAISY ALISON ARVILLE, MILDRED G. SEMMONS, INSTRUCTORS

French


5S. Recitations 5; credit 5.

2. Elementary French. Continuation of Course 1. Grammar, with special attention to irregular verbs; reading, constant practice in writing
and speaking French. Texts used are chosen from La Brete, Scribe, Erckmann-Chatrian.

28. Recitations 3; credit 3.

2a. **Elementary French.** Continuation of Course 1. For students in Home Economics. Grammar, special attention to irregular verbs; reading, practice in writing and speaking French. Texts used are chosen from La Brete, Scribe, Erckmann-Chatrian.

25. Recitations 3; credit 3.

3. **French Prose.** Selected reading from Maupassant, Daudet, Loti, and Anatole France; Cameron's Prose Composition. Prerequisite, Course 2 or 2a.

15. Recitations 3; credit 3.

4. **French Verse.** Selected French Lyrics and Dramas. Prerequisite, Course 3.

28. Recitations 3; credit 3.

18. **Scientific French.** Selected reading in physics, chemistry, geology and mineralogy. Texts used, Herdler's Scientific French Reader, and Bowen's Scientific Reader. Prerequisite, Course 2.

15. Recitations 3; credit 3.

19. **Scientific French.** Continuation of Course 18.

28. Recitations 3; credit 3.

51. **French Novel of the 19th Century.** A reading course devoted to the important novels of such authors as Hugo, Balzac, Sand and Daudet. Prerequisite, Course 4.

15. Recitations 3; credit 3.

52. **French Novel of the 19th Century.** Continuation of Course 51.

28. Recitations 3; credit 3.

53. **French Drama.** Selected dramas by Corneille, Racine and Marivaux. Prerequisite, Course 4. (Omitted, 1913-1914.)

Elective 15. Recitations 3; credit 3.

54. **French Drama.** Continuation of Course 53. (Omitted, 1912-13.)

28. Recitations 3; credit 3.

57. **Elementary French.** Fraser and Squair's French Grammar, and Aldrich and Foster's French Reader.

15. Recitations 3; credit 3.

58. **Elementary French.** Continuation of Course 57. Selected texts.

25. Recitations 3; credit 3.

**German**

5. **Elementary German.** Grammar and reading, constant practice in pronunciation and in writing German. Bierwirth's Beginning German and Seeligmann's Altes and Neues.

Both Semesters. Recitations 5; credit 5.

6. **Elementary German.** Continuation of Course 5. Grammar and
reading. Texts such as Storm's Immensee, Gerstäcker's Germelshausen, Wilhelmi's Einer musz heiraten, and Zschokke's Der zerbrochene Krug.

Both Semesters. Recitations 5; credit 5.

5a. Intermediate German. Review of grammar, reading and composition. Bierwirth's Beginning German. (Open to those who have offered one year of German for admission).

1S. Recitations 3; credit 3.


2S. Recitations 3, credit 3.

7. German Prose. Such texts as Wildenbruch's Das edle Blut, Baumbach's Der Schwiegersonn, Storm's Pole Poppenpälzer; and German composition. Prerequisite, Course 6 or 6a.

7a. German Prose. Similar to Course 7, for Home Economics Freshmen entering with two years of German.

1S. Recitations 5; credit 5.

8. Selected Reading. Continuation of Course 7 or 7a. A drama by Lessing, Goethe, or Schiller, followed by German prose.

2S. Recitations 3; credit 3.


5S. Recitations 5; credit 5.


6S. Recitations 5; credit 5.

16. Scientific German (Agricultural). Selected reading in botany, biology, bacteriology, chemistry and geology. Prerequisite, Course 6 or 6a.

1S. Recitations 3; credit 3.

17. Scientific German (Agricultural). Continuation of Course 16.

2S. Recitations 3; credit 3.

20. Scientific German (Engineering). Selected reading in physics (such topics as sound, heat, light, and electricity), chemistry, geology, and mineralogy. Texts used, Wallentin's Grundzüge der Naturlehre. Prerequisite, Course 6 or 6a.

1 and 2S. Recitations 3; credit 3.


1 and 2S. Recitations 3; credit 3.

22. Advanced Scientific German. German periodicals in engineering, agriculture, and the natural sciences, for individuals or groups of students, used as texts. Prerequisite, Course 17 or 21.

Both Semesters. Recitations 2 or 3; credit 2 or 3.

23. Advanced Scientific German. Continuation of Course 22.

Both Semesters, Elective. Recitations 2 or 3; credit 2 or 3.
24. German Composition and Conversation. Pope's German Composition is the basis of the work; review of grammar, individual reports in German; and conversation. (Students should consult with the instructor before electing the course). Prerequisite, Course 8, 15, 17 or 21. 1S. Recitations 3; credit 3.

25. German Composition and Conversation. Continuation of Course 24. A text is basis for conversation; individual reports in German; constant use of the language. 2S. Recitations 3; credit 3.

27. Modern German Novel. Novels selected from the works of Scheffel, Freytag, Hauff, and Sudermann. Prerequisite, Course 8. 1S. Recitations 3; credit 3.

28. Modern German Novel. Continuation of Course 27. 1S. Recitations 3; credit 3.

29. German Drama in English Translations. The dramas of Lessing, Goethe and Schiller will be read in translations, together with parallel reading in English biographies and histories of the literature. Discussions and reports. No knowledge of German required. Not open to Freshmen. One hour through each of two semesters. Both Semesters. 1 R; credit 2.

40. Modern German Poetry. Lyrics and Ballads. Text, Klenze's Deutsche Gedichte. Second semester. Prerequisite, Course 8. 2S. Recitations 2; credit 2.

41. Historical Prose. Selected Reading. Texts, Liliencron's Anno 1870, Arndt's Deutsche Patrioten. Prerequisite, Course 6 or 6a. 1S. Recitations 2; credit 2.

42. Goethe's Faust. The first part of the poem is discussed and interpreted, with supplementary lectures on the Faust literature. Prerequisite, Course 28. 1S. Recitations 2; credit 2.


Spanish


31. Elementary Spanish. Continuation of Course 30. Grammar and reading of such texts as Valera's Pepita Jiménez, or Alarcón's El Capitán Veneno, and Carrion's Zaragüeta. 2S. Recitations 5; credit 5.

33. Elementary Spanish. Giese's Spanish Book and Reader, Hill's Spanish Tales, Crawford's Spanish Composition. 1S. Recitations 3; credit 3.
34. **Elementary Spanish.** Continuation of Course 33. Text: Valera’s Pepita Jiménez or Alarcón’s El Capitán Veneno.
   2S. Recitations 3; credit 3.

36. **Advanced Spanish.** Reading and review of grammar, together with composition. Some text, such as Valdés’s José or Galdós’s Marianela.
   1S. Recitations 3; credit 3.

37. **Spanish Correspondence and Conversation.** Harrison’s Commercial Correspondence is the basis for this work. Prerequisite, Course 36.
   2S and Elective. Recitations 3; credit 3.

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**Department of Military Science and Tactics**

**General James Rush Lincoln, Professor**

It is not intended to complete the education of a 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 person, a gentlemanly deportment and a self-respecting discipline, with habits of neatness, order and punctuality. Opportunities are offered 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 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 Freshman and Sophomore years, except such as may be excused by proper authority on account of physical disability or religious belief, or Sophomores who have elected athletics, are required to become members of the College Battalion, and wear the prescribed military uniform during military exercises.

Students who are excused on account of religious belief must, if they are under twenty-one years of age, present to the President a written request from the parents. Such request must be accompanied by a written certificate from the proper church authorities, showing that the parents are members in good standing of either the Quaker or Dunkard churches. If the student is over twenty-one years of age, he must present a certificate from the proper church authorities, showing that he is a member in good standing of either the Quaker or Dunkard church.

No substitute for Military Drill will be allowed. Students entering the second semester of the Freshman year can be excused from Military Drill for that semester, but must commence to drill at the beginning of the first semester of the following year.

The price of the regular olive drab uniform is $12.00. All students
of the College Battalion will be measured for uniforms the second week in each semester, at which time a deposit of $5.00 is required. Second hand suits will not be permitted to be worn under any circumstances.

COURSES IN MILITARY SCIENCE AND TACTICS

1. Two drills per week.
2. Two drills per week.
3. Two drills per week, also the Non-Commissioned Officers' School of one hour per week, the School of the Guides and Guard Duty, required of all officers.
4. Two drills per week, also the Non-Commissioned Officers' School of one hour per week. Drill regulations and Guard Duty, required of all officers.
5. Elective. Two drills and Officers' School of one hour per week Drill regulations, Guard Duty and Army Regulations.
7. Elective. Two drills and Officers' School of one hour per week. Service of security and information, Military Engineering, Military Law and Military Hygiene.

The Library

VINA ELETHE CLARK, LIBRARIAN
HARRIETTE EDITH SESSIONS, REFERENCE LIBRARIAN
KATHREEN HOLDRIDGE, BETTY PRITCHETT, LIBRARY CATALOGUERS
CAROLINE E. LAIRD, ASSISTANT LIBRARIAN, ENGINEERING LIBRARY
ROBINA MARGUERITE RAE, ASSISTANT LIBRARIAN IN AGRICULTURAL LIBRARY

The College Library, consisting of 40,000 volumes and 50,000 pamphlets, is chiefly a library of reference containing standard and technical works bearing particularly upon the lines of work pursued in College. These include standard works of history, biography, engineering, agriculture, natural sciences, mental and moral philosophy, poetry, general literature and reference. The books are selected with great care, the heads of the departments indicating such works as they wish the library to have bearing upon their respective lines of work.

A few years ago the College received by bequest about 1,500 volumes pertaining to Engineering and Economics from the library of the late George W. Catt. This Engineering Library with that section of books from the general collection has been made a Department Library located in Engineering Hall.

An Agricultural Library has been established in the new Hall of Agriculture.
The library is classified according to the Dewey Decimal System of Classification and the card catalogue is in two parts, the Dictionary (author and title) and Classed.

The library is a depository for U. S. government documents, and is in constant receipt of large numbers of publications from the various departments of the government, agricultural experiment stations and other sources.

The library receives about 300 periodical publications, literary, scientific and general, and there are complete files of many of these upon the shelves.

The library subscribes for several dailies and, through the courtesy of the editors, a large number of the daily and country newspapers of Iowa are sent to the reading room for the use of students.

The reading room of the library is open to readers twelve and one-half hours daily, except Sundays, when it is open three hours. Current numbers of periodicals are kept in the reading room and are accessible to all, as are newspapers, college exchanges, dictionaries, encyclopedias, Poole's Index, the card catalogue, etc.

Personal assistance and suggestions upon all matters relating to the library will be given by the librarian and assistants to all who desire such help.

**COURSE IN LIBRARY WORK**

1. **Library Work.** Four hours in fall semester.

**Department of Physical Training**

**CLYDE WILLIAMS, PROFESSOR**

**JOHN P. WATSON, ASSOCIATE PROFESSOR**

**HOMER C. HURBARD, ASSISTANT PROFESSOR**

**ANDREW R. HACKETT, ASSISTANT PROFESSOR**

The work in the Department includes courses in personal hygiene, systematic gymnastic exercises, indoor and outdoor sports, including competitive athletics. The Department is committed to the principle that its work should be mainly with the many, rather than with the few, and that the development of special teams is of secondary importance as compared with the development of the student body as a whole. The idea that a College or University has any responsibility for the physical welfare of its students has been slow of acceptance, but at the present time is generally conceded by broad gauged educators everywhere. Interclass and Intercollegiate contests are deemed desirable under proper restrictions, but their importance is not exaggerated.

**Equipment.** The Department is well equipped for both indoor and outdoor work. The Gymnasium recently completed is admirably adapted for its purpose. It is of brick construction with terra cotta trimmings,
two hundred and ninety-seven feet long by eighty-three feet wide and two stories high. The main exercise floor is eighty feet by one hundred and seventy feet, without obstructions of any kind, and is twenty-four feet high. It is equipped with standard apparatus of the latest design, especially selected to secure the best possible results. The room is also equipped for basket ball, indoor base ball, volley ball and hand ball, and has a gallery running track twelve feet wide and twelve laps to the mile. The lower floor is of dirt and is used for general exercise, field and track work and team practice. The building is equipped with a swimming pool thirty feet wide and sixty feet long, and with general and team locker rooms with all the necessary bath and toilet facilities. It is well lighted, both naturally and artificially, and has forced ventilation throughout. In addition to the Gymnasium, the Department has at its disposal, the new athletic field containing ten acres, directly south of the Gymnasium, a playground to the north of the Gymnasium of about equal area, and the old athletic field containing about seven acres. These fields are fitted out for foot ball, basket ball, soccer, tennis, track and field work.

The Iowa State College is a member of the Missouri Valley Conference, and Intercollegiate athletics are governed by the rules of this Conference. The College is also a member of the National Collegiate Athletic Association and is committed to tolerate only clean and wholesome sport and to promote good sportsmanship among contestants and spectators.

The regular work of the Department consists of lectures on Hygiene, Physiology, Anatomy, and kindred subjects; drill in marching, floor tactics and class evolutions; class and individual drill in general calisthenics with and without apparatus, and mat exercises; class work in general indoor and outdoor Athletics corrective exercises for any who are defective physically; and, incidentally, in specialized individual and team work in foot ball, basket ball, track, cross country, tennis and wrestling.

A physical examination is required of all men taking work in the Department.

Fees. All students taking work in the Department of Physical Training are required to pay a Gymnasium fee of two dollars per semester. The fee covers the use of lockers, swimming pool, bath room; and expense for towels, soap, and attendance.

EFFICIENCY LECTURES

During the first ten weeks of the fall semester the following efficiency lectures will be given:

1. Student Economics.
2. College Spirit
3. Student Habits.
4. Personal Hygiene.
5. Disease Carriers.
COURSES IN PHYSICAL TRAINING

101. a. Lectures on Hygiene and Physiology.
     b. Elementary Floor Tactics.
     c. Elementary Calisthenics.
     d. Elementary Gymnastics.
     e. Course in Swimming.
     f. Class work in outdoor and indoor games and athletics.

1S. 2 hours per week; required.

202. Continuation of Course 101.

2S. 2 hours per week; required.

303 and 404. Advanced work in any of the subjects listed under Course 101. Military Drill or Physical Training is required of all able-bodied men throughout the Sophomore year.

3 and 4S. 2 hours per week; elective.

Many requests are received for teachers in general and applied science, who have had more or less physical training and work in athletics. Those who are preparing to teach may elect work specially adapted to their needs.

The several branches of outdoor and indoor athletics are given below. Each sport receives the personal attention of one or more competent instructors. The development of winning athletic teams is not unduly exalted. The man who stands no chance of representing the College in intercollegiate contests is encouraged to participate as well as the athletic "phenom."

All indoor and outdoor athletic exercises are under the general direction of the Department. All interclass and intercollegiate contests and invitation meets and tournaments, where gate receipts are charged, are under the control of the Athletic Council. Special stress is placed upon clean, wholesome sport, and questionable methods are strictly tabooed. Less emphasis is placed upon the winning of games than upon true sportsmanlike conduct.

Track Work

Light work on track and field is carried on during the fall semester.

Freshman-Sophomore Meet. Special and systematic work on track and field.

Cross Country Running. Special training is given in the way of walks and cross country work. A handicap meet, open to all, is run, and suitable trophies given the winners. A team represents the College in the Chicago and Missouri Valley Cross Country Meets.

During the Spring semester, light work on track and field is continued. Special and systematic work is encouraged and expected of all candidates for interclass and intercollegiate contests. The leading interclass event of the semester is the Home Meet. The intercollegiate events consist of one or more dual meets, the State Meet; and the year's work culminates in the Missouri Valley Track and Field Meet.
Foot Ball

Much attention and encouragement are given the interclass games. These are considered as not only beneficial to the participants, but also as a help to the student body and College in general.

Special training and coaching are given the team representing the College in intercollegiate games.

Baseball

Interclass and department games are encouraged. Several diamonds are laid out on the campus, providing room for the many who care to follow this form of exercise. A splendid trophy in the form of a loving cup was donated by the class of '08 for the winner of the interclass championship. Special training and coaching are given the team representing the College in intercollegiate games.

Basket Ball

During the winter months basket ball is the leading competitive sport offered by the department. Besides the general exercise offered to all, class teams have their schedules and a team represents the College in intercollegiate games.

Tennis

Tennis courts are provided and cared for by the department. These courts are open to all. Interclass schedules are played in the fall and spring, the latter for the McKay Tennis Trophy. This is a beautiful and costly loving cup presented by Professor George L. McKay, formerly head of the Dairy Department of the College.

One or more teams represent the College in intercollegiate tournaments.

Physical Culture for Women

WINIFRED R. TILDEN, DIRECTOR
RUTH VINCENT, STUDENT ASSISTANT
ANNA WOLFE, STUDENT ASSISTANT

Work in the Woman's Gymnasium is required of the young women throughout the Freshman and Sophomore years and is given in two forty-five minute periods each week. Before admission to any of the classes each student must be examined by the director with reference to physical development, strength of heart and lungs and hereditary tendencies. These examinations, with measurements, are given at the beginning of the Freshman year and at the close of the Sophomore year's work. At the close of the regular two years' work the department awards a silver cup to the Sophomore who has shown the most development. No student will be excused from exercises except by order of the College physician and director. If such an excuse is sent to the Dean the student is also deprived
of the privilege of entering athletic games and attending dances. The highest ideals are kept constantly before the mind, not only of health and strength, but ease, grace and refinement in manner and carriage of the body.

Facilities for basket ball, tennis and field hockey are provided. During the first six weeks in the fall and last six weeks in the spring the physical training will be out of doors and each student may choose which of the above mentioned sports she prefers.

The regular gymnasium work indoors begins the middle of October and continues until the middle of April and includes light and heavy gymnastics; marching, tactics; figure marching; bells; clubs; wands; and dancing, aesthetic, gymnastic, folk national and American contra.

The gymnasium uniform consists of a dark blue regulation bloomers, gymnasium shoes and white middy blouse. Bloomers and tennis shoes must be provided in advance. The director will order after classification the blouse and gym shoes.

There is for the women a splendid athletic association which has charge of the interclass athletic games, the awarding of hockey, basket ball and tennis medals, the girls’ official “A” sweater and the annual “May Day” festivities.

A fee of $1.00 is charged for each semester’s work.

EFFICIENCY LECTURES

During the first ten weeks of the fall semester the following efficiency lectures will be given.

1. Student Economics.
2. College Spirit
3. Student Habits.
4. Personal Hygiene.
5. Disease Carriers.

COURSES

Course A (out of door work).

10—Tennis, advanced—Fall semester. Theory and Practice—2 hours per week.
11—Tennis, elementary—Spring semester. Theory and Practice—2 hours per week.
20—Basket ball, elementary—Fall semester. Theory and Practice—2 hours per week.
21—Basket ball, advanced—Fall semester. Theory and Practice—2 hours per week.
22—Field hockey, elementary—Fall semester. Theory and Practice—2 hours per week.
24—Swimming, Theory and Practice. 2 hour per week.

Course B. Elementary Gymnastics.

1. Particular attention is paid to general carriage and physical con-
control of each student. Free-hand calisthenics, elements of Swedish gymnastics, simple fancy steps and games.

2. All forms of elementary work with light apparatus, including bells, wands, clubs, etc. Folk dancing and marching tactics.

Course C. Corrective Gymnastics.

This course will be arranged to meet the needs of all students not physically able to take course B 1 and 2.

Course D. Advanced Gymnastics.


4. Continuation of Course C 3. Advanced work on buck (low and high), parallel bars, horizontal and serpentine ladders, traveling and flying rings, merry-go-round, and vaulting box.

Course E. Elementary Dancing.

Aesthetic dancing, rhythmic movements of arms and body, combined with fancy steps. Simple Gilbert and Chalif series.

Course F. Gymnastics. National and American contra dancing.

The new feature of the course will be the "American Contra Dances." Until recently they were the only dances performed in rural districts. They are valuable in that they, too, give poise, grace, and cultivate a sense of rhythm.

Course G. The nature, function, and administration of play.

A course for students wishing to assist in Playground and Campfire movement.

First Year—Course A—(2 courses) 2 hours per week throughout the year.

Course B—(1 and 2)
or
Course C.

Second Year—Course A—(2 courses) 2 hours per week throughout the year.

and

Course D—(3 and 4)
Prerequisites, Course A and B, 1 and 2,
or
Course E—prerequisite, B or C.
or
Course F—prerequisite B or C.
Elective—3rd or 4th year.
Course E—prerequisite, Course D, 3 and 4,
or
Course F—prerequisite, Course D, 3 and 4.
Course G—prerequisite, Course C or equivalent.
School of Music
(Affiliated)
School of Music

AFFILIATED

ALEXANDER STEWART THOMPSON, DIRECTOR, PIANO, PIPE ORGAN, VOICE AND THEORY

CLARA DUTTON THOMPSON, VICE-DIRECTOR, VOICE

SELMA FLAGGE, INSTRUCTOR IN PIANO, MUSICAL HISTORY AND HARMONY

JAMES WAYDE DRENNAN, INSTRUCTOR IN VIOLIN, GUITAR AND MANDOLIN

CHARLES L. MUNDEHNK, BRASS INSTRUMENTS

The School of Music is established as an affiliated Department of the College. It is essentially a school of musical learning. It stands for high ideals, and strives by means of thorough training to develop to the highest stage of artistic capability all those possessing musical talent.

All grades of instruction are given from the beginning to the most advanced ideas in interpretation.

Complete courses are offered in Pianoforte, Pipe Organ, Voice, Harmony, Counterpoint, Canon, Fugue, Analytical Harmony and Form, Composition and Musical History. Other courses are offered in Ensemble Music, Sight Reading, Chorus Singing, Choir and Band Practice.

All of the recitals by students and the recitals and lectures given by the instructors are free to all of the music students, also practice in the college choir.

From time to time great musical artists will be heard at the College. For these entertainments a charge will be made, and all musical students are expected to attend.

The Conservatory admits two classes of students. College Music students who have met the full entrance requirements for admission to the Freshman class in the Science Course, and take not less than six hours per semester of College work in addition to their work in Music, and the students not meeting these requirements, who are known as Music Students.

Young women taking the College Music Course may room in Margaret Hall under the same arrangements as any other College student.

College Music Students who complete the four years' music course, which includes sight singing and four years' theoretical work and have taken forty-eight hours of College studies, will receive an Artist's Diploma in Music.
SCHOOL OF MUSIC

COURSES OF STUDY

THEORY

HARMONY


First Term. Keys, scales, and signatures; intervals, the triads, chord connection, simple part writing, and keyboard work.

Harmonizing basses, inversions, chords of the sixth, keyboard work, and ear training.

2S. Chords of the sixth continued. Chords of the seventh and their inversions. Chords of the ninth. Other discords.


4S. Suspensions, Retardations, and Organ Point. Diminished Sevenths and Analytical Harmony.

5S. Single Counterpoint in all species including florid in two, three and four parts. Sir Frederick Bridge's and Dr. Francis E. Gladstone's Counterpoint used. Analytical Harmony.

6S. Canon and Fugue. Richter's Double Counterpoint and Fugue, and Higgs on Fugue are used. Or Analytical Harmony.

7S. Interpretation and Form. Includes the psychology of rhythm with its application in conducting and interpretation generally, the psychology of tone color, harmony, and melody, in its relation to interpretation; also the interpretation of standard works in voice and piano. Messiah, Elijah, St. Paul, etc., and notable piano works by Beethoven, Chopin, Schumann, and present day authors, etc.

8S. Study of instrumentation. Ebenezer Prout's "Instrumentation" and Berlioz's "Instrumentation, etc." are the main text-books employed.

HISTORY OF MUSIC


Various schools of polyphonic music. The rise of dramatic and instrumental music. and the development of the various musical instruments.

The development of the Opera and Oratorio. The Romanticists. Modern music and musicians.

The above course can readily be accomplished in one year with two recitations a week.

PIANO

The course in this department is intended to meet the varying needs of individual pupils, with the idea of furnishing a comprehensive, rather than a rigid, inelastic training in pianoforte technic. While the acquirement of finger dexterity is necessary, the value and importance of the mental training to be obtained from the study of music is emphasized.
and the course is expected to make apparent the advantage of a broad musical education.

Preparatory Course

The preparatory course is sufficiently simple to include beginners, and requires the study of the following exercises: Stephen Emory’s Foundation Studies, or Wohlfahrt, First Lessons in Piano, Herz Scales. Sartorio Books 2, 3 and 4, or Mathew’s Graded Courses, first four books.

The major and minor scales and major and minor chords must be played from memory, besides a variety of musical figures suggested by the various compositions. These points are brought out by the use of works by Kohler, Duvernoy, Burgmuller, Gurlitt, and Schumann’s studies for young students.

These fundamentals must be fully mastered before a pupil can be classified as a student in the Advanced Musical Course. The mastery of these principles is of the greatest importance, as it is the only way to secure intelligent and sure progress in the advanced stages.

Advanced Course

First Year. Major and minor scales and arpeggios.

Mathew’s Graded Course, Books 5 and 6; Mason’s Technics; Beren’s New School of Velocity, Books 1 and 2; Selection from Clementi and Kuhlau Sonatinas; Pieces by Bohm, Thome, Godard, Lebierre, Sapelnikoff, suitable novelties, American or foreign.

Second Year. Scales and Double Thirds, etc.

Mathew’s Graded Course, Book 7; Mason’s Technics; Beren’s New School of Velocity, Books 3 and 4; Low’s Octave Studies; Selections from Haydn and Mozart Sonatas; Selections from Mendelssohn’s Song Without Words; Easier pieces of Chopin, also pieces by modern authors, Chaminade, Rachmaninoff.


Fourth Year. Bach continued. Chopin Etudes, Beethoven Sonatas. Advanced Chopin and Liszt compositions or other suitable difficult pieces.

PHYSICS COURSE

508. Sound. Required of all regular music students. A discussion of the theory of sound with special reference to music. The course includes a study of the nature of sound, the physics of the musical scale, and those topics, such as tone quality, resonance, etc., which are of special interest and importance to the student of music. Lectures, one hour per week.

VOICE

The aim of this course is to develop, through deep breathing properly applied to voice placement, that full, resonant tone which has always
characterized the artists trained in the Italian school, to attain a clear enunciation, a keener appreciation of the subtler meanings of the verbal text and an understanding of the foundational principles underlying all musical interpretation to the end that the singing may be distinguished by musicianly, scholarly qualities and deep human sympathy.

**Preparatory Course**

Breathing and voice placing exercises; sustained tones and scale work according to the Italian method as taught by Sims Reeves, of London, England, and Vannucini, of Florence, Italy. Concone’s Fifty Lessons; Concone’s Forty Lessons for Bass; Marchesi’s Exercises, Op. 1, First Part; Vaccai’s Studies.

**Advanced Course**

*First Year.* Voice placing exercises; scales, sustained notes, and articulation exercises; Marchesi’s Studies; Concone’s Twenty-five Lessons; songs by American composers, Denza, Cowen, Gastaldon, Jensen, Grieg, and Mendelssohn.

*Second Year.* Voice placing exercises continued; scales, etc., Marchesi’s Studies; Concone’s Fifteen Lessons; songs or solos by Schubert, Schumann, Grieg, Handel, or other good foreign and American composers.

*Third Year.* Advanced studies and exercises; solos from the standard oratorios and operas. Handel, Haydn, Mendelssohn, Mozart, and a few of the Italian or French composers.

*Fourth Year.* Review of Handelian arias; Beethoven, Wolf, Strauss, Brahms, and Franz songs; Wagnerian, and other opera solos.

**Sight Singing**

Beginning Class. The work will embrace a thorough explanation of all the fundamental principles of music—notes, time, keys, major scales, intervals, arpeggios, common chords and chromatics. Special work in ear training.

Advanced Class. The work will embrace the study of minor and chromatic scales, dominant and diminished seventh chords. Mordent, trill, appoggiatura, acciaccatura. Ear training. Sight reading will be the great feature.

**PIPE ORGAN**

It is desirable that a student should have had a thorough course in piano finger technic; and have taken at least a year of Harmony as a prerequisite. As natural adaptation for the organ plays a great part in the student’s progress on organ an outline only of the work is given.

The course comprises simple exercises for developing correctness and fluency in pedal playing: Stainer’s Organ; Nillson’s A System of Technical Studies in Pedal Playing; Buck’s Studies in Pedal Phrasing; Thayer’s Pedal Studies; Works of Bach and the Modern French School; also Mendelssohn, Rheinberger, etc.
The aim in this course is to develop players of fine quality and to
develop executive and interpretive power in the highest degree.

**Preparatory Course**

Franz Wolfhart, Book I.
Violin Method for Beginners, O. Sevcik, Parts I, VI, VII. Easy
pieces.

**Advanced Course**

*First Year.* Preparatory method of Violin Technics, O. Sevcik. Books
I and II. Changes of Position and Preparatory Scale Studies. Prepar-
tory Studies in Double Stopping in Thirds, Sixths, Octaves, and Tenths.
Pieces by De Beriot and others.

*Second Year.* Etudes of Kreutzer, Fiorillo and Rode. Concertos by
Mozart, Wieniawski, and pieces by classic and modern composers.

*Third Year.* School of Violin Technics for Advanced Pupils, O.
Sevcik, Books I, II, III, and IV; Exercises in Double Stopping, Triple
and Quadruple Stopping, Pizzicato, Flageolet-tones. Solos from Wien-
iawski, Ernst, and Vieuxtemps.

*Fourth Year.* 40 Variations, O. Sevcik. Bow technics. Preludes
Campagnoli, Caprices Paganini. Concerts from Paganini, Mendelssohn,
Beethoven, Bruch, Saint Saens, etc.

**GUITAR AND MANDOLIN**

The instructor in violin will offer a course in guitar and mandolin
music, with the view of meeting the demand for such instruction, and
with the hope that a good mandolin club will result.

**SUPERVISOR MUSIC COURSE**

This course is designed for those students who are desirous of mak-
ing a specialty of teaching music in the public schools. A thorough
mastery of singing by syllable is one of the great objects to be attained
in conjunction with as thorough cultivation of the voice as the time will
permit. In the first semester methods and study of the child voice are
taken up. Musical History and Harmony are continued throughout the
year.

The two Courses in Psychology, 7 and 8, are required. On the
completion of the course a certificate will be issued.

**MUSIC COURSE. ONE YEAR**

**Prerequisites**

Graduation from an accredited high school or its equivalent. Ability
to play piano, fourth grade, with a full knowledge of the major and
minor scales.
Voice Culture. Two semesters. Two private lessons a week.
Harmony. Two semesters. Two class lessons a week.
Sight Singing. Two semesters. One hour a week.
Musical History. Two semesters. Two class lessons a week.
Methods of Public School Music Teaching and Study of the Child Voice. One semester. Two class lessons a week.

Tuition for this course: $50.00 each semester.

Descriptive Psychology 7 and 8 and the additional hours required in college.

BAND INSTRUMENTS

Instruction is given in these instruments by Charles L. Mundhenk, the director of the College Band.

CHORAL SOCIETY CONCERTS

At least two concerts will be given during the year by the Choral Society on which occasions the Society will be assisted by celebrated musical artists from abroad.

Such works as Barnby's Rebekah, Gaul's Holy City, Buck's Forty-sixth Psalm, Coleridge Taylor's Hiawatha's Wedding Feast, Cowen's Rose Maiden, A. S. Thompson's Lazarus, Handel's Messiah, and Mendelssohn's Elijah have been given successfully. Such artists as Madame Isabelle Bouton, Wm. Frederic Martin, Dr. Carl Duftt, Dr. Ian Jackson, of New York, Madame Sibyl Sammis Macdermid and Mr. Garnett Hedge, of Chicago, as well as Madame Frieda Langendorff, of Berlin, have sung with the Choral Society or in the Artists' Course.

A fine Ladies' Glee Club gives one concert each year. Members of this club are selected by Mrs. Thompson, the directress.

An excellent Male Glee Club gives concerts each semester. Membership in this organization is gained by examination by the Director, A. S. Thompson, and the vote of the members.

REGULATIONS

Students must register and secure entrance cards (each semester) before they begin their lessons. A student may register at the beginning of the semester or for the unexpired portion thereof. The entrance card must be presented to the instructor at the first lesson.

All tuition is payable at time of registration. No deviation from this rule will be permitted unless the pupil, parent, or guardian makes application to the Director for an extension of time.

Students may enter at any time. Students may enroll for music alone without additional expense.

No pupil will be allowed to register at the regular semester rates for less than a full semester. Pupils taking less than a full semester will pay for their lessons at the following rates: Half-hour private lessons with Alexander S. Thompson, $1.25. Class lessons in Harmony, etc., 50 cents.
Half-hour private lessons with Mrs. Thompson, $1.25. Half-hour private lessons with Mrs. Plagge or James Wayde Drennan, $1.00.

Only in case of protracted illness (two weeks or more duration), certified by a physician's statement, can any deduction be made for absence from lessons. In such cases the pupil will pay at the above rates for the lessons he has received, and the balance of the tuition paid will be refunded. All claims of this nature must be made and settled before the end of the term in which the absence occurs.

Students may enter the Conservatory at any time, but it is greatly to their advantage to enter, if possible, at the beginning of the semester.

Students entering within two weeks of the beginning of the semester will be charged for the full semester; after that time for the remainder of the semester and one week additional.

College Music Students are required to take the work in the gymnasium, also to sing in the Sunday chapel choir and glee club if required by the director.

One credit per semester is granted to students in any course for singing in the daily chapel choir. This credit hour can be substituted for some of the electives required in the student's course. Application for entrance to the choir to be made to the director.

Tuition per Semester

The following table shows the rates of tuition for private lessons of thirty minutes in length, one lesson or two lessons a week:

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<th>One</th>
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<tr>
<td><strong>Vocal</strong></td>
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<tr>
<td>Alexander Stewart Thompson</td>
<td>$20.00</td>
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<tr>
<td>Clara Dutton Thompson</td>
<td>$20.00</td>
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<tr>
<th><strong>Piano</strong></th>
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<tr>
<td>Alexander Stewart Thompson</td>
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<tr>
<td>Selma Plagge</td>
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<tr>
<th><strong>Harmony, Counterpoint, Etc.</strong></th>
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<td>(Private)</td>
<td>$15.00</td>
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<tr>
<th><strong>Pipe Organ</strong></th>
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<td>Alexander Stewart Thompson</td>
<td>$20.00</td>
<td>$35.00</td>
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<tr>
<th><strong>Violin, Etc.</strong></th>
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<tr>
<td>James Wayde Drennan</td>
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<td>$32.00</td>
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<tr>
<th><strong>Brass Instruments</strong></th>
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<tr>
<td>Charles L. Mundhenk</td>
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<td>$27.00</td>
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<tr>
<th><strong>Class Lessons</strong></th>
<th>Two hours a week</th>
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<tbody>
<tr>
<td>Harmony</td>
<td>$10.00</td>
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<tr>
<td>Counterpoint</td>
<td>$10.00</td>
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SCHOOL OF MUSIC

Fugue .......................................................... 10.00
Interpretation .................................................. 10.00
Form and Instrumentation ................................... 10.00
Musical History ............................................... 6.00
Sight Singing (one hour a week) ............................. $3.00

Other Expenses

Piano Practice, one hour per day for the semester, $3.50; two hours per day, $6.50; three hours per day, $9.00.
Pipe Organ Practice, four hours per week, per semester, $7.00. Additional hours, if organ is available, at the same rate.
Non-Collegiate Courses
Non-Collegiate Courses

Two Year Course in Agriculture.
Two Year Course for Homemakers.
Two Year Trade School Work in Engineering.
One Year Course in Dairying.
One Year Course in Poultry Husbandry.

OFFICERS OF INSTRUCTION

RAYMOND ALLEN PEARSON, 1912 ....................... President
B. S. in Agr., Cornell University, 1894; M. S. in Agr., Cornell University, 1899; LL. D., Alfred University, 1909.

CHARLES FRANKLIN CURTISS. 1897, 1891..Dean of the Division of Agriculture, Director of Experiment Station.
B. S. A., Iowa State College, 1887; M. S. A., Iowa State College, 1892; D. Sc. in Agriculture, Michigan Agricultural College, 1907.

ANSON MARSTON. 1892..Dean of Division of Engineering, Professor of Civil Engineering
B. C. E., Cornell University, 1889.

CATHARINE J. MACKAY. 1911, 1910 ..Professor of Home Economics

ASSOCIATE PROFESSORS

ELIZABETH MACLEAN. 1908, 1899..Associate Professor of English
B. Di., State Normal, Iowa, 1894; M. Di., 1900; B. Ph., Chicago, 1909.

MARK G. THORNBURG. 1910..Associate Professor of Animal Husbandry
B. S. A., Iowa State College, 1910.

ASSISTANT PROFESSORS

CLAUDE KEDZIE SHEDD. 1911..Assistant Professor of Agricultural Engineering
B. S. A. in Agr., University of Nebraska, 1909.

JULES COOL CUNNINGHAM. 1911..Assistant Professor of Horticulture and Botany
B. S., Kansas State College, 1905.

ESTHER LIEPER COOPER, 1912, 1909 ........Assistant Professor of English
Ph. B., Iowa State University, 1903.
HENRY LOUIS EICHLING, 1912, 1911........Assistant Professor of Agronomy

B. S. in Agn., Iowa State College, 1911.

------------------------Assistant Professor of Engineering
------------------------Assistant Professor of Home Economics

INSTRUCTORS

MAY CHASE, B. S..................Instructor in Mathematics, 1910
MILTON HENRY HOFFMAN, M. Di.....Instructor in Agricultural Engineering, 1911

CHARLOTTE DRYDEN, Ph. B....Instructor in Public Speaking, 1911
FRED LLOYD OVERLEY, B. S. in Hort.Instructor in Horticulture, 1911

MAUREN RASMUSSEN TOLSTRUP, B. S. in Dairying.Instructor in Dairying, 1912

D. HAROLD ZENTMIRE, B. S. in Agricultural Engineering, 1912
EARL BRUNSON BISBEE............Instructor in Chemistry, 1912
HARRY COWIE COWAN...Instructor in Agricultural Engineering, 1912
MAX MERWYN ALLENDER...Instructor in Poultry Husbandry, 1913

FRED KOENIG.....................Student Assistant in German, 1912
RUBY LYNCH .....................Student Assistant in Mathematics, 1912
ROSS P. WHITE...................Student Assistant in Economic Science, 1912
MYRTLE MCDONALD ...............Student Assistant in History, 1912
MIRIAM RICHER...............Student Assistant in History, 1912
HOWARD S. COE, B. S...........Student Assistant in Botany, 1912

CALENDAR

1913

FIRST SEMESTER

September 9-10, Tuesday and Entrance Examinations.
   Wednesday, 8:00 A. M.

September 12-13, Friday, 8:00 A. M., to Saturday, 5:00 P. M.

* First date after the name indicates date of appointment to present position, the second date, when the first fails to do so, indicates the date of first appointment in the College.
December 29, to January 9, Monday to Saturday
Special Short Courses in Agriculture and Home Economics and Engineering.
February 6, Friday, 5:00 P. M. College Work closes.

1914.

SECOND SEMESTER
February 3-4, Tuesday and Wednesday
Entrance Examinations.
February 6-7, Friday, 8:00 A. M., to Saturday, 5:00 P. M.
Registration-Classification Days.

June 11, Friday.
Summer Vacation begins.

REQUIREMENTS FOR ADMISSION

Any student desiring to enter a non-collegiate course must be, at least, seventeen years of age (except in the Homemakers Course where the student must be eighteen years of age), and must present a certificate signed by the county or high school superintendent showing that he has satisfactorily completed the eighth grade of the public schools. If the applicant has attended high school, this certificate must also give his complete high school or academic record, and must be signed by the superintendent or principal. All applications for admission should be addressed to the Registrar, Iowa State College, who will furnish the proper blanks. These certificates should be filed with the Registrar as promptly as possible, and, at least, two weeks before the opening of the semester.

High School graduate who are able to meet the entrance requirements of the collegiate courses, or students who are able to present 13½ units of acceptable high school or academic work, are not eligible to the non-collegiate courses.

FEES AND EXPENSES

The entire expenses of a student need not exceed $350.00 per College year.

Tuition. No charge for tuition is made to the students from the State of Iowa. To the non-residents, a tuition fee of $50.00 per year is charged.

Incidental Fee. The regular incidental fee for the semester is $12.00, but all students who classify during the classification period, Friday, and Saturday, before College work begins, will be charged only $10.00 per semester.

Laboratory Fees. Laboratory fees at the actual cost of breakage and usage are charged to the students, the Treasurer's receipt for such fees being required before the students are admitted to laboratories. Some fees represent charges for mimeograph notes which are furnished.
at cost; usually when these notes are supplied no text-book is required and the fee is in lieu of text-book purchase. Deposits are required in some departments to cover the value of equipment loaned to students and at the end of the semester, the amount is returned less deduction for loss and breakage. For the amount of the fee in any course the student should refer to the description of courses, under the department in which the course is taught.

Board and Rooms. Students can secure furnished rooms and board in clubs or private families adjacent to the College grounds at from $4.50 to $5.00 per week.

The young women should consult Mrs. Emily Cunningham, matron, and the young men should consult John P. Clyde, secretary of the Y. M. C. A., concerning rooms and rooming places, that undesirable rooms and houses may be avoided. For sanitary or any other reasons the College authorities reserve the right to forbid students from rooming in any particular house.

Text Books. All text books and stationery may be purchased at the College Book Store at about 20 per cent below the average retail price.

TWO YEAR COURSE IN AGRICULTURE

The two year course in Agriculture is offered in order to meet the demand of young men who have not had the advantages of high school training, and who wish to obtain such preparation for practical agricultural work as a two year course will afford. The work offered in this course is naturally of lower grade than the collegiate work and will have special application to practical problems in agriculture in its various phases. Upon the completion of this course the student will be granted a certificate.

Students who cannot take the full two years' work are advised to enter either September twelfth at the opening of the College year, or January first, at the opening of the two weeks' short course, and remain during the second semester of the two year course.

First Year

FIRST SEMESTER

<table>
<thead>
<tr>
<th>Required</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Agricultural Engineering A1, Blacksmithing or</td>
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<td>Agricultural Engineering A2, Carpentry</td>
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<tr>
<td>Animal Husbandry A1,</td>
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<td>Animal Husbandry A5,</td>
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<td>Dairying A12,</td>
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<td>Horticulture A3,</td>
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<td>Botany T2,</td>
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<tr>
<td>Market Types of Cattle and Sheep</td>
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</tr>
<tr>
<td>Feeding and Management of Live Stock</td>
<td>2 3/4</td>
</tr>
<tr>
<td>Principles of Dairying</td>
<td>2 3/4</td>
</tr>
<tr>
<td>Corn</td>
<td>2 3/4</td>
</tr>
<tr>
<td>Fruit Growing</td>
<td>1 3/4</td>
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<tr>
<td>Farm Weeds and Seeds</td>
<td>1 3/4</td>
</tr>
<tr>
<td>Course</td>
<td>Semester Hours</td>
</tr>
<tr>
<td>--------------------------------------------</td>
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</tr>
<tr>
<td>Chemistry T57,</td>
<td>2</td>
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<tr>
<td>English T14</td>
<td>2</td>
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<tr>
<td>Physical Training T1,</td>
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<tr>
<td><strong>Total semester hours</strong></td>
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</table>

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
</tr>
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<tbody>
<tr>
<td>Agricultural Engineering A1, Blacksmithing</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Agricultural Engineering A2, Carpentry</td>
<td></td>
</tr>
<tr>
<td>Agricultural Engineering A4, Field Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Animal Husbandry A2, Market Types of Dairy Cattle, Horses and Swine</td>
<td>2</td>
</tr>
<tr>
<td>Animal Husbandry A6, Feeding and Management of Live Stock</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Farm Crops A2, Small Grains</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Farm Crops A6, Farm Accounts</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Botany T1, Agricultural Botany</td>
<td>1 1/2</td>
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<tr>
<td>English T18, Letters and Themes</td>
<td>4</td>
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<td>Physical Training T2, Physical Training</td>
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**Second Year**

**THIRD SEMESTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Hours</th>
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<tbody>
<tr>
<td>Agricultural Engineering A5, Farm Machinery and Farm Motors</td>
<td>2 1/2</td>
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<tr>
<td>Animal Husbandry A3, Breed Types of Cattle and Sheep</td>
<td>3 1/2</td>
</tr>
<tr>
<td>Farm Crops A4, Farm Management</td>
<td>3</td>
</tr>
<tr>
<td>Horticulture A4, Truck Crops and Canning</td>
<td>2</td>
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<tr>
<td>Soils A1, Soil Physics</td>
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<td>Veterinary T1, Sanitary Science and Obstetrics</td>
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<tr>
<td>Economic Science T22, Rural Economics</td>
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<td>Physical Training T3, Physical Training</td>
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**FOURTH SEMESTER**

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<thead>
<tr>
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<tr>
<td>Agricultural Engineering A6, Farm Buildings</td>
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<tr>
<td>Animal Husbandry A4, Breed Types of Dairy Cattle, Horses, and Swine</td>
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<tr>
<td>Animal Husbandry A9, Animal Breeding, Feeding, and Herdbook Study</td>
<td>7 7/8</td>
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<tr>
<td>Dairying A13, Commercial Dairying</td>
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<tr>
<td>Animal Husbandry A8, Poultry Management</td>
<td>2 3/5</td>
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<tr>
<td>Farm Crops A7, Grain Judging and Breeding</td>
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NON-COLLEGIATE COURSES

Farm Crops A3, Forage and Pasture Crops 2
Forestry A14, Farm Forestry 1¾
Soils A2, Soils and Fertilizing Materials 3
Horticulture A2, Plant Propagation 1¾
Physical Training T4, Physical Training R

Total semester hours 18 to 20

AGRICULTURAL ENGINEERING

**1 or 2S. Labs. 2, 2 hr.; credit 1¾; Fee $2.50.

1 or 2S. Labs. 2, 2 hr.; credit 1¾; fee $2.50.

2S. Recitation 1, lab. lectures 2; credit 2; fee $1.50.

A5. Farm Machinery and Farm Motors. The development, construction, adjustment, repair, and use of agricultural machinery. Principles of draft, the horse as a motor, the windmill, steam, gasoline, and electric motors. Laboratory work devoted to the calibration and testing of machines and motors.
3S. Recitations 2, lab. 1, 2 hr; credit 2½; fee $2.00.

4S. Recitation 1, lab. lectures 2; credit 2; fee $1.50.
**Meaning 1st or 2nd semester, two, two hours laboratories per week, 1½ semester hours' credit, fee $2.50.

3S. Labs. 2, 2 hr.; credit 1¾; fee $2.50.

A23. Dairy Engineering. Management, care, and operation of steam and gasoline engines and refrigerating machinery. Laboratory work devoted to the operation, adjustment and testing of boilers and engines, also soldering, plumbing, etc.
1S. Recitations 2, labs. 2, 2 hr.; credit 3½; fee $2.50.

ANIMAL HUSBANDRY

1S. Labs. 2, 2 hr.; credit 2; fee $2.00.

2S. Labs. 2, 2 hr.; credit 2; fee $2.00.

A3. Breed Types of Cattle and Sheep. Judging according to of-
ficial standards. Origin, history, characteristics, and adaptability to climate and soil.


A5. Feeding, Care and Management of Beef and Dairy Cattle.

A6. Feeding, Care and Management of Horses, Hogs and Sheep.


THE ONE YEAR COURSE IN POULTRY HUSBANDRY

The One Year Course in Poultry Husbandry is designed to meet the needs of those who desire to spend one year in study.

**FIRST SEMESTER**

<table>
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<tr>
<th>Course</th>
<th>Required Hours</th>
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<tbody>
<tr>
<td>Animal Husbandry A30</td>
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<tr>
<td>Animal Husbandry A31</td>
<td>2</td>
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<tr>
<td>Animal Husbandry A32</td>
<td>1</td>
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<tr>
<td>Animal Husbandry A38</td>
<td>1</td>
</tr>
<tr>
<td>Animal Husbandry A43</td>
<td>2</td>
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<tr>
<td>Animal Husbandry A19</td>
<td>2</td>
</tr>
<tr>
<td>Horticulture A3</td>
<td>1½</td>
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<tr>
<td>Agricultural Engineering A6, Farm Buildings</td>
<td>2</td>
</tr>
<tr>
<td>Farm Crops A4,</td>
<td>3</td>
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<tr>
<td>Physical Training T1,</td>
<td>R</td>
</tr>
</tbody>
</table>

Total semester hours 17½
ANIMAL HUSBANDRY-POULTRY COURSES

A30. Breed Types of Poultry. This course consists in the scoring and judging by comparison of the more important varieties in accordance with the American Standard of Perfection.
1S. Recitation 1, labs. 2, 2 hr.; credit 2%; fee $2.00.

A31. Poultry Management. This course includes a study of Poultry buildings, the arrangement of buildings and yards on the general farm, the planning of poultry farms, and feeds and feeding.
1S. Recitations 2; credit 2.

A32. Practice in Poultry Feeding and Management. The student will be given charge of a pen of fowls and will be required to keep a record of the amounts and cost of food consumed, gains made, eggs produced, and calculate the profit and loss. This work will cover a period of three weeks, and the student must be present morning, noon and afternoon, time to be arranged by appointment with instructor.
1S. Credit 1; fee $2.00.

A33. Incubator Practice. Each student will be given charge of one or more incubators for the period of one hatch and required to keep the records of fuel consumed, temperatures, infertile eggs, dead germs, dead in shell, chicks hatched, and reckon the cost of incubation. This course will cover a period of four weeks and the student must be present morning, noon and afternoon, time to be arranged by appointment with the instructor in charge.
2S. Credit 1; fee $2.00.

A34. Brooder Practice. Each student will be given charge of chicks in a brooder for four weeks from time of hatching, and must keep records of temperatures, fuel and foods consumed, gains made, mortality, and calculate the cost of brooding. The student will be required to be
present morning, noon and afternoon, time to be arranged by appointment with instructor.

2S. Credit 1; fee $2.00.

A37. Poultry Management. This course continues the work started in Course A31, and takes up in a general way, breeding, marketing, incubating and brooding.

2S. Recitations 2; credit 2.

A38. Practice in Poultry Fattening. Each student will be given charge of, and feed several lots of fattening stock, comparing different method and rations for fattening poultry. Records must be kept, showing the amounts and cost of food fed, amounts and cost of gains in weight, cost per pound of gain, and calculations made of the profit or loss on each lot of stock. This course will cover a period of three weeks, and the student must be present morning and evening, time to be arranged by appointment with instructor.

1S. Credit 1; fee $2.00.

A39. Advanced Poultry Judging. This course is a continuation of Course A30.

2S. Labs. and lectures 2, 2 hr.; credit 2; fee $2.00.

A42. Marketing of Poultry Products. Includes the study of the market classifications of poultry, eggs, and feathers, methods of dressing, packing, shipping, selling, requirements of different markets, poultry and egg boards, cold storage of poultry and eggs.

2S. Recitations 2; credit 2.

A43. Market Types of Poultry. This includes a study of the various types of market poultry. It will include score card and comparison judging of the various breeds of poultry, with reference to market requirements.

1S. Lectures and labs. 2, 2 hr; credit 2; fee $2.00.

A44. Practice in Packing and Judging Poultry Products. Includes practice in the modern methods of preparing poultry and eggs for market and judging dressed poultry and eggs.

2S. Lectures and lab. 1, 2 hr; credit 1; fee $2.00.

**ONE YEAR DAIRY COURSE**

The one year course in dairying is designed to meet the needs of those who wish to acquire a knowledge of practical dairy methods to enable them to operate a creamery, cheese factory, or ice cream plant. This course is also of value to dairy farmers who are unable to take a complete college course. Students completing this course will be given certificates when evidence is furnished that they have operated a creamery or other dairy establishment successfully for one year.

It is preferable to have the students enter during the Spring semester, as such students can be placed in creameries during the summer season, where they will obtain practical experience. They will also complete their course at a time when there is a good demand for buttermakers.
## FIRST SEMESTER

<table>
<thead>
<tr>
<th>Course/Title</th>
<th>Required</th>
<th>Semester Hours</th>
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</thead>
<tbody>
<tr>
<td>Dairying A1,</td>
<td>Dairy Practice</td>
<td>6</td>
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<tr>
<td>Dairying A2,</td>
<td>Buttermaking</td>
<td>2</td>
</tr>
<tr>
<td>Dairying A3,</td>
<td>Milk Testing</td>
<td>2</td>
</tr>
<tr>
<td>Agr. Engineering A23,</td>
<td>Dairy Engineering</td>
<td>3½</td>
</tr>
<tr>
<td>Animal Husbandry A19,</td>
<td>Feeding Dairy Stock</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry T28,</td>
<td>Dairy Chemistry</td>
<td>2</td>
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<tr>
<td>Dairying A6,</td>
<td>Soils Bacteriology</td>
<td>1</td>
</tr>
<tr>
<td>Soils A3,</td>
<td>Soils and Fertilizing Materials</td>
<td>2</td>
</tr>
<tr>
<td>Physical Training T1,</td>
<td>Physical Training</td>
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<td><strong>Total semester hours</strong></td>
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## SECOND SEMESTER

<table>
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<th>Semester Hours</th>
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<tbody>
<tr>
<td>*Dairying A102,</td>
<td>Buttermaking</td>
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<tr>
<td>**Dairying A103,</td>
<td>Milk Testing</td>
<td>1</td>
</tr>
<tr>
<td>Dairying A26,</td>
<td>Judging Dairy Products</td>
<td>1</td>
</tr>
<tr>
<td>Dairying A4,</td>
<td>Dairy Practice</td>
<td>6</td>
</tr>
<tr>
<td>Dairying A8,</td>
<td>Cheese Making</td>
<td>1</td>
</tr>
<tr>
<td>Dairying A20,</td>
<td>Factory Management</td>
<td>2</td>
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<tr>
<td>Animal Husbandry A18,</td>
<td>Breeding and Judging Dairy Stock</td>
<td>2</td>
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<tr>
<td>Dairying A21,</td>
<td>Preparation of Ice Cream and Ices</td>
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<tr>
<td>Farm Crops A8,</td>
<td>General Farm Crops</td>
<td>2</td>
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<tr>
<td>Physical Training T2,</td>
<td>Physical Training</td>
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<tr>
<td><strong>Total semester hours</strong></td>
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<td>17½</td>
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*Not required of students who have a credit in A2.
**Not required of students who have a credit in A3.

## DAIRYING

### For One Year Dairy Course.

**A1. Dairy Practice.** Practical work in buttermaking, cheesemaking, ice cream making, pasteurization of milk and cream, preparation of starters, testing of dairy products, and refrigeration engineering.

1S. Labs. 5, 7 hrs. per day; credit 6; fee **

**A2. Buttermaking.** Composition of milk and dairy products, the principles of gravity and centrifugal separation of cream, cream ripening, preparation of starters, churning and preparation of butter for market.

1S. Recitations 2; credit 2.

**A3. Milk Testing.** The Babcock test. The Farrington and Mann's test for. determining acidity. The use of the lactometer for detecting adulterations, also the composite sampling and testing of individual cows.

1S. Credit 2; fee **


2S. Labs. 5-7 hrs. per day; credit 6; fee **
2S. Recitation 1; credit 1.

2S. Recitations 2; credit 2.

A21. Ice Cream and Ices. Preparation of ice creams, lacto and ices. 
2S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee **

2S. Credit 1; fee **

A102. Elementary Course in Buttermaking. 
2S. Credit 1; fee **

A103. Elementary Course in Milk Testing. 
**For above courses a laboratory fee of $10 per semester is charged.

For Two Year Course in Agriculture

A12. Principles of Dairying. Secretion and composition of milk; testing of dairy products; separation and care of milk and cream on the farm; cheesemaking, buttermaking, and ice cream making on the farm. 
1S. Recitations 2, lab. 1, 2 hr.; credit 2%; fee $3.00.

A13. Commercial Dairying. A continuation of Dairying A12 in milk testing, buttermaking, cheesemaking, and ice cream making. Also advanced registry cow testing; market milk and cream; co-operative creamery management; etc. 
2S. Prerequisite A12; recitation 1, lab. 1, 2 hr; credit 1%; fee $2.50.

FARM CROPS

Farm Crops A1. Corn. Corn production, seed ears, storing, testing, grading, planting, cultivating, and harvesting. Corn breeding different varieties, growth, cost of production, marketing, and uses. 
1S. Recitations 2, labs. 1, 2 hr; credit 2%; fee $1.50.

Farm Crops A2. Small Grains. Varieties of soil, climate, preparation of seed bed, seeding, harvesting, cost of production uses, etc. Score card practice and commercial grading. 
2S. Recitations 2, labs. 1, 2 hr; credit 2%; fee $1.50.

Farm Crops A3. Forage and Pasture Crops. Varieties, soil crops, pastures; habit of growth, adaption, palatability, and composition; seeding, handling, harvesting, etc. 
4S. Recitations 2; credit 2.

Farm Crops A4. Farm Management. Farm Management, rotations, special crops, buildings, labor and marketing. Specialized and general farming. 
3S. Recitations 2, lab. and lecture 1, 2 hr.; credit 3; fee $1.00.

Farm Crops A6. Farm Accounts. Systems of farm bookkeeping adapted to modern farm management; forms of contracts; renting, banking, marketing, trade discounts and commissions. 
2S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $1.00.
Farm Crops A7. **Grain Judging and Breeding.** Advanced work in corn and small grain judging to prepare students to judge at corn shows, institutes, and the corn expositions. Attention will also be given to advanced work in grain breeding.
4S. Prerequisites A1 and A2; recitation 1; lab. 1, 2 hr.; credit 1%; fee $1.50.

Farm Crops A8. **General Farm Crops.** This course is given only to the One Year Dairy Students. Corn and small grain growing, care of pastures and meadows and growing of forage and soilng crops.
2S. Recitations 2; credit 2.

**FORESTRY**

A14. **Farm Forestry.** Trees and shrubs for ornamental purposes, lawns, drives, etc.; for utility, windbreaks and shelter belts; for revenue, farm woodlots and plantations; identification of common trees and their uses; preservation of posts and timber.
2S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $1.00.

**HORTICULTURE**

A2. **Plant Propagation.** Plant reproduction, seeds, seed testing, germination, storage, transplanting, grafting, budding and cuttage.
4S. Recitations and labs. 2, 2 hr.; credit 1%; fee $1.00.

A3. **Fruit Growing.** Orchard site, varieties, orchard culture, pruning, spraying and storage.
1S. Recitation 1, lab. 1, 2 hr.; credit 1%; fee $1.00.

A4. **Truck Crops and Canning.** Growing and marketing the more important truck and canning crops of Iowa, such as the potato, sweet corn, cabbage, onion, tomato.
3S. Recitations 2; credit 2.

A5. **Orchard Practice.** Handling fruit, picking, grading, packing, judging, storage and other orchard operations.
1 or 3S. Lab. 1, 3 hr.; credit 1.

A6. **Nursery and Orchard Practice.** Transplanting, pruning, grafting, and spraying.
2 or 4S. Lab. 1, 3 hr.; credit 1.

A7. **Handling Truck Crops.** Practice in harvesting, storing, canning and marketing the potato, tomato, and other truck crops.
1 or 3S. Lab. 1, 3 hr.; credit 1.

2 or 4S. Lab. 1, 3 hr.; credit 1.

A9. **Floriculture.** Selection, propagation and care of flowering plants for the house, conservatory, lawn and garden.
3S. Labs. 2, 2 hr.; credit 1%;

A10. **Small Fruits and Vegetables.** The selection, propagation, cultivation and care of vegetables and small fruits with special reference to the farm garden.
4S. Recitation 1, lab. 1, 2 hr.; credit 1%;

A11. **Landscape Gardening.** Planning and planting of home and
school grounds, streets and parks. Ornamental trees and shrubs adapted to Iowa conditions.

1 or 3S. Recitations 2; credit 2.

**SOILS**

Soils A1. **Soil Physics.** Physical and chemical condition of soils, seed beds, draining, plowing, harrowing, cultivating, rolling, mulches, and soil management.

3S. Recitations 2, labs., lectures and demonstrations 2 hrs.; credit 3; fee $1.00.

Soils A2. **Soils and Fertilizing Materials.** Improvement of soils; soil organisms, fertility, organic compounds, plant food, fertilizers, manures, crop rotations. Sandy, arid, alkali, acid, peat, and gumbo soils.

4S. Recitations 2, labs., lectures and demonstrations 2 hrs.; credit 3; fee $1.50.


1S. Recitations 2, lab. with lectures, 1 2 hr.; credit 2; fee $1.50.

**TWO YEAR HOME MAKERS COURSE**

Inasmuch as there is a demand throughout the state for a course in Home Economics which will meet the needs of those who desire to secure special training in homemaking, and yet do not wish to spend the time to take the four year course, it is recommended that a two year course be established.

The purpose of this course is to prepare young women for the duties and responsibilities of modern homes, giving them a broader view of life and a knowledge and training that will enable them to meet home conditions in a thoroughly practical and capable manner. This is in no sense to be regarded as a teacher's training course.

Upon the completion of this course, a Home Maker's Certificate is granted.

**First Year**

<table>
<thead>
<tr>
<th>Required Semester Hours</th>
</tr>
</thead>
</table>

**FIRST SEMESTER**

<table>
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<tr>
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<td>Home Economics A16</td>
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<tr>
<td>Home Economics A1</td>
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<tr>
<td>Home Economics A2</td>
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<td>Home Economics A3</td>
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<tr>
<td>Chemistry, T31</td>
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<td>Botany T1, Physical Culture T1</td>
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*Electives

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6⅔ to 8⅔

18 to 8⅔

*To be selected from elective list page.
## SECOND SEMESTER

<table>
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<td>Home Economics A5,</td>
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<tr>
<td>Zoology T1,</td>
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<td>Home Economics A7,</td>
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<tr>
<td>Agricultural Chemistry T32,</td>
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<tr>
<td>Bacteriology T1,</td>
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<td>English T18,</td>
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<td>*To be selected from elective list page.</td>
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## THIRD SEMESTER

<table>
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<th>Required Semester Hours</th>
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<tbody>
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<td>Home Economics A6,</td>
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<tr>
<td>Home Economics A8,</td>
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<td>Home Economics A9,</td>
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<td>Home Economics A10,</td>
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<td>Horticulture A9,</td>
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<td>Zoology T2,</td>
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<td>Physical Culture T3,</td>
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<td>*Electives</td>
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<td>Total semester hours</td>
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## FOURTH SEMESTER

<table>
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<th>Required Semester Hours</th>
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<td>Home Economics A11,</td>
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<tr>
<td>Home Economics A12,</td>
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<tr>
<td>Home Economics A13,</td>
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<tr>
<td>Home Economics A14,</td>
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<tr>
<td>Home Economics A15,</td>
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<tr>
<td>Horticulture A10,</td>
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<tr>
<td>Literature T17,</td>
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<tr>
<td>Physical Culture T4,</td>
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</tr>
<tr>
<td>*Electives</td>
<td>3½ to 5½</td>
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<tr>
<td>Total semester hours</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

*To be selected from elective list page.
A1. **Elementary Cookery.**  
1S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00.

A2. **Sewing.**  
1S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A3. **Hygiene and Sanitation.**  
1S. Recitation 1; credit 1.

A4. **Cookery.**  
2S. Recitation 1, labs. 2, 2 hr; credit 2½; fee $3.00.

A5. **Sewing.**  
2S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A6. **Home Sanitation.**  
3S. Recitations 2; credit 2.

A7. **Applied Design.**  
2S. Labs. 2, 2 hr.; credit 1½; fee $1.00.

A8. **Food Preparation.**  
3S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00.

A9. **Sewing.**  
3S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A10. **Home Decoration and Furnishing.**  
3S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A11. **Food Preparation.**  
4S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00

A12. **Sewing.**  
4S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A13. **Home Nursing.**  
4S. Recitation 1; credit 1.

A14. **Child Study.**  
4S. Recitations 3; credit 3.

A15. **Home Decoration and Furnishing.**  
4S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $1.00.

A16. **Household Accounts.**  
1S. Recitations 2; credit 2.

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**TWO YEAR COURSE IN TRADE SCHOOL WORK ALONG ENGINEERING LINES**

The two year course in trade school work in engineering is designed to meet the needs of young men who have not had the time nor the opportunity to prepare themselves to meet the entrance requirements of the regular engineering courses. Elementary mathematics, including shop and business arithmetic, elementary algebra and geometry, freehand and mechanical drawing, and shop work, continues through the two years. The fundamental principles of Chemistry and Physics are presented the first year, while practical exercises in surveying receive attention during the second. Practical work on cement products, road making, power plants, and applications of electricity is given through the two years in order to acquaint the student with some of the fundamental processes of the industries. Cultural work is not neglected, as
two semesters work in English or Literature and one semester each in Economics and Citizenship are required.

A certificate will be given to those who complete the course satisfactorily.

**First Year**

<table>
<thead>
<tr>
<th><strong>First Semester</strong></th>
<th><strong>Required</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics T11</strong></td>
<td>Shop and Business Arithmetic 4</td>
</tr>
<tr>
<td><strong>Civil Engineering E3,</strong></td>
<td>Cement Products 4</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E1,</strong></td>
<td>Drawing 2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E5,</strong></td>
<td>Shop Work 2</td>
</tr>
<tr>
<td><strong>Chemistry T1,</strong></td>
<td>Principles of Chemistry 3</td>
</tr>
<tr>
<td><strong>English T14</strong> or <strong>Literature T11,</strong></td>
<td>Letters and Themes 2</td>
</tr>
<tr>
<td><strong>Physical Training T1,</strong></td>
<td>English Classics 3</td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td>17 or 18</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Second Semester</strong></th>
<th><strong>Required</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics T12,</strong></td>
<td>Beginning Algebra 4</td>
</tr>
<tr>
<td><strong>Civil Engineering E4,</strong></td>
<td>Road Making 4</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E2,</strong></td>
<td>Drawing 2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E6,</strong></td>
<td>Shop Work 2</td>
</tr>
<tr>
<td><strong>Physics T1,</strong></td>
<td>Principles of Physics 3</td>
</tr>
<tr>
<td><strong>English T15</strong> or <strong>Literature T11,</strong></td>
<td>Letters and Themes 3</td>
</tr>
<tr>
<td><strong>Physical Training T2,</strong></td>
<td>English Classics</td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td>18</td>
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<table>
<thead>
<tr>
<th><strong>Second Year</strong></th>
<th><strong>Required</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Third Semester</strong></td>
<td><strong>Required</strong></td>
</tr>
<tr>
<td><strong>Mathematics T13,</strong></td>
<td>Elementary Algebra and Beginning Trigonometry 4</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E9,</strong></td>
<td>Steam and Gas Plants 4</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E3,</strong></td>
<td>Drawing 2</td>
</tr>
<tr>
<td><strong>Mechanical Engineering E7,</strong></td>
<td>Shop Work 2</td>
</tr>
<tr>
<td><strong>Civil Engineering E1,</strong></td>
<td>Surveying 3</td>
</tr>
<tr>
<td><strong>Economic Science T1,</strong></td>
<td>Industrial Economics 2</td>
</tr>
<tr>
<td><strong>Public Speaking T2,</strong></td>
<td>Declamation 1</td>
</tr>
<tr>
<td><strong>Physical Training T3,</strong></td>
<td>Gymnasium Work R</td>
</tr>
<tr>
<td><strong>Total semester hours</strong></td>
<td>18</td>
</tr>
</tbody>
</table>
### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Semester Hours</th>
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<tbody>
<tr>
<td>Mathematics T14,</td>
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</tr>
<tr>
<td>Electrical Engineering E1,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering E4,</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering E8,</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering E2,</td>
<td></td>
</tr>
<tr>
<td>Economic Science T15,</td>
<td></td>
</tr>
<tr>
<td>Physical Training T4,</td>
<td></td>
</tr>
<tr>
<td>Plane Geometry</td>
<td>4</td>
</tr>
<tr>
<td>Applications of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>Drawing</td>
<td>2</td>
</tr>
<tr>
<td>Shop Work</td>
<td>2</td>
</tr>
<tr>
<td>Surveying</td>
<td>3</td>
</tr>
<tr>
<td>Government of State and Nation</td>
<td>R</td>
</tr>
<tr>
<td>Gymnasium Work</td>
<td></td>
</tr>
<tr>
<td>Total semester hours</td>
<td>18</td>
</tr>
</tbody>
</table>

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### CIVIL ENGINEERING

**E1.** The course will take up the theory and practice of elementary surveying, the idea being to train the student by lecture, demonstration, and field practice in the duties of rodman and chainman on field parties.

3S. Recitations 3; credit 3.

**E2.** A continuation of Course E1, taking up the same general line of work.

4S. Recitations 3; credit 3.

**E3. Cement Products.** A study of the uses and physical properties of concrete and concrete materials. In connection with the lecture work there will be laboratory studies on cement and concrete to determine its strength for structural purposes.

1S. Recitations 4; credit 4.

**E4. Road Making.** A detailed study of rural road construction, from the standpoint of drainage, grading, and the treatment of the wearing surface of the most common types of road construction, including earth, gravel, broken stone, etc.

2S. Recitations 4; credit 4.

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### ELECTRICAL ENGINEERING

**E1.** Applications of Electricity. A study of the different uses to which electricity is put, of the materials and systems used, and of the construction and operation of electrical machinery.

4S. Recitations 2; credit 2.

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### MECHANICAL ENGINEERING

**E1. Mechanical Drawing.** Geometric construction involving right line and circle; use of instruments in construction of plane curves; free-hand and mechanical lettering.

1S. Labs. 2, 3 hr.; credit 2; fee $5.00.

**E2. Mechanical Drawing.** Preparation of scaled and dimensioned drawings from blue prints or cuts of machine parts, free-hand and mechanical lettering.

2S. Prerequisite E1 or equivalent; labs. 2, 3 hr.; credit 2; fee $5.00.
3S. Prerequisite E2 or equivalent; labs. 2, 3 hr.; credit 2; fee $5.00.

4S. Prerequisite E3 or equivalent; labs. 2, 3 hr.; credit 2; fee $5.00.

1S. Labs. 2, 2 hr.; credit 2; fee $5.00.

2S. Prerequisite E5; labs. 2, 3 hr.; credit 2; fee $5.00.

E7. Shop Work. Forging. Management of fire; simple forging under hand and power hammer, drawing, bending and upsetting; welding of steel and iron; forging, hardening and tempering of steel tools, chisels, drills, and lathe tools. Lectures on structure of iron and steel, preparation for welding, effects of heat treatment on crystalline structure and physical properties.
3S. Labs. 2, 3 hr.; credit 2; fee $5.00.

4S. Labs. 2, 3 hr.; credit 2; fee $5.00.

E9. Steam and Gas Plants. Lectures and recitations on design, operation and management of steam boilers, engines, pumps, injectors, and gas, gasoline, and oil engines and gas producers.
3S. Recitations 4; credit 4.

OPTIONAL STUDIES IN THE NON-COLLEGIATE COURSES

With the consent of the Dean of Agriculture for Agricultural students and the Dean of Engineering for Engineering students, students having the prerequisite preparation may elect subjects from the following list, in place of any study named in the regular semester schedules, provided they have the equivalent of two and a half years of high school work, or have passed up in advance part of the required work scheduled. Two year students may take an additional course in English in the second year with the approval of the Dean.

Optional Studies for Agricultural Students

The star (*) indicates that the course designated is designed especially for women.
### SPRING SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours’ Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Engineering A8*, Manual Training</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Horticulture A5, Orchard Practice</td>
<td>1</td>
</tr>
<tr>
<td>Horticulture A7, Handling Truck Crops</td>
<td>1</td>
</tr>
<tr>
<td>Horticulture A11, Landscape Gardening</td>
<td>2</td>
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</table>

### FALL SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours’ Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany T5*, Plant Diseases</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Horticulture A6, Nursery and Orchard Practice</td>
<td>1</td>
</tr>
<tr>
<td>Horticulture A8, Greenhouse Crops</td>
<td>1</td>
</tr>
</tbody>
</table>

### Optional Studies for Agricultural and Engineering Students

#### SPRING SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours’ Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Science T15, Government in State and Nation</td>
<td>3</td>
</tr>
<tr>
<td>English T1, Grammar</td>
<td>5</td>
</tr>
<tr>
<td>English T2, Rhetoric and Composition</td>
<td>5</td>
</tr>
<tr>
<td>English T16, Elementary Grammar</td>
<td>3</td>
</tr>
<tr>
<td>English T17, Elementary Rhetoric and Composition</td>
<td>3</td>
</tr>
<tr>
<td>History T1, English History</td>
<td>5</td>
</tr>
<tr>
<td>History T2, Advanced American</td>
<td>4</td>
</tr>
<tr>
<td>History T16, National Period</td>
<td>3</td>
</tr>
<tr>
<td>Literature T11, English Classics</td>
<td>3</td>
</tr>
<tr>
<td>Literature T12, English Classics</td>
<td>4</td>
</tr>
<tr>
<td>Literature T13, English Classics</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics T1, Algebra</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics T2, Algebra</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics T3, Algebra Review</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics T5, Plane Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Mathematics T16, Solid Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Modern Language T5, German</td>
<td>5</td>
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<tr>
<td>Modern Language T5a, German</td>
<td>3</td>
</tr>
<tr>
<td>Public Speaking T2, Declamation</td>
<td>1</td>
</tr>
</tbody>
</table>

#### FALL SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours’ Credit</th>
</tr>
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<tbody>
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<td>5</td>
</tr>
<tr>
<td>English T2, Rhetoric and Composition</td>
<td>5</td>
</tr>
<tr>
<td>English T17, Elementary Rhetoric and Composition</td>
<td>3</td>
</tr>
</tbody>
</table>
NON-COLLEGIATE COURSES

| History T1,      | English History | 5 |
| History T2,      | Advanced American | 4 |
| History T16,     | National Period  | 3 |
| Literature T11,  | English Classics | 3 |
| Literature T12,  | English Classics | 4 |
| Literature T13,  | English Classics | 4 |
| Mathematics T3,  | Algebra Review  | 5 |
| Mathematics T5,  | Plane Geometry  | 5 |
| Mathematics T16, | Solid Geometry  | 3 |
| Mathematics T17, | Plane Trigonometry | 5 |
| Modern Language T6, | German      | 5 |
| Modern Language T6a, | German     | 3 |
| Public Speaking T2, | Declaration | 1 |

**BACTERIOLOGY**

T1. General Bacteriology and Fermentations for Students in Home Economics. Bacteria in their relations to the home, including a brief consideration of the pathogenic forms and the bacteria, yeasts, and molds in their zymotic activities.

2S. Recitation 1, labs. 2, 2 hr; credit 2½; fee $2.50.

**BOTANY**

T1. Agricultural Botany. Seed germination, elementary principles of plant physiology; the root, lateral appendages, leaves, flower, fruit and seed, absorption of food materials, conduction of food, storage of food. Special attention is given to the terms used in Descriptive Botany, especially in its relation to Agriculture and Horticulture.

1 or 2S. Recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.00.

T2. Farm Weeds and Seeds. Injurious weeds, methods used to exterminate same; purity and vitality of agricultural seeds; methods used to detect these impurities and to determine vitality. State laws governing destruction of weeds and restriction and sale of agricultural seeds.

2S. Recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.00.

T4. Plant Diseases. Bacterial and fungous diseases of cultivated plants, including blights, rusts, smuts, mildews, and molds.

2 or 4S. Recitation 1, lab. 1, 2 hr.; credit 1½; fee $2.00.

**CHEMISTRY**

T1. Elementary Chemistry. Principles of Chemistry as applied to the industries.

1S. Recitations 3; credit 3.

T28. Dairy Chemistry. An elementary course arranged to meet the needs of the students in the One Year Course in Dairying.

1S. Recitation 1, labs. 1, 1½ hr.; credit 2; fee $3.00.

T31. Elementary Chemistry.

1S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $5.00.
T32. Chemistry of Food and Textiles.  
2S. Recitation 1, labs. 2, 2 hr.; credit 2¥.; fee $5.00.

T57. Elementary Chemistry. Principles of Chemistry as applied to Agriculture.  
1S. Recitations 2; credit 2.

ECONOMIC SCIENCE

T1. Industrial Economics. The elementary principles of Economic Science as applied to practical business administration will constitute the subject matter of this course.  
3S. Recitations 2; credit 2.

T15. Government in State and Nation. City, county, and state governments; constitutional conventions; constitutions and "Supreme Law;" checks and balances; the presidency, senate and house of representatives; general powers of Congress; judicial system, federal and state; division of power; comparison with other federal governments; spoils system and civil service; and government of territories and colonies; text book, supplemented by papers and library work.  
4S. Recitations 3; credit 3.

T22. Rural Economics. Lecture and reading course. History of agriculture in the United States; the crop areas; live stock areas, imports and exports of agricultural products; markets; land tenure; agricultural organizations; coöperation; and rural social problems.  
3S. Recitations 2; credit 2.

ENGLISH

T1. The Sentence. A review of grammar such as would be required in the twelfth grade of the high school. It presupposes a knowledge of elementary grammar, and includes work in correcting common errors, punctuation, analysis of good modern prose, and daily drill in sentence construction and original composition.  
Any S. Recitations 5; credit 5.

T2. Rhetoric and Composition. Fast review of rhetoric and composition, and also of literature. Prerequisites, English A1 or its equivalent, with the major part of a high school course in rhetoric and composition, and also in literature. For the first ten days there will be a rapid review of grammar, with essays on simple themes. Students who show the need of further review will be required to make up the deficiency.  
Any S. Recitations 5; credit 5.

T14. Letters and Business Forms. This course is intended to aid the students in writing letters of the various forms and types, and in writing other business forms. Its aim is to secure correctness and clearness, not only in form, but also in material. Much attention is paid to spelling, correct grammatical usage, and effective sentence structure.  
1 or 2S. Recitations 2; credit 2.

T18. Letters and Themes. A continuation of A14, in that atten-
tion is still paid to letters and correct form. The students will take up a study of the paragraph and of the whole composition.

2S. Recitations 4; credit 4.

T16. Elementary Grammar. A course intended to give the student a working knowledge of the English sentence, a study of the various elements, and of their relation to each other and to the sentence as a whole.

1 or 3S. Recitations 3; credit 3.

T17. Elementary Rhetoric and Composition. A course continuing the work of A14 and A18 in order more thoroughly to prepare the student for the writing of short practical themes. Three hours' credit.

2 or 4S. Recitations 3; credit 3.

HISTORY

T1. English History. Political, constitutional, religious, social and economic development of Great Britain. Special attention to those influences which have affected American history. Text-book, library and written work.

Any S. Prerequisite 1 yr. general history; recitations 5; credit 5.


Any S. Recitations 4; credit 4.


Any S. Recitations 3; credit 3.

T11. English Classics. A course intended to supplement the student's training in good literature, not only technical or scientific, but also general; an attempt to secure his appreciation of what is good in each. May be substituted, by consent, for English A14 or A18.

Any S. Recitations 3; credit 3.

A12. English Classics. A course in literature intended merely to supplement and complete this study for those who have not finished a fully accredited four year high school course. It is taken up mainly as an approach to a more intelligent and discriminating appreciation of literature, and an incentive to a wider and more thoughtful reading. The authors and work studied will be selected with the view of repeating as little as possible what the students have already studied.

Any S. Prerequisite Eng. 1 or 2; recitations 4; credit 4.

T13. English Classics. To be given in lieu of A12, the only difference being that the classics read shall be other than those read in the First Semester.

1S. Recitations 4; credit 4.

T17. Literature of Home Economics.

4S. Recitations 2; credit 2.
T18. The best literature which every one should know. Emphasis on the simple epic or essay, the lyric, the ballad, the story,—the literature which aids in developing or controlling the imagination, in strengthening the power of clear expression, in training the mind to grasp structural units, be they ever so simple.

4S. Recitations 3; credit 3.

MATHEMATICS

T1. Algebra to Involution. Special stress is laid upon the statement of definitions and the demonstration of principles. It is exceedingly desirable that students taking this course shall have made some preparatory study of the fundamental algebraic operations, though strong students with an earnest purpose can by diligent application, carry the course without such previous preparation.

1S. Recitations 5; credit 5.

T2. Algebra, Involution to Ratio and Proportion. Involution, Evolution, Radicals, Pure and Affected Quadratic Equations. Prerequisite, Course A1. At the completion of this course students are expected to have such a 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 reasonable rapidity and accuracy.

2S. Recitations 5; credit 5.

T3. Algebra Review. This course, which covers all fundamental principles up to and including radicals and quadratics, takes the place of the review in algebra given in most high schools and corresponds to the review in algebra given in an increasing number of the best high schools of the state.

The student is introduced to a quality of work demanding a broad view of principles and methods, and a marked degree of skill in algebraic manipulation.

The course is intended primarily for students who, having taken elementary algebra in the high school, need a thorough review before entering advanced work, but it may be taken by students who show evidence of a thorough knowledge of algebra through the simple equations and at least a brief course through radicals.

Any S. Recitations 5; credit 5.

T5. Plane Geometry. 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 proofs outlined 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 geometrical language. Special emphasis will be laid upon the demonstration of original exercises.

Any S. Prerequisite A1; recitations 5; credit 5.
T11. **Shop and Business Arithmetic.** Under Shop Arithmetic is included denominate numbers with their applications to such problems as finding the capacity of tanks, estimating bills of lumber, etc., methods of making rapid rough estimates, and various applications of arithmetic to the trades. Under business arithmetic is included percentage and its applications to simple and compound interest, discount, partial payments, taxes, duties, etc.

1S. Recitations 4; credit 4.

T12. **Algebra to Involution.** Beginning with the elements of algebra, the student is led through the fundamental operations to the study of the algebraic equation and its application to practical problems.

2S. Prerequisite E1; recitations 4; credit 4.

T13. **Algebra, Involution to Ratio and Proportion.** This course includes—Involution, Evolution, Radicals, Pure and Affected Quadratic Equations, together with the most elementary operations and applications of trigonometry.

3S. Prerequisite E2; recitations 4; credit 4.

T14. **Plane Geometry.** The line, circle, areas, proportion, measurements, and constructions.

4S. Prerequisite E3; recitations 4; credit 4.

T15. **Solid Geometry.**

3S. Recitations 3; credit 3.

T17. **Plane Trigonometry.**

4S. Recitations 5; credit 5.

**MODERN LANGUAGE**

T5. **Elementary German.** Grammar and reading, with constant practice in pronunciation and in writing German. Bierwirth's Beginning German, and Seeligmann's Altes and Neues.

1S. Recitations 5; credit 5.

T6. Continuation of Course 5. Grammar and reading. Texts such as Storm's Immensee, Gerstäker's Germelhausen, Wilhelmi's Einer musz heiraten, and Zschokke's Der zerbrochene Krug.

2S. Recitations 5; credit 5.

T5a. **Intermediate German.** Review of grammar, reading and composition. Bierwirth's Beginning German, Hewett's German Reader. (Open to those who have offered one year of German for admission).

1S. Recitations 3; credit 3.

T6a. **Intermediate German.** Continuation of Course 5a. Grammar, selected reading and composition.

2S. Recitations 3; credit 3.

**PHYSICAL TRAINING**


1S. 2 hours per week, required.
T2. Continuation of Course T1.
2S. 2 hours per week, required.
T3. Continuation of Course T2.
3S. 2 hours per week, required.
T4. Continuation of Course T3.
4S. 2 hours per week, required.

PHYSICS

T1. Elementary Physics. Principles of mechanics, heat, electricity, and magnetism are covered as fully as the time will permit. The course is given by means of recitations, lectures, accompanied by demonstration work.
2S. Recitations 3; credit 3.

PUBLIC SPEAKING

T2. The Declamation. A course planned to help the student get command of himself. Attention given to voice building and bodily expression. Besides this technical work, students are assigned individual selection for practice and each is met for private rehearsal at regular intervals.
2S. Recitation 1; credit 1.

VETERINARY

T1. Sanitary Science and Obstetrics. General hygiene; water supply, air and ventilation; food and the effect of quality of food; habitation; disposal of excreta; drainage and general rules for disinfecting. Physiological obstetrics, evolution, fecundation, sterility, gestation, hygiene of pregnant animals and parturition.
3S. Recitations 3; credit 3.

ZOOLOGY

T1. Anatomy and Physiology.
2S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00.
T2. Human Physiology.
3S. Recitation 1, labs. 2, 2 hr.; credit 2½; fee $3.00.
Winter Short Courses in Agriculture
Winter Short Courses in Agriculture

CHARLES FRANKLIN CURTISS, DEAN OF AGRICULTURE

Agonomy, Animal Husbandry, Poultry, Dairying, Horticulture, Soils, Agricultural Engineering and Home Economics

The special short course in agriculture, which originated in this institution in January, 1900, met with popular favor. The work has proven to be of great practical value and the attendance has extended far beyond the borders of the state and has reached nearly a thousand annually. A large amount of instruction is crowded into a brief period. Class and laboratory work extend from 8:00 A. M. to 5:00 P. M. daily except Sunday, and the evenings are devoted to convention programs consisting of lectures and general discussion of topics of interest to those in attendance. This is an intensified system and a modern method of imparting instruction and inspiration to busy, practical men and women whose lives are devoted to agricultural pursuits. Many of the most prominent and successful men of the state and nation are annually attracted to these sessions. It is believed that the work furnished during the coming winter will be more practical and more popular than at any previous session.

Calendar

1913-1914

December 29, Monday, 8:00 A. M. Registration.
Monday, 10:00 A. M. Classes Begin.
January 9, Friday, 5:00 P. M. Session Closes.

Fees and Expenses

The fees required in the different courses are payable at the treasurer's office. The enrollment fee is $5.00 and covers all charges of this nature, except in the Dairy Department, where higher rates are charged on account of the greater expense involved in giving the work. Board and room may be had near the college for $5.00 to $6.00 per week. A Bureau of Information will be maintained in the new Agricultural Hall to assign boarding places.

ANIMAL HUSBANDRY

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 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 steers 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.

POULTRY HUSBANDRY

In the ten days available for instructional purposes, lectures, demonstration and practical exercises will be given in the most important points of poultry management. Some of the topics that will be discussed in the lectures are The Importance of the Poultry Industry, Selection of Poultry Farms, Building Poultry Houses, Feeding for Egg and Meat Production, Selection of Breeding Stock, Incubation, Brooding, Raising Chicks, Caponizing, Killing, Dressing and Marketing of Poultry, Diseases and Parasites. Frequent use will be made of charts and lantern slide in this work.

The practical exercises and laboratory work will consist of exercises in studying poultry houses, incubators, brooders, anatomy of the fowl and egg, study of feeds, killing and dressing of fowls, selection of breeding stock, preparing fowls for exhibition.

AGRONOMY

Farm Crops. The Agronomy Department will offer an excellent course in Farm Crops and Crop Production this year. This work will be so arranged as to meet the demands of the men who have already attended one or more Short Courses here, as well as those who will attend this year for the first time. The first year men will devote much of their time to judging work, while the more advanced students will give more time to the consideration of some of the latest experimental work, as this may be related to farm practice.

Corn. The characteristics and adaptation of the various varieties of corn will be studied fully. Aside from the corn judging work, practice will be given in corn grading, in order that we may meet to better advantage market demands. Considerable attention will also be given to various methods of testing corn.

Small Grains. Wheat, oats and barley will be studied carefully, taking up, aside from the judging and grading, a study of variety characteristics and adaptation, methods of seeding, etc.

Forage Crops and Grasses. Our grass lands are not giving as great returns as they should. Aside from the consideration of preparation of seed beds, seeding and curing, a study will be made in the laboratory of the characteristics of the more important grasses and legumes.

Cereal Breeding. Considerable attention will be given to improvement of corn and small grains by systematic breeding.
Farm Management. Some investigations have been in progress in this state which will be found of great interest and value. A practical, thorough study of a system of farm accounts is a special feature.

SOILS

A series of lectures and demonstrations dealing with soil management and the fertility problem with special reference to Iowa soils. Valuable facts and data will be presented regarding commercial fertilizers, green manures, barnyard manures, the use of leguminous crops, and indirect fertilizers, such as lime. In addition to the fertility problem, special emphasis will be placed upon methods of plowing, cultivating, preparing the seed bed, etc.

HORTICULTURE AND FORESTRY

The work in Horticulture and Forestry is presented in two sections. The first section includes Fruit Growing and such general subjects as Propagation and Storage. The second section includes Truck Crops and Forestry and such general subjects as Spraying and Marketing. The student may take the work of both sections or he may choose one section and alternate that with either Animal Husbandry or Farm Crops. In either case one fee covers all charges.

I. FRUIT GROWING

Orchard Soil. Management, preparation for planting, cultivation, rotation and cover crops.

Pruning and Grafting. Various methods used with both young and old trees and vines; treatment of neglected trees.

Spraying. Practice in preparation of spray mixtures and in the operation of modern spray machinery.

Picking, Packing and Storage. Latest appliances, bags, ladders, baskets, etc., will be shown and their use demonstrated; practice in box apple packing; models and stereopticon views of home and cold storage plants.

Marketing. Coöperative and also the development of private trade on local markets.

II. VEGETABLE GARDENING

Gardening Soils. Study of soils with regard to planting, cultivation and growth of truck crops, such as potatoes, cabbage, tomatoes, and onions.

Care of Crops. Cultivating, spraying, harvesting and storage of the leading vegetable crops.

Marketing. Coöperative selling; advantages of same and study of local and individual markets. Canning of vegetables for market.
III. FARM FORESTRY

Woodlots. Location, care, varieties to be planted.

Timber Plantations. Culture of the catalpa, cottonwood, white pine, European larch, and other trees, for posts, lumber and fuel.

Preservation of Farm Timbers. Treatment of posts and timber with creosote and other preservatives.

Windbreaks and Shelterbelts. Cost, location, care, varieties, and the effects on growing crops.

DAIRYING

Course 1. Dairy-demonstrations, buttermaking, factory management, bacteriology, testing milk and its products, scoring dairy products, refrigeration dairy engineering, ice cream making, feeding and breeding dairy stock. This course is especially designed for buttermakers, and ice cream makers with some experience.

A fee of $10 will be charged each student. This will cover the necessary expenses of this course, excepting board. Students should provide themselves with white suits, which can be procured for $1.00 per suit in local stores.

Course 2. Dairy practice, buttermaking, cheesemaking, scoring dairy products, bacteriology, care of milk and cream, ventilation of dairy barns, judging dairy stock and swine, feeding and breeding dairy stock, poultry, obstetrics and tuberculosis, our record testing associations, silo and its construction, steam and gasoline engines.

This course is offered by the Animal Husbandry and Dairy Departments and is intended for dairy farmers, their wives, sons and daughters. It will include a thorough study in milk production, care of milk on the farm, buttermaking and cheesemaking on the farm, etc.

The afternoon of each day will be given over to practical demonstrations, and the forenoons to lectures.

A fee of $4.00 will be charged to cover the necessary expenses.

AGRICULTURAL ENGINEERING

A series of lectures on various phases of agricultural engineering. These lectures and demonstrations have in the past years been well received and many will be glad to learn that additional work of this nature will be added this year. These lectures will not conflict with the work scheduled by other departments, and are designed to be of general interest and will be illustrated by lantern views and accompanied with demonstrations, where possible.

The following list of subjects will be discussed: Farm Machinery and its Management, Modern Silo Construction, The Road Problem, The Use of Cement and Concrete on the Farm, Laying out the Drainage System, The Gasoline Engine and its Successful Operation, Farm Building Construction, Corn Growing Machinery.
SCHOOL OF SILO CONSTRUCTION.

The Agricultural Engineering Department conducted a short course of silo construction in June, 1912, and January, 1913. It was the purpose of this work to help those who want to become familiar with the latest features of silo construction. It was planned to be especially helpful to farmers, masons, contractors, carpenters, and others who desired to learn silo construction, either to erect a silo for themselves or to superintend or contract the erection of silos for others.

The course consisted in lectures and practical demonstrations in which the student either performed or saw performed each kind of work necessary for the construction of various kinds of silos. The practical instruction was held in a room large enough to permit full size sections of silos to be erected.

The instruction covered silos made of wood, concrete and clay blocks. Different types of construction were tried out. Also various forms of scaffolding and equipment were explained.

The morning from 9:00 to 12:00 o'clock was devoted to lectures. The afternoons from 1:00 to 4:00 o'clock to demonstrations.

A fee of $2.50 was required of those in attendance, to pay in part the expense of the school. No charge was made for space, but exhibitors were expected to enroll in the school.

The headquarters of the school are in the general office of the Agricultural Engineering Department, Agricultural Engineering Hall.

Detailed information in regard to further school of this kind may be obtained by writing the Department of Agricultural Engineering, Ames, Iowa.

Some of the topics discussed were as follows: Silage as a Feed for Beef and Dairy Cattle, Essentials of Silo Construction, Construction of Foundations, Construction of Scaffold, Forms, Derrick, etc., Wood Silos, Masonry Silos Concrete Silos, Roof Construction.

HOME ECONOMICS

The course is designed for all women who are interested in the practical and scientific working out of household problems and who are unable to avail themselves of a regular course in Home Economics.

Hundreds of agricultural men and their sons yearly take advantage of the Short Courses which deal with the problems of the farm, such as feeding of cattle, judging of corn, study of soils, etc. It is to meet the demand of Iowa women in their interest shown in the correct feeding of the family, the judging and selecting of materials used in the home, and the study of sanitary conditions which lead to the health, comfort and happiness of the family, that this course has been established and carried on for the past four years.

The course consists of the following subjects: Practical Lessons in the Values and Cookery of Foods; Foods for School Children, Growing Boys and Girls, Adults in Active Life, the Aged and Invalids; Methods of Preparing and Serving These Foods.
Practical course in Domestic Art is offered which deals with the principles of home garment making; lectures upon the choice of materials suitable for garments of various kinds.

Lectures will be given on various subjects of interest to home makers throughout the course, such as "Home Care of the Sick," "Home Decoration and Furnishing," "Home Sanitation," etc.

**VETERINARY LECTURES**

The series of lectures will include tuberculosis and other diseases of cattle and swine. The prevention, control, and eradication of the infectious and contagious diseases will receive special emphasis, including the application of sanitary principles involved in each case. On account of the increasing importance of the eradication of bovine tuberculosis these lectures should be of special interest to all. The new serum treatment for the prevention of hog cholera will also be discussed.

The series will also include the lectures on Lameness and Horse-shoeing, including diseases of the foot. These subjects will be considered from a scientific standpoint, but described in a way so as to be understood by everybody.

The Conformation and Soundness of the horse will be taken up and illustrated on the live animal. Those points which should be borne in mind in the breeding of farm animals will receive special emphasis.

While it is impossible to give a course in Veterinary Medicine, the subjects of especial interest and immediate importance to the agriculturist will be considered as well as their practical application to farm conditions.

**BOTANY**

The laboratories of the Botany Department in Central Building will be open from 8 to 9 and 4 to 5 each day, for work in seed testing, identification and examination of weeds and weed seeds, or other special work that may be arranged with Dr. Pammel, head of the department. Special attention will be given to the identification of weeds common to Iowa farms, and to the provisions of the Iowa weed laws.

A special course of instruction will be arranged to meet the needs of seedsmen with reference to the requirements of the seed inspection law.

**SPECIAL WORK FOR BOYS AND GIRLS**

Special classes will be arranged for juniors (boys and girls from 10 to 18 years of age). This class will be in charge of instructors who are especially skillful in teaching these particular subjects to boys and girls and the work will be adapted to the needs of the young people.

The Fifth Annual State Junior Contest will be held at the College during the time of the short course, at which prizes are offered for exhibits of work by members of the Iowa Boys' and Girls' Club in corn, potatoes, poultry, canned fruits and vegetables, sewing and cooking, reports, essays, etc.
The State Convention of the Iowa Boys' and Girls' Club is also held at this time, at which the annual business meeting is held and other features of the convention are observed.

The premiums and trophies offered in judging team work in corn, livestock and domestic science, will be awarded at the close of the short course. The judging teams consist of three boys or three girls for each respective team organized. These teams may represent a local club, a school district, county, or other organization. The work offered in the Special Junior classes aid in preparing the members of the team for the judging contests.

Scholarships and other state premiums will be awarded during the time of the contest and convention.

WINTER SHORT COURSES ALONG ENGINEERING LINES

Monday, December 29, 1913, to January 10, 1914

In the Uses of Cement.
In Clay Working.
In Road Making.
In Drainage Work.
In the Installation, Operation and Care of Power Plants.
In Care and Operation of Steam and Gas Tractors.
In Applications of Electricity.

The winter short courses along industrial lines are designed to meet the needs of young men employed in the industries who cannot spare the time to complete one of the longer courses, but will avail themselves of the opportunity to attend a shorter course when work is slack in their particular lines. The work will be carried on by means of lectures, conferences and demonstrations. The scope of the work will include cements and cement products, clay and clay products, road materials and road making, drainage problems, power plants, applications of electricity and gas and steam tractor.

Fees and Expenses. A registration fee of $3.00 will be charged. No fees will be charged for any of the courses given. Board and room may be obtained in the vicinity of the College at from $5.00 to $6.00 per week.

In Clay Working. This course is designed especially for practical clay workers and consists of lectures on the chemical and physical properties of clays, their occurrence and distribution, clay testing, clay working, and the testing of clay products. Practical demonstrations will be made throughout the course in which students are expected to participate. The uses of clay products, standard specifications and clay plants will be considered if the time permits.

In the Uses of Cement. There has been an insistent demand from the cement users of the state that the College do something to aid in the intelligent use of cement in its various applications. This course will in-
clude lectures on cement materials, the manufacture of cements, the chemical and physical properties of cements, cement testing, and the uses of cement and will be supplemented by practical demonstrations as far as possible. Specifications for cement and some of the leading cement products will be presented and considered as fully as the time will permit.

In Road Making. In this course will be taken up such subjects as the drainage of earth roads and road foundations; simple field tests of road materials; available road materials of the State, and their use in road construction; desirable forms of construction for different conditions; organization of field forces and camps for road work; and all matters of interest to the road maker.

This work will in no way qualify a man for a position as County Engineer, but will be of much benefit to the practical road maker who wishes to assume active charge of road gangs and intelligently carry on the work under the direction of the County Engineer.

In Drainage Work. This course is designed to fill the needs of farmers, drainage contractors and others who wish to obtain a fair working knowledge of the essentials of drainage engineering without going into technical details.

The course will take up the laying out of drainage systems, the calculation of sizes of tile and of open ditch, using tables and diagrams, the calculation of grades and drawing of profiles, the staking out of drains, and the superintendance of construction work, including selection of tile.

It should be understood that this work is not intended as a course for drainage engineers, but rather for superintendents of construction, contractors and for persons desiring a general working knowledge of the subject.

In the Installation, Operation and Care of Power Plants. A series of lectures arranged for firemen and engineers employed or seeking employment in the power plants of the state. The lectures will cover selection of boilers, engines and pumps best suited for particular service; the efficient and smokeless burning of Iowa coal; valve setting and indicator diagrams; choice of lubricating oils, feeding devices and filters; boiler feed waters, compounds and purifiers. The lectures will be illustrated and supplemented by short inspection trips to nearby plants.

In Care and Operation of Steam and Gas Tractors. A course of lectures arranged for men operating power trucks, road rollers, hoisting apparatus, steam, gas or oil fired traction machinery of all kinds. The lectures will take up the combustion of fuels, conditions for efficiency, ignition systems, carburetor adjustment, choice of lubricants, oiling devices, and allied topics.

In Applications of Electricity. This is a course of lectures, demonstrations, and laboratory work for electric power station operators and wiremen. These will deal in a practical way with the methods of operat-
ing generators and motors, different kinds of plants, different schemes of connections and their purposes, switchboards and switchboard arrangements, parallel operation, motor and generator troubles, standard practice in low tension and high tension wiring, the care and operation of storage batteries and the characteristics of different kinds of lamps. For those who desire it, time will be given to the study of the fundamental theory of generators, motors, transformers, meters, and of direct and alternating current circuits.
Summer School
Summer School

G. M. Wilson, Director

June 16 to July 26, 1913

The farmer is not the only man who has become interested in scientific agriculture. Teachers, ministers, editors, bankers, lawyers, doctors, laborers, landlords, merchants and all other classes of people are thirsting for a better knowledge of the principles and processes of improved agriculture. A similar awakening has occurred regarding better homemaking and better living.

Coincident with this has been the growth of the great educational movement for the teaching of the industrial subjects in our public schools.

Educators are insisting that to properly educate a child we must cultivate the head, the heart and the hand and exercise them upon those things which constitute the child's environment.

Parents are demanding that the schools shall give to the boys and girls a more practical education, an education that shall fit them for the duties of life.

It is felt that this great Institution so generously endowed by the State should bend its energies to the solution of these problems and should bear the responsibility of leadership in industrial education which the State and nation has placed upon it. It has been doing this for regular college students through its regular college courses and for the adult farmers and their families through its winter Short Courses, but there remains a large number who cannot be so served in this way and yet upon whose improvement depends in a great degree the future growth of industrial education in our State.

To meet the needs of these, the teachers, ministers, business and professional men and women who cannot attend the college during the regular college year, this Summer School has been established. It is to commence June 16th and continue for six weeks and is to be accompanied by conventions and conferences of different classes of people interested in the solution of our industrial problems, particularly our rural problems.

Courses will be offered in Animal Husbandry (including Poultry Husbandry), Dairying, Farm Crops, Soils, Horticulture, Manual Training, Household Economics and subjects related thereto, such as Chemistry, Botany, Zoology, Economics, etc.

The class, laboratory and field work in agricultural, manual training and household subjects will be devoted mainly to improving the student's knowledge of the subject matter with some consideration given to methods of presentation.
As the pedagogy of these subjects is new special conferences will be held, devoted to plans of developing industrial work, methods of teaching, equipment, correlation with other school work, material, text-books, courses of study and other subjects that will aid teachers to carry forward the work in their own schools.

To make the work specifically practical, conferences will be held for rural teachers and for high school teachers and other conferences will be organized as the need is manifest.

The work will include judging horses, cattle, sheep and hogs both from breed and market viewpoints; feeding, care and management of stock with some reference to the laws of inheritance, selection, breeding and to the history of breeds.

The poultry course will include varieties, their history, characteristics, care and management with practical work in judging: Eggs, incubators and incubation; brooders and brooding; buildings and grounds, marketing, etc.

Dairying will consider care and testing of milk and cream, butter making and judging, use and care of the separator and other phases of butter and cream methods of especial value to those present.

The Farm Crops work will be devoted to the judging of corn and the small grains, selecting, testing and preparing seed; methods of cultivation, crop enemies and their eradication; types, varieties, history, uses and methods of improvement of the various crops.

In the Soils work the elemental phases of the subject will be considered including soil areas of Iowa, origin, classification, characteristics, physical properties, moisture, temperature, capillarity, permeability, washing, cultivation, drainage tillage, crop rotation preservation of fertility and many other interesting topics.

The Horticultural work will concern itself with the garden, orchard and the home and school grounds including such useful subjects as fruits, flowers, vegetables, grafting, layering, budding, spraying, troublesome pests, what to plant and how to plant it on school and home grounds.

Courses in wood work will be given for both country and city schools, dealing with the making of interesting useful articles, care and handling of tools, principles, working from plans, and finishing.

Household economics will include both lecture and laboratory work in cooking, sewing, sanitation and decoration. The fundamental principles will be taught and will be illustrated through the new and thoroughly equipped domestic technology building. Each student will be given practical work in the cooking and sewing laboratories.

Those professional subjects necessary to procure a special state certificate for agriculture and home economics will be offered.

Special attention will be given the consideration of general problems of rural sociology such as the rural church, school, good roads, clubs, improvement of social conditions, home improvements and others.
Superior speakers will address the Summer School throughout the session on important phases of the subjects being considered.

Special efforts will be made to get the largest amount of pleasure out of the beautiful campus and surroundings and also to pack every working hour full of valuable and helpful knowledge.
Teachers' Certificates
Teachers' Certificates

STATE CERTIFICATES

In accordance with the law passed by the Thirty-first General Assembly, the State Board of Educational Examiners will grant five year first grade state certificates to graduates of the Iowa State College who have completed the following work:

(1) Psychology—Six semester hours.
(2) Education—Fourteen semester hours.
   a. Principles and Science of Education. Limited to eight semester hours.

Under this head may be included Child Study, Philosophy of Education, Philosophy of Teaching and Ethics or Psychology of Conduct.

b. History of Education. Limited to eight semester hours.

Under this head History of Philosophy or History of Industrial Education may be offered.

c. General and Special Methods of Teaching. Limited to four semester hours.

Under this head accredited colleges may offer courses in methods of teaching secondary subjects to students who have made majors of these subjects.

This first grade five year state certificate may be renewed at the end of five years upon proof of at least three years of successful teaching.

SPECIAL STATE CERTIFICATES

(1). The special state certificate (five year) for domestic economy, is issued to the graduates of the Home Economics course at the Iowa State College who have a record of six semester hours in psychology.

(2). The special state certificate (five year) for agriculture to the graduates in Agriculture at the Iowa State College who have a record showing six semester hours in psychology.

(3). The special state certificate (five year) for manual training to the graduates in the courses in the Division of Engineering who have had not less than two years of shop work with the six hours in psychology.

This special state certificate may include any two of the above subjects, but not other high school subjects.

It is recommended that a person desiring to teach shall elect the courses which will secure the regular five year state certificate upon graduation. This will entitle him to teach any subject and also hold any position in the high school.

For the courses which count toward the five year state certificate
see "Notes" under Psychology and Agricultural Education in this catalogue.

For special state certificates for manual training for the graduates of the Agricultural Engineering course and also information concerning other preliminary or special uniform county certificates correspond with the State Superintendent or see Uniform County Certificate Regulations.

SPECIAL UNIFORM COUNTY CERTIFICATES

A graduate of any four year course in the Iowa State College of Agriculture and Mechanic Arts may be issued a special uniform county certificate for his major subject or for his major or minor subjects, without examination.

A person wishing a special certificate should send a copy of his college record to the President of the Educational Board of Examiners, Des Moines, Iowa. If the record is approved for the kind of certificate requested, a statement to that effect, together with an application blank, will be mailed to the applicant. The application, together with a fee of $1.00, should be presented to the county superintendent of the county in which the applicant has been teaching or of the county in which he expects to teach, who will mail it to the President of the Educational Board of Examiners.

A special uniform county certificate may be issued for any one or two of the following subjects or group of subjects: Music; Drawing; Domestic Science or Home Economics; Manual Training; German; French; Physical Culture; Rhetoric, English, Composition, English and American Literature; History and Political Science; Algebra, Geometry, Trigonometry; Physiology; Geology; Botany; Zoology; Physics; Chemistry; Astronomy; Agriculture.
Honor Students

FORENSIC CONTESTS

Declamatory Contest, Spring Semester, 1912


Dramatic Class. 1st. Mayme Lloyd, Phileleutheroi, Deloies Defies the King. 2d. Alma Tonsfeldt, Quill, The Christmas Substitute.

Oratorical Contest, Spring Semester, 1912

First Prize—J. G. Watson, Beardshear, Tolstoy, Apostle of Peace. Second Prize—C. L. Burlingham, Beardshear, Coöperation and Industrial Peace. Third Prize—V. E. Wasser, Delphian, A World Court of Justice.

Intersociety Debates

Kennedy Cup Contest, Spring Semester, 1912

Question: Resolved, that the Recall should be adopted for all elective state and municipal officers, except judges.

Following the debates of the fall semester, 1911, the following societies were left to compete for the award of the Kennedy Cup: Welch, Delphian, Phileleutheroi: The debaters were as follows, the winning society being named first in each contest:

**FIRST SERIES**


**SECOND SERIES**

*Phileleutheroi*—Wm. Macklin, Ben Helmick, O. H. Joy.

Kennedy Cup Contest, Fall Semester, 1912

Question: Resolved, that the Sherman Anti-trust Law should be repealed.

The debaters were as follows, the winning society being named first in each contest:

**FIRST SERIES**

Bachelor—L. W. Osborn, Hans Pfund, S. Lake.

Phileleutheroi—C. Dodds, A. W. Joy, C. Combs.

Crescent—T. B. McKee, Geo. Iverson, L. S. Gillette.


SECOND SERIES

Crescent—I. S. Gillette, T. S. McKee, Geo. Iverson.


Philomathean—H. Steen, R. Miller, M. E. Sar.

The winners of the second series, the Crescents and Welch with the Bachelors will compete in the spring semester, 1913, for the final award of the Kennedy Cup.

Intercollegiate Debates, Fall Semester, 1912

Forensic League of Iowa State College and Iowa State Teachers' College. Seventeenth debate, seventh in series of dual debates.

Question: Resolved, that the Recall should be adopted for all state and municipal officers except judges.

Affirmative for Iowa State College, at Cedar Falls:
O. H. Joy, Phileleutheroi.
C. S. Dorchester, Philomathean.
A. L. Smith, Welch.

Negative for Iowa State College, at Ames:
Fred C. Fenton, Welch
G. A. Ellis, Forum.
A. W. Clyde, Philomathean.

Intercollegiate Debates, Spring Semester, 1913

State Triangular League (Grinnell College, Drake University, Iowa State College). Seventh annual debate.

Question: Resolved, That the Sherman Anti-Trust Law should be repealed.

The affirmative team for Iowa State College, against Grinnell College, at Ames:
O. H. Joy, Phileleutheroi.
C. F. Wambeam, Welch.
L. S. Gillette, Crescent.

The negative team for Iowa State College, against Drake University, at Des Moines:
C. S. Dorchester, Philomathean.
V. E. Wasser, Delphian.
C. L. Burlingham, Beardshear.
LIST OF STUDENTS

Iowa State Oratorical Contest, Spring Semester, 1912
Fifteen colleges represented. Iowa State College, represented by Hugh Webster, won first place. Subject, "Commerce and World Peace."

Interstate Intercollegiate Contest, Spring Semester, 1912
Hugh Webster, representing Iowa State College and the State of Iowa, won second place, tying for first place on total points but losing in percentages.

Iowa State Peace Contest, Spring Semester, 1912
Mr. J. G. Emerson represented Iowa State College and won first. Subject, "America and Peace in the Orient."

Iowa State Oratorical Contest
Western Division, Spring Semester, 1913
Mr. J. G. Watson represented Iowa State College. Subject: The Royalty of Knowledge versus The Sovereignty of War.

ROSTER OF CADET CORPS

Commandant
James Rush Lincoln, Brigadier General, First Brigade, Iowa National Guard
Adjutant Lieutenant, D. V. Gordon.
Color Sergeant, R. E. Patterson.
Second Color Sergeant, F. K. Newkirk.
Chief of Signal Corps, E. A. Holmes.

First Battalion
Major, C. C. Daly; Adjutant Lieutenant, L. H. Barker.
Co. A—Captain, O. D. Davidson; Lieutenant, C. H. Obye.
Co. C—First Lieutenant, C. A. Goss; Second Lieutenant, H. A. Sears.
Co. D—Captain, Paul Bird; Lieutenant, P. H. Priday, Second Lieutenant, L. E. Myers.

Second Battalion
Major, A. J. Swift; Adjutant Lieutenant, R. S. Tillie.
Co. E—Captain W. Ashby; Lieutenant, Oscar Syverend.
Co. G—Captain, O. M. Camburn; First Lieutenant, F. N. Kerwin.
List of Students

GRADUATE STUDENTS

Allen, Frank W., B. S. A., University of Missouri, 1910, Horticulture.
Black, L. O., B. D., St. Lawrence University, N. Y., Economics.
Crabb, J. Byrk, B. S. A., Ohio State University, 1903, Animal Husbandry.
Doty, Hiram S., B. S., Iowa State College, 1912, Botany.
Ellis, W. O., A. B., Lebanon Valley College, 1911, Zoology.
Hensel, Frederick W., B. S. A., Texas A. & M. College, 1907, Horticulture.

SENIORS

NAME

Abram, William A.,
Adams, David E.,
Adams, Neil,
Allen, Ami L.,
Allender, M. M.,
Allstrand, Harry P.,
Anderson, Jacob P.,
Arentson, James,
Armour, H. B.,
Arthur, Edna,
Ashby, William Wallace,
Bancroft, John S.,
Barker, Howard C.,
Barker, W. Earl,
Barney, Fay C.,
Batchelder, D. Thomas,
Baxter, Luke J.,
Bird, Paul,
Bisbee, Earl,
Bliss, Callie May,
Bonner, Gladys,

COURSE

C. E.,
C. E.,
C. E.,
Dairy,
A. H.,
M. E.,
H. & F.,
A. E.,
C. E.,
H. E.,
A. E.,
A. H.,
A. H.,
Dairy,
A. H.,
Sci. & Ag.,
Agron.,
Dairy,
H. E.,
H. E.,
M. E.,
A. H.,
A. H.,
A. H.,

COUNTRY

Jasper.
North Dakota.
Story.
Story.
Jefferson.
Carroll.
Decatur.
Shelby.
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Story.
Polk.
Illinois.
Indiana.
Jones.
Franklin.
Clinton.
Ida.
Story.
Illinois.
Linn.
Hamilton.
Story.
South Dakota.
Grundy.
Delaware.
Linn.
Burlingham, C. Lloyd, A. H., Central City, Linn.
Burnett, L. E., A. H., Clinton, Clinton.
Cairy, Forest, Vet., Algona, Kossuth.
Campbell, Clyde B., A. H., Des Moines, Chickasaw.
Chamberlain, Mark O., E. E., Perry, Polk.
Clapp, Paul, H. E., Alaga, Kossuth.
Clark, Clifford King, Mn. E., Sioux City, Woodbury.
Clark, Hal B., H. & F, Dairy, Newton, Jasper.
Clutter, J. A., Dairy, Lamoni, Decatur.
Cochran, Clyde F., H. & F, Crawfordsville, Indiana.
Cochran, M. E., A. H., Wooster, Ohio.
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Conlee, Harold E., C. E., Monroe, Jasper.
Corray, Lawrence E., A. H., Maquoketa, Jackson.
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Crocker, Thomas F., A. H., Omaha, Sioux.
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Divine E. R., M. E., Guadalupe, California.
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Dyke, B. L., Vet., Logan, Story.
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iElijah, Earl, A. H., Ames, Cedar.
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Ferguson, Howard C., C. E., Boone.
Fick, Adolph, C. E., Belle Plaine, Benton.
Frazier, Everette H., H. E., Early, Sac.
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Hamm, J. Richard, E. H., Glidden, Carroll.
Hanson, Clara, H. E., Glidden, Carroll.
Hanson, Marie, A. H., Waterloo, Black Hawk.
Harmon, Guy E., Agron., Omaha, Nebraska.
LIST OF STUDENTS

McDonald, Myrtle, Sci., A. H., Ames,
McDonald, Roy, Dairy, Ames,
McElroy, Harold, Sci., M. E., Newton,
McKimm, Elizabeth, M. E., Deloit,
McKitterick, Robert, A. H., Burlington,
McMillan, Harry, A. H., Paulding,
McMullan, Ralph Otis, M. E., Van Wert,
Negaard, Oscar, Vet., Canby,
Nelson, S. Oscar, M. E., Keosauqua,
Newburger, L. B., Dairy, Woodward,
Nordstrom, Harry M., A. H., St. Joseph,
Nordstrom, R. F., Vet., Humboldt,
Nutty, N. S., Vet., Humboldt,
Olsen, James C., A. E., Nevada,
Olson, Sanford, A. H., Williams,
Osborn, Lynn W., A. H., Kelley,
Patterson, Nellie Agron, Flandreau,
Peshak, Leona, H. E., Burt,
Pfund, Hans C., Sci., Osage,
Pickus, Joseph, M. E., Hubbard,
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Reis R. B., M. E., Ida Grove,
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Richardson, Willa, H. E., Richmond,
Ringheim, Horace, Agron, Manchester,
Roberson, Frank, M. E., Nevada,
Rogers, Raymond, H. & F., Ames,
Ross, R. G., E. E., Dunlap,
Rush, Fern F., M. E., Winterset,
Sar, Martin Agron, Ames,
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Schwab, J. W., H. E., Marshalltown,
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Seba, J. H., Dairy, Monticello,
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Shaffer, L. P., Dairy, Ames,
Shallenberger, James K., M. E., Des Moines,
Shoemaker, Joseph J., E. E., Albia,
Smith, Milton O., Agron, Whiting,
Snyder, Leroy D., C. E., Humboldt,
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Taff, Paul C. Agron, Panora,
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Thornburg, Earl R., E. E., Ames,
Tong, Boyd H., Mn. E., Ames,
Tong, Edna, H. E., Ames,
Triggs, Fred E., M. E., Lake Park,
Trottnow, Ivan Emery, C. E., Dysart,
Tuttle, Randall M., Agron, Spencer,
Tyler, Merle C., C. E., Logan,
Vader, Leo Claude, C. E., Pocahontas, Pocahontas.
Vale, Bruce R., A. H., Bonaparte, Marion.
Vaughn, Edward, A. H., Cedar Rapids, Ames.
Vincent, R. T., A. E., Ames, Jackson.
Walls, Mildred, Sci., Clinton, Linn.
Warner, J. Harry, A. H., Algona, Kossuth.
Watts, Everett, Agron., Cedar Rapids, Linn.
Weirick, Laura E., C. E., Ames, Story.
Welles, Edward S., M. E., Iowa Falls, Hardin.
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White, Helen, H. E., Marion, Linn.
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Wills, Mirian, H. E., Eldora, Hardin.
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Wilson, David B., Vet., West Liberty, Hardin.
Wilson, F. W., A. H., Rockwell City, Muscatine.
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Woody, Ethel E., H. E., Muscatine, Muscatine.
Worley, Floyd E., M. E., Burlington, Linn.
Wormley, Burton H., A. H., Appleton, Linn.
Wray, G. Edward, M. E., Creston, Linn.
Wright, T. H., Dairy, Fort Dodge, Clinton.
Wygle, Lila, H. E., Ames, Story.

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NAME
Aldrich, Leon E., Agron., Dows, Wright.
Aldrich, Sperry W., C. E., Guthrie Center, Guthrie.
Almquist, Elmer, E. E., Des Moines, Clinton.
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Bone, Joe, A. H., Perry, Clayton.
Borg, Elmer Herman, Agron., Storm Lake, Buena Vista.
Bradford, B. L., H. E., Omaha, Nebraska.
Bradley, Paul, Sci., A. H., Omaha, Nebraska.
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Cutchall, Ray, H. E., Eldon.
Daniels, Beryl A., C. E., Des Moines.
Danielson, Jesse, C. E., Clarinda.
Davidson, Chas. E., A. E., Hedrick.
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Dean, James M. W., A. E., Decorah.
Delaney, Francis, H. E., Ames.
De Spelder, Alonzo B., C. E., Hamburg.
Denny, Jesse, E. E., Clinton.
Devine, Mary, Zeeland.
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Drake, Wilbur, A. E., Wapello.
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| Jenning, Harvey          | Agr.,      | Waterloo,     |
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| Johnston, J. Carl        | Agr.,      | Buffalo Center,|
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| Jones, Russel S.         | Agr.,      | Keokuk,       |
| Jupp, Russell E.         | Agr.,      | Vinton,       |
| Jusek, Harry             | Agr.,      | Milwaukee,    |
| Karr, Arthur H.          | Agr.,      | Sioux City,   |
| Keating, Zoa Mary        | Agr.,      | Ireton,       |
| Kelly, Raymond C.        | Agr.,      | Afton,        |
| Kent, Floyd W.           | Agr.,      | Davenport,    |
| Kerns, Arthur B.         | Agr.,      | Shenandoah,   |
| Kerrigan, Frank          | Agr.,      | Moline,       |
| Kerwin, Fred Noble       | Agr.,      | Davenport,    |
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|                           | Sci.,      | Panora,       |
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|                           |           | Woodbury,     |
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|                           |           | South Dakota, |
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|                           |           | Colorado,     |
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|                           |           | Page,         |
|                           |           | Illinois,     |
|                           |           | Scott,        |
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|                           |           | Hancock,      |
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McLane, Agnes J., A. E.
McLeod, Max, Vet.
McMartin, Arch, Agr.
McMullin, Raymond, Ind. Chem.
McNee, Laurence, Agr.
McNutt, Philip, Agr.
McQuilken, Homer S., Agr.
McTavish, Hugh, Agr.
Maakestad, William, Agr.
Maben, Clair, H. E.
Mack, J. Fay, E. E.
Macy, Harry L., Agr.
Malloy, Paul V., H. E.
Manhardt, Clara, H. E.
Mann, Grace L., E. E.
Marshall, H. S., C. E.
Marston, Morrill, E. E.
Mason, Clyde, C. E.
Mattison, Homer, A. E.
Matson, Tauge F., H. E.
Eacham, F. A., C. E.
Mead, Walter P., A. E.
McTavish, Hugh, H. E.
Malko, William, H. E.
Mallet, Arthur F., H. E.
Miller, Bessie G., H. E.
Miller, Marshall P., A. E.
Miller, Richard C., Agr.
Minter, Claude C., Agr.
Minthorn, M. Lloyd, Agr.
Moffat, Alex. Robert, M. E.
Montgomery, Mary E., H. E.
Moore, Eugene R., Agr.
Moore, M. Glenn, C. E.
Moore, William N., M. E.
Morin, Wm. T., A. E.
Morris, Benjamin, Agr.
Morris, Lewis, Agr.
Morris, Roger, M. E.
Moyer, Harvey, H. E.
Mueller, Paul, M. E.
Munley, Mina, Ag. Ed.
Munger, Geo. H., C. E.
Murphy, Harry, A. E.
Murphy, Lawrence T., Mn. E.
Murray, Chas. B., C. E.
Musgrave, William, H. E.
Myers, Ada, C. E.
Myers, Bert, C. E.
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Beaman, Benton.
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Laurens, Des Moines.
Algona, Pocahontas.
La Porte City, Kossuth.
Cotton, Black Hawk.
Story, Linn.
Forest City, Story.
Mason City, Winnebago.
Adel, Cerro Gordo.
Marshalltown, Marion.
Knoxville, Wright.
Indianola, Warren.
Ames, Story.
Harlan, Story.
Oskaloosa, Shelby.
Goodell, Mahaska.
Calumet, Hancock.
Manchester, O'Brien.
Eagle Grove, Delaware.
East Orange, Wright.
Fayette, New Jersey.
Ames, Iowa.
Wapello, Hancock.
Garner, Pocahontas.
Fonda, Story.
Ames, Story.
Ames, Story.
Lyons, Clinton.
Burlington, Des Moines.
Spencer, Clay.
Perry, Dallas.
Ottumwa, Wapello.
Jackson, Minnesota.
Neligh, Nebraska.
Castana, Minnesota.
Dubuque, Pocahontas.
Goldfield, Story.
Oklahoma City, Iowa.
Waverly, Minnesota.
Des Moines, Wisconsin.
Albert Lea, Buena Vista.
Dodgeville, Muscatine.
Linn Grove, Fayette.
West Liberty, Pottawatomie.
Oelwein, Marion.
Council Bluffs, Minnesota.
Knoxville, Hardin.
Winona, Page.
Eldora, Colorado.
Denver, Polk.
Des Moines, Polk.
Dexter, Dallas.
Madrid, Boone.
LIST OF STUDENTS

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Myers, Lowell, Agr.,
Myers, Zell S., M. E.,
Nash, John F., E. E.,
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Neer, Beatrice, H. E.,
Newkirk, Frank K., Cer.,
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Patterson; Claire, Agr.,
Patterson, Ralph E., A. E.,
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Pearson, Earnest, H. E.,
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Osler, Marguerite, H. E.,
Peek, Alice, Agr.,
Penningroth, Edward, H. E.,
Perkins, Juanita, Agr.,
Perry, Guy, M. E.,
Persons, Eva, Agr.,
Peters, Ivan, H. E.,
Petersen, R. Waldo, Agr.,
Petheram, Harry D., Agr.,
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Plagge, Newton O., Agr.,
Poole, W. Ross, Agr.,
Potter, Elbridge G., E. E.,
Powell, Lester D., Agr.,
Pownall, Paul, Agr.,
Prichett, Geo. P., Sci.,
Priddy, Paul, Agr.,
Primrose, Clifford G., Sci.,
Probert, Leon, Agr.,
Prudhon, Herbert, M. E.,
Prussing, Elmer, Agr.,
Ramey, Ethel, A. E.,
Dexter, Music, West Liberty,
Ida Grove, Des Moines,
Des Moines, Belton,
Belton, Hawarden,
Hawarden, Ventura,
Ventura, Stonington,
Stonington, Sioux Falls,
Sioux Falls, West Liberty,
West Liberty, Marshalltown,
Marshalltown, Windom,
Windom, Ottumwa,
Ottumwa, Lake City,
Lake City, Jewell,
Jewell, Prescott,
Prescott, Ames,
Ames, Oakland,
Oakland, Ames,
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Ames, Carson,
Carson, Boone,
Boone, Wallingford,
Wallingford, Marion,
Marion, Edgewood,
Edgewood, Charles City,
Charles City, Albert Lea,
Albert Lea, Rensselaer,
Rensselaer, Mitchellville,
Mitchellville, Boone,
Boone, Springville,
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Mitchellville, Paulina,
Paulina, Tipton,
Tipton, Eldora,
Eldora, Afton,
Afton, Ames,
Ames, West Liberty,
West Liberty, Hancock,
Hancock, Ames,
Ames, Clarinda,
Clarinda, Nevada,
Nevada, Hudson,
Hudson, Sibley,
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West Branch, Fort Madison,
Fort Madison, Omaha,
Omaha, Clinton,
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West Union, Nashua,
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Sabula, Ames,
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Polk, Texas,
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Linn, Clayton,
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Hardin, Union,
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Black Hawk, Osceola,
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Story, Jackson,
Jackson, Montgomery,
Montgomery, Cedar,
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IOWA STATE COLLEGE
Oskaloosa, Mahaska.
Cerro Gordo, Dubuque.
Monona, Polk.
Hardin, Dubuque.
Delaware, Osceola.
Pottawattamie, S. Dakota.
Pennsylvania, Story.
Lee, Illinois.
Ohio.
Taylor, Mahaska.
Fayette, Illinois.
Nebraska, Illinois.
Kentucky.
Sioux.
Benton, Hardin.
Decatur, Tama.
Poweshiek, Woodbury.
Crawford, Woodbury.
Poweshiek, Dubuque.
Marshall, Linn.
Woodbury, Tama.
Story.
Story.
Story.
Grundy, Keokuk.
Nebraska, Story.
Minnesota: Woodbury.
Carroll, Polk.
LIST OF STUDENTS

Selover, Lowell, Agr., Des Moines,
Seymour, James H., Ag. Ed., Ames,
Shideler, Chas. J., A. E., Attica,
Shimer, Fern, Agr., Grundy Center,
Shugart, John L., Agr., Council Bluffs,
Simpson, C. Francis, M. E., Waterloo,
Simpson, Elmer D., E. E., Rake,
Skelley, Charles, Agr., East Moline,
Skott, Hans E., Agr., Maquoketa,
Slingerland, Day, E. E., Superior,
Slocum, Ormand, C. E., Indianola,
Sly, John F., Vet., Waterloo,
Smillie, Ernest W., Fairfield,
Smit, Laura, H. E., Alton,
Smith, Cecil, Agr., Oskaloosa,
Smith, Curtis K., E. E., Rockwell,
Smith, Earl W., A. E., Lake City,
Smith, Frank R., A. E., Marengo,
Smith, Glenn M., Agr., Muscatine,
Smith, Harry G., M. E., Walnut,
Smith, Harold Leland, Agr., Des Moines,
Smith, John B., Agr., Des Moines,
Smith, Melville A., Agr., Marshalltown,
Smith, Rex C., Agr., West Branch,
Smith, Rush C., Agr., Spencer,
Smith, Willis, C. E., Albia,
Snyder, Lloyd B., Agr., Castana,
Southwick, Myrtle, H. E., Oskaloosa,
Sobrero, Luis R., A. E., Victoria,
Sommers, Roy, Agr., Kalona,
Sparks, Arline, H. E., Ames,
Sparks, Hazel, H. E., Ames,
Spencer, Hazel B., H. E., Iowa City,
Spencer, Kathleen, H. E., Des Moines,
Sperry, Alice M., H. E., Grundy Center,
Sprinkle, Lloyd, E. E., Winterset,
Spurin, Florence, H. E., Union,
Spurin, Lena, H. E., Union,
Squire, Edward, Agr., Grinnell,
Stanton, Harmon L., Agr., Marshalltown,
Stason, Edna, H. E., Albia,
Stauffer, Earl Geo., Agr., Gladbrook,
Steele, Ray N., M. E., Cedar Rapids,
Steigerwalt, Frank, A. E., Ames,
Stephenson, Perry, Agr., Mount Ayr,
Stephney, Raymond, A. E., Moingona,
Stewart, Burr, E. E., Valley Junction,
Stewart, Minnie E., H. E., Watertown,
Stillwell, Edwin W., Agr., Grand Bay,
Stoddard, Erling, C. E., Villisca,
Storm, Van M., Agr., Ames,
Stuckenbruck, Harold, M. E., Belle Plaine,
Stuewe, Eric F., Agr., Milwaukee,
Surring, Richard Elmer, Agr., Monona,
Susong, Homer D., C. E., Des Moines,
Swart, Minnie L., Vet., Manassas,
Swinney, John D., C. E., Davenport,
Sykes, A. Lee, Ag. Ed., Manilla,
Symonds, Harold,  
Syvem, Oscar,  
Talcott, Frank,  
Talcott, James P.,  
Tann, Calla,  
Tanner, Winifred R.,  
Taylor, Clair,  
Taylor, Fred K.,  
Taylor, Walter N.,  
Temple, William,  
Thayer, Bernice,  
Thayer, Homer,  
Thiel, William,  
Thode, Edna,  
Thoen, Pearl,  
Thomas, ChaPles W.,  
Thomas, Merton,  
Thomasen, Fred,  
Thornburg, Herbert,  
Tiernan, Joseph,  
Tillie, Robert T.,  
Tonsfeldt, Alma,  
Torblaa, Elling M.,  
Tott, Arthur G.,  
Tracy, Ernest,  
Tregilgus, Chester,  
Trevarten, Lota,  
Turner, Oscar T.,  
Tuttle, Otis Harris,  
Ufford, Gladys,  
Ufford Glen R.,  
Uhl, Edwin,  
Van Anda, Carmi,  
Van Drimmelen, Josie,  
Van Horn, Joe,  
Vaughn, Charles,  
Veach, Claude,  
Vifian, May,  
Vorhes, Carl Arthur,  
Wagner, Joe,  
Walker, Dessie A.,  
Walker, William G.,  
Walker, James,  
Wallace, John B.,  
Wallace, Josephine,  
Wallace, Leonard J.,  
Walters, Henry,  
Wangen, Mary,  
Warden, Albert W.,  
Warner, Clara,  
Warlock, Glenn,  
Wasser, Blanche,  
Watkins, Florence,  
Watson, Besse,  
Watson, Melvin R.,  
Waugh, Charles B.,  
Waugh, Mark,  
Weatherwax, Edwin,  
M. E., Agr.,  
M. E., Agr.,  
M. E., Sc.,  
M. E., Agr.,  
M. E., Agr.,  
M. E., Agr.,  
M. E., Agr.,  
H. E., Agr.,  
H. E., Agr.,  
H. E., Agr.,  
H. E., Vet.,  
E. E., Agr.,  
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H. E., Agr.,  
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H. E., Agr.,  
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M. E., Sci.,  
M. E., Sci.,  
H. E., Agr.,  
H. E., Agr.,  
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H. E., Agr.,  
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Renwick,  
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Ames,  
Dubuque,  
Red Oak,  
Serena,  
Storm Lake,  
Storm Lake,  
Kasson,  
Holstein,  
Kensett,  
Coon Rapids,  
Dow City,  
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Linden,  
Perry,  
Muscatine,  
Remsen,  
Mitchell,  
Sibley,  
Belle Plaine,  
Sibley,  
Eldora,  
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Norway,  
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Ames,  
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Ames,  
Tipton,  
Guernsey,  
Ames,  
Ames,  
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Fayette,  
Hamilton,  
Humboldt,  
Story,  
Story,  
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Montgomery,  
Illinois,  
Buena Vista,  
Buena Vista,  
Minnesota,  
Ida,  
Worth,  
Carroll.  
Crawford,  
Marion,  
Dallas,  
Dallas,  
Muscatine,  
Plymouth,  
Mitchell.  
Osceola,  
Benton,  
Osceola,  
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Story,  
Audubon,  
Boone,  
Nebraska,  
Butler,  
Black Hawk.
LIST OF STUDENTS

Weaver, Minnie, H. E., Lake Park, Dickinson.
Weldin, John, H. E., Buena Vista, Louisa.
Wenholz, Alfred, Agr., Osage, Mitchell.
Whinery, Vern, Agr., Sioux City, Sioux City.
White, John W., Agr., Roland, Pocahontas.
Whittemore, Osgood, Agr., Belle Plaine, Polk.
Wieland, Karl, Agr., Sioux City, Woodbury.
Wilcox, Fred, Agr., Indianola, Polk.
Wilder, George I., Agr., Mason City, Cerro Gordo.
Wilkinson, Herbert, Agr., Mount Ayr, Ringgold.
Williams, Joe, Agr., Sibley, Coal.
Williams, Virginia, Agr., Davenport, Scott.
Wilson, Ella, H. E., Mason City, Cerro Gordo.
Wilson, Eva, H. E., Mason City, Cerro Gordo.
Wilson, Joseph J., H. E., Tipton, Tipton.
Wilson, Ray, Agr., Tipton, Tipton.
Williams, Harold, Agr., Tipton, Tipton.
Williams, Herbert, Agr., Tipton, Tipton.
Wills, George, Agr., Tipton, Tipton.
Willard, H. E., Lake Park, Dickinson.
Willett, S. Leland, E. E., Council Bluffs, Pottawattamie.
Willetts, Earl E. E., Lamont, Buchanan.
Willetts, H. E., Perry, Dallas.
Woodard, Clare, Agr., Keokuk, Lee.
Woodin, William J., Agr., Des Moines, Polk.
Woodroffe, Clara, H. E., Keokuk, Lee.
Woodroffe, Hugh B., Agr., Grinnell, Polk.
Wyckoff, Marjorie, Agr., Rock Island, Tama.
Yoeman, Reamer, Agr., Newton, Dallas.
York, Ethel, H. E., Newton, Dallas.
Yorker, Oscar B., Agr., Newton, Dallas.
Young, Josephine, H. E., Newton, Dallas.
Zimmerman, John C., A. E., Dubuque, Dubuque.

SPECIAL STUDENTS

NAME
Blythe, Stuart O., Sp. A. H., Washington, D. C.
Boyd, Montelle M., Sp. Ag., Des Moines, Polk.
Conover, Walton, Sp. A. H., Okskaloosa, Mahaska.
Hayes, Thomas, Sp. A. H., Copenhagen, Denmark.
Mize, Helen, Sp. H. E., Manitoba.
O'Banion, Allan C., Sp. For., South Dakota.
Truax, Thomas Roy, Sp. For., Guthrie.

IRREGULAR STUDENTS

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ONE AND TWO YEAR AGRICULTURAL COURSES

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Bornholdt, Elmer F., 2 Yr. Agr., Avoca, Pottawattamie.
Beazley, Everett, 2 Yr. Agr., Washita, Pottawattamie.
Bebensee, Max, 2 Yr. Agr., Council Bluffs, Missouri.
Bellows, Fred D., 2 Yr. Agr., Maryville, Pottawattamie.
Beno, Bernard, 2 Yr. Agr., Council Bluffs, Clayton.
Benson, C. A., 2 Yr. Agr., Elkader, Johnson.
Blanchard, Elmer F., 2 Yr. Agr., Iowa City, Denmark.
Boe, Philip, 2 Yr. Agr., Sheldon, O'Brien.
Bromler, J. L., 1 Yr. Dairy, Postville, Winneshiek.
Bollman, Obert, 1 Yr. Dairy, Fonda, Pocahontas.
Bye, Emil, 2 Yr. Agr., Scarville, Tama.
Casey, William T., 2 Yr. Agr., Iowa City, Johnson.
Chapman, Ralph K., 2 Yr. Agr., Bagley, Pocahontas.
Christianson, Clarence V., 2 Yr. Agr., New Orleans, Louisiana.
Clark, Chas. Lee, 2 Yr. Agr., Webster.
Clarke, A. R., 2 Yr. Agr., Scott.
Clayton, Chalmers, 2 Yr. Agr., Boone.
Clare, Pearl, 2 Yr. Agr., Fremont.
Connell, J. E., 2 Yr. Agr., Lucas.
Converse, Durrell, 2 Yr. Agr., Jasper.
Cooper, Fay, 2 Yr. Agr., Emmet.
Corcoran, Thomas, 2 Yr. Agr., Cerro Gordo.
Cox, Robert J., 2 Yr. Agr., Allamakee.
Craig, Raymond B., 2 Yr. Agr., Illinois.
Creger, Merrill, 2 Yr. Agr., Marion.
Crisman, Harold, 2 Yr. Agr., Madison.
Culp, Homer, 2 Yr. Agr., Story.
Davis, Homer, 2 Yr. Agr., Story.
Deakins, Elbert, 1 Yr. Dairy, Keokuk.
Deal, Guy, 2 Yr. Agr., Dallas.
Dolvin, Joy, 2 Yr. Agr., Minnesota.
Eldridge, Waldo, 1 Yr. Dairy, Humboldt.
R. Scott Ellis, 2 Yr. Agr., Cedar.
Engelson, Noah, 2 Yr. Agr., Louisa.
Engstrom, Fred, 2 Yr. Agr., Cedar.
Escher, Earnest, 2 Yr. Agr., Hamilton.
Estle, John L., 2 Yr. Agr., Worth.
Eyer, Leland, 2 Yr. Agr., Story.
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Field, Louis, 2 Yr. Agr., Story.
Finkbein, Frank M., 2 Yr. Agr., Wisconsin.
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Flynn, James M., 2 Yr. Agr., Monona.
Foote, Merrill, 2 Yr. Agr., Montgomery.
Forbes, Jay W., 2 Yr. Agr., Kingsley,
Forney, Wm. Roy, 1 Yr. Dairy, Kingfisher,
Frasche, Lynn C., 2 Yr. Agr., Ames,
Futtrup, Hans, 1 Yr. Dairy, Ames,
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George, Merwyn, 2 Yr. Agr., Waverly,
Gillespie, Raymond, 2 Yr. Agr., Dexter,
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Gosch, Henry, 1 Yr. Dairy, Randall,
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Grau, Oscar, 2 Yr. Agr., Newell,
Gray, Ernest T., 1 Yr. Dairy, Basalt,
Griffith, Edwin Henry, 1 Yr. Dairy, Columbus Jct.,
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Grovert, Hugo, 2 Yr. Agr., Newhall,
Guthrie, Stewart, 2 Yr. Agr., Newton,
Halladay, Ray A., 2 Yr. Agr., Monticello,
Hampton, Floyd, 2 Yr. Agr., Springfield,
Hanson, Fred B., 2 Yr. Agr., Inwood,
Harding, Robert, 2 Yr. Agr., Des Moines,
Harrison, Harold, 2 Yr. Agr., Sac City,
Hartsook, Ralph, 2 Yr. Agr., Orient,
Hawkins, Ivan, 2 Yr. Agr., Granger,
Heidman, Henry S., 2 Yr. Agr., Kesab,
Hekimian, Joseph K., 2 Yr. Agr., Randall,
Henderson, Walter L., 2 Yr. Agr., Janesville,
High, John, 2 Yr. Agr., Springville,
Hobson, J. H., 1 Yr. Dairy, Macedonita,
Hougas, Almon G., 2 Yr. Agr., Ft. Madison,
Houston, Paul D., 2 Yr. Agr., Adel,
Hoy, Irvin, 2 Yr. Agr., Knoxville,
Hudson, Lloyd E., 2 Yr. Agr., Wayland,
Hulme, Harold, 2 Yr. Agr., Earlville,
Hunt, Evlon, 2 Yr. Agr., Earlville,
Hunt, Roy, 2 Yr. Agr., Woolstock,
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Jacobs, George W., 2 Yr. Agr., Hamburg,
James, Ralph, 2 Yr. Agr., Lamoni,
Jamison, D. N., 2 Yr. Agr., Council Bluffs,
Jennings, Henry B., 2 Yr. Agr., Nevada,
Johnson, Alex T., 2 Yr. Agr., Laurens,
Johnson, Arthur E., 2 Yr. Agr., Decorah,
Johnson, Walter C., 2 Yr. Agr., Missouri Valley,
Jones, Chris C., 2 Yr. Agr., Snencer,
Jones, Joseph, 1 Yr. Dairy, Clarinda,
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Kelsey, Max, 2 Yr. Agr., Clermont,
Kerr, George D., 2 Yr. Agr., Prairie City,
Kingdon, Everett, 2 Yr. Agr., Brooklyn,
Korns, Truman, 2 Yr. Agr., Tyndall,
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Lang, Harold, 2 Yr. Agr., Remsen,
Lang, Walter L., 2 Yr. Agr., Granger,
Leaverton, Robert, 2 Yr. Agr., Letts,
Lieberknecht, Fred, 2 Yr. Agr., Plymouth,
Kingsley, 1 Yr. Dairy, Oklahoma.
Kemp, Jay W., 2 Yr. Agr., Story.
Forney, Wm. Roy, 1 Yr. Dairy, Story.
Ames, 2 Yr. Agr., Mexico.
Futtrup, Hans, 1 Yr. Dairy, Bremer.
Garza, Simon de la, 2 Yr. Agr., Dallas.
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Shadduck, Homer W., 2 Yr. Agr., Lyons, Clinton.
Sloss, John W., 2 Yr. Agr., Ames.
Smith, Clifford, 1 Yr. Dairy, Plainfield.
Smith, Lew J., 1 Yr. Dairy, Bonair.
Smith, Ralph, 2 Yr. Agr., Macedonia, Germany.
Smith, Roland B., 2 Yr. Agr., Alliance.
Smith, Virgil, 2 Yr. Agr., Lorimer, Creston.
Steele, Jay, 2 Yr. Agr., Le Mars, Treynor,
Stokes, Carleton, 2 Yr. Agr., Sanborn.
Sweeney, Ren, 2 Yr. Agr., Muscatine.
Swigart, Clarence B., 1 Yr. Dairy, Villisca, Montgomery.
Terwilliger, Lewis, 2 Yr. Agr., Davenport.
Thoermer, Fred, 1 Yr. Dairy, Norway, Louisa.
Thomas, Neal, 2 Yr. Agr., Columbus Jct., Kossuth.
Thornton, Lester L., 2 Yr. Agr., Algona.
Tjornhoj, Rasmus J., 1 Yr. Dairy, Wyoming.
Vaughn, Dillon C., 2 Yr. Agr., Muscatine.
Tompkins, Lyle C., 2 Yr. Agr., Villisca, Montgomery.
Townsley, Irvin E., 2 Yr. Agr., Villisca, Montgomery.
Tyler, Henry F., 1 Yr. Dairy, Villisca, Montgomery.
Warth, Carl O., 2 Yr. Agr., Muscatine.
Watson, William, 1 Yr. Dairy, Davenport.
Way, Lloyd P., 2 Yr. Agr., Davenport.
Webster, Deo H., 2 Yr. Agr., Muscatine.
White, Harold S., 2 Yr. Agr., Crawfordsville.
Wiest, Philip R., 2 Yr. Agr., York.
Williams, Wm. Glenn, 2 Yr. Agr., Van Orin, Illinois.
Wilson, Frank B., 2 Yr. Agr., Farmington, Illinois.
Wood, Ellis, 1 Yr. Dairy, Augusta, Illinois.
Young, Harry L., 2 Yr. Agr., Graettinger, Palo Alto.

MUSIC STUDENTS

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<th>COURSE</th>
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<td>Bartlett, Mrs. C. M.</td>
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<td>*Beck, George E.</td>
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<td>*Brekke, Julia E.</td>
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</tr>
</tbody>
</table>

* Students also enrolled in other courses.
LIST OF STUDENTS

*Clemmer, C. F., V., O., Ames, Story.
Clemmer, Mrs. C. F., V., Ames, Story.
*Cockran, Morris E., V., Crawfordsville, Indiana.
*Combs, Roy,
Cook, Luella,
Crawford, Beulah, O., Ames, Story.
*Deacon, Anna,
*Dean, Caroline,
P. & O., Grundy Center, Grundy.
*Dew, Martha,
*Dunlap, Howard,
Edwards, Enid,
Edwards, Lois,
*Eichling, Paul,
*Dunlap, Howard,
Har.
English, Olive, O., Nebraska, Story.
Evans, Marguerite,
Ferguson, Marie,
Freed, Niva,
P.
*Fuchs, Iva,
Galloway, Kathryn, V. & Har., Waterloo, Black Hawk.
Gamble, Lura,
*Geasey, Sylvester,
Ghrist, David,
*Graham, Loraine,
Grau, A., S. S.
*Grau, O. J., S. S.
Green, Mrs. Gertrude, P., Ames, Story.
*Hackett, S. M., S. S.
Hall, Margaret, V., P., Cpt., Cpt., Evanston, Illinois.
Hansman, Esther,
*Hanson, Clara,
*Harvey, Neil,
*Hopkins, Mariel,
Hopkins, Mrs. P. F., P., Ames, Story.
Holden, Helen,
*Houser, Virgual,
*Hug, Mrs. Louise, V. & Har., Ames, Story.
Hultz, Gladys,
Key, Florence,
*King, C. R., P., Brit., Hancock.
*Kintsley, Harriet,
Knapp, Jeanette,
*Karns, Truman,
*Kurz, Eva,
*Lake, Philena,
Lang, Adeline,
Leland, Mrs. Margaret,
*Liinnan, C. J., S. S.
*Luce, Wilbur C., V.,
Lysinger, Margaret,

* Students also enrolled in other courses.
McMurray, Cooper, P., Ames, Story.
McDonald, Ruth, Vio., Ames, Story.
Madson, Nina, P., Ames, Story.
Marston, Morrill, P., Ames, Story.
Mather, Vera, P., Ames, Story.
Minchin, Medora, P., Ames, Story.
Moland, Erabelle, V. & P., Ames, Story.
Noble, Margaret, P., Ames, Story.
Nowlin, Bernice, V., Ames, Story.
O’Brien, Mrs. Floyd, V., Ames, Story.
Osborn, Eleanor, P.,
*Page, Nellie, Vio., Charles City, Floyd.
Peters, Anna, V., Ames, Story.
*Peters, Julius H., V., Sac City, Sac.
*Peters, Mabel, E., Sac City, Sac.
Pickford, A. Harold, V., Nora Springs, Floyd.
Pierce, Laura, P.,
*Pitts, Ima G., V., Mondamin, Harrison.
Plagge, Mrs. Selma, V., Ames, Story.
Potts, Mildred, Vio., Ames, Story.
*Prine, Edna, V., Tama, Tama.
Proctor, Dorothy, P., Ames, Story.
RaRousky, Julia, Vio., Ames, Story.
*Ranney, Royal, V., Ames, Story.
*Richardson, Florence, P., Indiana.
*Richer, Miriam, V., Story.
Ringgenberg, Carl, V., Ames, Story.
Ringold, Reuben, V., Gilbert, Story.
*Rippel, Joe, V., Sunbury, Pennsylvania.
Scofield, Ralph, Vio., Ames, Story.
Statler, Edna, P.,
Thomas, Edna, P., Ames, Story.
*Tuttle, R. M., V., Spencer, Clay.
Ufford, Gladys, P., Ames, Story.
Mus. His., P. & Har.,
Valentine, Isabel, P., Ames, Story.
*Ward, Lottie, P.,
*Wangan, May, V., P., Minnesota.
Wentworth, E. N., V., Ames, Story.
*Williams, H. J., V., Story.
Williams, Nellie R., P., Ames, Story.
Wilson, Hazel, Mus. His., P. & Har., Breda, Carroll.

* Students also enrolled in other courses.
LIST OF STUDENTS

*Wygle, Lila, O., Ames, Story.

Abbreviations—V., Voice; Vio., Violin; P., Piano; Har., Harmony; S. S., Sightsinging; Mus. His., Musical History; Cpt., Counterpoint; Ins., Instrumentation; Int., Interpretation.

ENROLLMENT FOR SUMMER SCHOOL

NAME
Backman, Hettie,
Bardwell, Etta W.,
Bare, E. D.,
Barton, Claire,
Bateson, Gladys,
Berger, Ed B.,
Berquist, Medora,
*Bohning, H. J.,
Booher, Edith,
*Bourland, C. C.,
Brice, Bay,
Brodersen, Hilda L.,
Brooker, Elsie,
Calonkey, Josephine,
Campbell, Macy,
Christy, Catherine E.,
Coleman, H. C.,
*Conaway, Laura,
Connell, J. E.,
*Conover, Walton T.,
Cook, Jennie Francis,
Cosner, H. L.,
Crawford, Alex,
Crawford, B. Vincent,
*Cretsinger, Elsie Mae,
*Culp, Harold,
Cunningham, Mamie G.,
Currier, Adah,
Daugherty, Lewis S.,
Davis, Hazel,
Davis, Hazel,
*Deacon, Elizabeth,
DeKay, Earle,
Douglass, Wm. A.,
Duffy, Alice E.,
Eason, Nellie,
Eason, Ray W.,
*Edgar D. Dixon,
Eells, H. L.,
Erwin, Minnie L.,
*Fogleman, Oma Verne,
*Fox, F. E.,
Galpin, M. C.,
*Gholson, H. E.,
*Ghrist, Orrie,
*Giese, Henry,
*Gifford, C.,
Gilchrist, Margaret,

TOWN
Holdredge,
Cedar Rapids,
Walker,
Jefferson,
Eldora,
Toledo,
Atlanta,
Belmond,
Danbury,
Ames,
Tama,
Denison,
Thompson,
Woodward,
West Liberty,
Clinton,
Lowell,
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Newton,
Oskaolosa,
Allendorf,
Milo,
Mt. Vernon,
Mt. Vernon,
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Sioux City,
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Garner,
Jefferson,
Jefferson,
Ames,
Rolle,
St. Charles,
Callender,
Ames,
Oakland,
Clarksville,
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Danville,
Omaha,
Ames,

COUNTY
Nebraska.
Linn.
Buchanan.
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Hardin.
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Pocahontas.
Madison.
Webster.
Story.
Pottawattamie.
Tennessee.
Story.
Des Moines.
Nebraska.
Story.

* Students also enrolled in other courses.
Greene, Harry A.,
*Guinn, Ray L.,
Hicks, Mrs. W. A.,
Hjort, Elmer V.,
Howard, H. H.,
*Jensen, Florence,
*Johnson, Hazel,
*Jones, Laura,
*Jordan, Hugo,
*Kelley, James Byron,
Kelley, M. A. Raymond,
*Kingston, Mabel F.,
*Kinney, Gratia,
*Kirkpatrick, Ellis L.,
Kirkham, Mrs. Mary E.,
Kjelleovig, Lars,
*Knapp, Hermine,
Kraft, J. Horace,
Lake, Carrie,
*Lako, John,
Lillard, Leona,
McAhren, Myrtle,
Meacham, Martha Lois,
Merrick, Grace A.
MacMurray, Mrs. A.,
*Moore, Ora B.,
Nanney, Leslie C.,
*Nash, C. W.,
*Neilson, W. R.,
Nolan, A. Maybelle,
*Olson, Marian E.,
Park, S. J.,
Parks, Laura,
Patty, R. L.,
Patty, R. L.,
Paulson, Cardie,
*Pearson, Ernest,
Pervier, Norville C.,
Peters, R. J.,
*Pollock, Roscoe C.,
*Ramey, Ethel,
*Reece, Howard E.,
Roberson, Violet,
Roddan, Marie,
Rush, Gladys,
Schmidt, Florence E.,
Secor, R. J.,
*Shinkle, Clara,
Shutts, H. J.,
*Skegg, Ella,
Smith, E. S.,
Smith, Mrs. E. S.,
Stanton, W. S.,
Sterns, Harvey,

Center Point, Linn.
Des Moines, Polk.
Mason City, Cerro Gordo.
Beacon, Mahaska.
Ames, Story.
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Dubuque, Story.
Nevada, Story.
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Ames, South America.
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Talca, Story.
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South English, Keokuk.
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Ames, Jasper.
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Ames, Crawford.
Ames, Keokuk.
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Ames, Hardin.
Ames, Polk.
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Ames, Dallas.
Ames, Story.
Ames, Buena Vista.
Ames, Story.
Ames, Humboldt.
Coin, Page.
Coin, Page.
Rockford, Floyd.
Ames, Story.

* Students also enrolled in other courses.
LIST OF STUDENTS

Storm, A. V.,
Sunderlin, Myrtle V.,
Swenson, Marie A.,
Taylor, Ilo T.,
*Thompson, Lora,
Thornburg, Mrs. E. R.,
*Tong, Edna,
Treasure, James F.,
*Troyke, Louis,
Tucker, Fred R.,
Uhde, Irma A.,
Wadson, Roberta
*Warner, J. H.,
*Watson, James G.,
Welch, F. A.,
Wells, Everett D.
Weston, Vallie,
*White, Ross P.,
*Wiest, P. R.,
*Wilcox, A. C.,
Wilson, Maude,
Wolcott, B. A.,
*Zentmire, Zelma,

Ames, Story.
Elkader, Clayton.
Story City, Story.
Sac City, Sac.
Burt, Kossuth.
Ames, Story.
Ames, Story.
Chariton, Lucas.
Ames, Story.
Panora, Guthrie.
Davenport, Scott.
Vinvent, Webster.
Ames, Story.
Ames, Story.
Hampton, Franklin.
Nashua, Chickasaw.
Ames, Story.
Ames, Story.
York, Pennsylvania.
Mt. Vernon, Linn.
Sac City, Sac.
Nevada, Story.
Ames, Story.

ENROLLMENT FOR SILO SCHOOL — Summer Session

NAME
Ackert, Abram,
Ames, A. D.,
Anderson, Leo F.,
*Arentson, James,
*Ashby, Wallace,
Baird, A. R.,
Baird, J. M.,
Bell, E. M.,
Bevan, W. A.,
*Blasingame, R. U.,
Bucklan, William
Burrow, L. A.,
*Carl, Leslie M.,
Carter, H. B.,
Chase, Walter,
Cummings, Roy H.,
Dannath, C. B.,
*Darbishire, G.,
Dorson, C. L.,
Fowler, E. S.,
Hansen, Hal,
Hansman, J. A.,
*Hoff, Carl R.,
Howard, Edwin B.,
Korethe, L. A.,
*Lako, John,
Lofstedt, O. B.,
Lynn, H. C.,
Mc Cannon, Guy R.,
McDonald, Charles B.,

TOWN
Dixon,
Kirkham,
Dawson,
Harlan,
Des Moines,
Redding,
Redding,
W iota,
Ames,
Auburn,
Ames,
Sumner,
Lone Tree,
Rock Valley,
Varina,
Beaver Creek,
Boone,
Shannon City,
Ames,
Kane,
Stanton,
Gilbert,
Grimes,
Ames,
Sheffield,
Ames,
Grand Junction,
Sirgourney,
Ames,
Ames,

COUNTY
Illinois.
Shelby.
Dallas.
Shelby.
Polk.
Ringgold.
Ringgold.
Cass.
Story.
Alabama.
Story.
Bremer.
Johnson.
Sioux.
Pocahontas.
Minnesota.
Boone.
Ringgold.
Story.
Illinois.
Montgomery.
Story.
Polk.
Story.
Franklin.
Story.
Keokuk.
Story.

* Students also enrolled in other courses.
<table>
<thead>
<tr>
<th>NAME</th>
<th>TOWN</th>
<th>COUNTY</th>
</tr>
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<tbody>
<tr>
<td>Abbey, Henry W.</td>
<td>Hawarden</td>
<td>Sioux</td>
</tr>
<tr>
<td>Abbey, Walter</td>
<td>Hawarden</td>
<td>Sioux</td>
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<tr>
<td>Adams, K. P.</td>
<td>Solon</td>
<td>Johnson</td>
</tr>
<tr>
<td>Adams, R. W.</td>
<td>Schaller</td>
<td>Sac</td>
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<tr>
<td>Adams, Stephen S.</td>
<td>Sioux City</td>
<td>Woodbury</td>
</tr>
</tbody>
</table>

* Students also enrolled in other courses.
Albaugh, Lester,
Albert, Leon,
Albert, Loran,
Alberts, Amos T.,
Anderson, Benjamin,
Anderson, Herbert,
Anderson, Oscar,
Andrew, Kenneth,
Anstey, Charles,
Appel, Karl C.,
Appelman, Carl,
Arthur, Charles H.,
Augburn, Leslie,
Bacon, Lloyd O.,
Baer, S. C.,
Bakehouse, A. H.,
Bakke, Henry,
Ball, David L.,
Ballew, Howard,
Barnes, Fred,
Barnett, Ray,
Barron, Ralph A.,
Bartlett, Arthur,
Bass, Paul L.,
Bates, F. A.,
Bauge, J. S.,
Bayless, Earl,
Bayman, Ray,
Beckman, Otto,
Bedell, L. E.,
Bell, Arthur E.,
Bennison, Wm. R.,
Benson, Carl,
Benson, Robert,
Benson, Willis,
Berg, Raymond,
Betz, Rev. W. H.,
Bishop, S. E.,
Bixler, Clarence,
Bjork, Albert,
Blankinson, Clarence,
*Blythe, Stuart O.,
Boice, R. H.,
Bolte, John,
Bond, Clair A.,
Bond, H. E.,
Boyce, Ernest,
Brinkmeyer, E. W.,
Brown, Frank,
Brown, Harry E.,
Brown, John L.,
Brown, Raymond,
Brown, Thayer E.,
Brownlee, Estey,
Brush, Frank,
Bunthuis, Allen,
Burlingame, Edward,
Ankeny,
Reinbeck,
Reinbeck,
Radcliffe,
Stanhope,
Shenandoah,
Bagley,
Spring Hill,
Massena,
Pella,
Clermont,
Spirit Lake,
Geneva,
Waterloo,
Odebolt,
Sigourney,
Decorah,
Quasqueton,
Moulton,
Milton,
Weston,
Waterloo,
Ireton,
Boone,
Allison,
Ames,
Kellerton,
Clarence,
Sperry,
Springville,
Underwood,
Lenox,
Leland,
Rose Hill,
Leland,
Pleasant Plain,
Attica,
Rudd,
Clarence,
Lanyon,
Belknap,
Washington,
Nashua,
Andrew,
Winterset,
Red Oak,
Winterset,
Radcliffe,
Shannon City,
Humboldt,
Grimes,
Inwood,
Turin,
Villisca,
Traer,
Rock Valley,
Norwalk.

Polk.
Tama.
Tama.
Hardin.
Hamilton.
Page.
Guthrie.
Warren.
Cass.
Mahaska.
Fayette.
Dickinson,
Indiana.
Black Hawk.
Sac.
Keokuk.
Winneshiek.
Buchanan.
Appanoose.
Van Buren.
Pottawattamie.
Black Hawk.
Sioux.
Boone.
Butler.
Story.
Ringgold.
Cedar.
Des Moines.
Linn.
Pottawattamie.
Taylor.
Illinois.
Mahaska.
Illinois.
Jefferson.
Marion.
Floyd.
Cedar.
Webster.
Davis.
D. C.
Chickasaw.
Jackson.
Madison.
Montgomery.
Madison.
Hardin.
Union.
Humboldt.
Polk.
Lyon.
Monona.
Page.
Tama.
Sioux.
Warren.

* Students also enrolled in other courses.
Burton, J. V.,
Butterfield, R. W.,
*Bye, Emil,
Byrns, George W.,
Callam, Eddie,
Callhoun, Elvin,
Callhoun, Roy,
Campbell, Jay,
Campbell, Ray L.,
Campbell, Walter,
Carlson, Elmer W.,
Carr, Oral,
Carson, E. C.,
Cartwright, T. C.,
Casey, John,
Catlin, S. H.,
Chapin, Kenneth,
Chapman, W. H.,
Clark, Will H.,
*Clause, Robert,
Coftand, W. T.,
Cook, Harold D.,
Coppage, E. M.,
Coppock, Robert E.,
Corlis, Ray B.,
Coughlin, Thomas L.,
Cramer, W. E.,
Crawford, R. H.,
Cromer, Will,
Curphey, Harold,
Curry, Roy,
Dahlin, Fridolf,
Davis, Allen,
Davis, John E.,
Day, F. W.,
Delfs, John,
De Reus, Clarence A.,
De Silva, W. O.,
Detoff, Arthur,
Dickey, H. W.,
Dickey, Ross,
Doggett, Ralph,
Doheny, Martin M.,
Doherty, Murat,
Dreus, Chris,
Drewelow, G. J. A.,
Drewelow, Oswald,
Dudley, Josiah,
Duncan, Rolly,
Dunlop, Kenneth M.,
Durks, Waldo E.,
Dwire, George H.,
Dyas, Roy W.,
Dymond, James E.,
Dymond, Lida E.,
Edwards, Galen,
Edwards, Vivian,

Batavia,
Irvington,
Ames,
Cooper,
Clarksville,
Shambaugh,
Shambaugh,
Maquoketa,
Oto,
Maquoketa,
Boxholm,
Moulton,
Woodburn,
Marshalltown,
Knoxville,
Vinton,
Tripoli,
New Hartford,
Mt. Vernon,
Beaver,
Blairstown,
Maquoketa,
Stanton,
West Branch,
Sabula,
Melrose,
Red Oak,
Afton,
Clinton,
Lenox,
Massena,
Lanyon,
Redfield,
Lime Springs,
Afton,
Gladbrook,
Mingo,
Allerton,
Le Mars,
Norwalk,
Norwalk,
Cambridge,
Cumming,
Maurice,
Moivre,
New Hampton,
New Hampton,
Churdan,
Morley,
Jefferson,
Clinton,
Central City,
Bellevue,
Lake Zurich,
Lake Zurich,
Clarksville,
Clarksville,

Illinois.
Kossuth.
Story.
Greene.
Butler.
Page.
Page.
Jackson,
Woodbury.
Jackson.
Boone.
Appanoose.
Clark.
Marion.
Benton.
Bremer.
Benton.
Linn.
Boone.
Benton.
Clinton.
Montgomery.
Cedar.
Jackson.
Monroe.
Montgomery.
Union.
Clinton.
Taylor.
Cass.
Webster.
Dallas.
Howard.
Union.
Tama.
Jasper.
Wayne.
Plymouth.
Warren.
Warren.
Polk.
Warren.
Sioux.
Woodbury.
Chickasaw.
Chickasaw.
Greene.
Jones.
Greene.
Clinton.
Linn.
Jackson.
Illinois.
Illinois.
Butler.
Butler.

* Students also enrolled in other courses.
LIST OF STUDENTS

- Students also enrolled in other courses.
LIST OF STUDENTS

Jacobson, Elmore,
Jacobson, Joseph,
James, Clyde K.,
Jamison, F. E.,
Jarvis, Kirk,
Jensen, George,
Jenson, Walter D.,
Jessen, Peter A.,
Jessen, Walter,
Joanning, Theodore,
Johnson, Arthur,
Johnson, Axel R.,
Johnson, Charles O.,
Johnson, Elmer,
Johnson, E. M.,
Johnson, Henry,
Johnson, Ray,
Johnson, Simon C.,
Johnson, Thomas A.,
Johnston, David,
Jones, Howard T.,
Jordan, Don D.,
Judson, E. C.,
Kading, Oscar,
Kahl, W. R.,
Keith, Stanley,
Kelly, Glen,
Kelsay, Harvey,
Kepper, Lawrence,
Kepper, Samuel,
Kerkhuff, Harry,
Kidder, Carl,
Kidder, Hugh,
Klostermann, Charles,
Knaur, Earl,
Kock, Walter,
Krakow, Fred,
Krakow, W. E.,
Krum boltz, Rollie,
Kruse, Henry,
Kuyper, A. C.,
Kurtz, William,
Kurtzweil, Carl,
Kwe ger, Carl,
Lamkin, Fred K.,
Lane, Halwin C.,
Lin e, Herbert,
Lang, Harry M.,
Lang, Howie,
Larsen, Harold L.,
Laugh lin, Emmet,
Lawrence, Paul,
Leathers, Forrest,
Lee, Harold L.,
Lehman, Albert,
Lehman, Frank,
Leonard, Frank,
Spaulding,
Gowrie,
Westfield,
Oakville,
Ames,
Dike,
Newell,
Exira,
Exira,
Alton,
Hawarden,
Paton,
Provo,
Gowrie,
Linn Grove,
Armstrong,
Coin,
Paton,
Jewell,
Clarinda,
West Branch,
Pleasantville,
Lamoni,
Casey,
Holstein,
Al gona,
Clarence,
V illisca,
Winfield,
Winfield,
Eldora,
Epworth,
Epworth,
Ashton,
Sheldon,
Hudson,
Franklin,
Franklin,
Pleasant Plain,
Sheldon,
Orange City,
Pleasant Plain,
Altoona,
Carroll,
Sheldon,
Adel,
Dallas,
Greenfield,
Brooklyn,
Newell,
Waukon,
Lake Park,
Fairfield,
Mitchellville,
Alleman,
Al gona,
Dayton,
Union,
Webster,
Plymouth,
Louisa,
Story,
Grundy,
Buena Vista,
Audubon,
Audubon,
Sioux,
Sioux,
Greene,
South Dakota,
Webster,
Buena Vista,
Emmet,
Page,
Greene,
Hamilton,
Page,
Cedar,
Marion,
Decatur,
Adair,
Ida,
Kossuth,
Cedar,
Montgomery,
Henry,
Henry,
Hardin,
Dubuque,
Dubuque,
Osceola,
Sioux,
South Dakota,
Lee,
Lee,
Jefferson,
Sioux,
Sioux,
Jefferson,
Polk,
Carroll,
O'Brien,
Dallas,
Marion,
Adair,
Poweshiek,
Buena Vista,
Allamakee,
Dickinson,
Jefferson,
Polk,
Polk,
Kossuth,
Webster.

* Students also enrolled in other courses.
Lewis, D. W.,
Lewis, Earl,
Lewis, Riley,
Lincoln, Carl A.,
Lincoln, Harry E.,
Ling, M. E.,
Linsted, Marion,
Loper, Lincoln E.,
Lovett, George,
Lubben, Harrison,
Lubben, Harry S.,
Luce, Ernie L.,
Lund, Chester,
Lundgren, E.,
Lunning, B. I.,
Lyon, Frank J.,
McArthur, Clarence E.,
McCain, Roy,
McConnell, R. C.,
McCray, Floyd E.,
McGee, J. W.,
McKee, Oscar,
McKissich, Ralph J.,
McPherson, W. N.,
McQuown, Earl,
McWhorter, Lewis V.,
Nash, John Farnsworth,
Neely, W. W.,
Neessen, Heeko C.,
Nelson, Carl,
Nelson, Elmer,
Nelson, John,
Nichols, Harold H.,
Nordholm, Wm. D. T.,
Nordinger, Robert P.,
Norman, E. H.,
Maclean, Elizabeth,
MacMurray, Arthur,
MacRae, Murdo,
Magel, P. R.,
Marsh, Gerald,
Martin, Edd,
Martin, Frank H.,
Mather, Paul,
*Meinke, Louis C.,
Meints, Arthur,
Meints, Carl C.,
Meleen, V. H.,
Merritt, Harold,
Merritt, W. F.,
Messers, Eli,
Michalek, Arthur,
Mickelsen, Elmer,
Miller, Albert W.,
Moen, Ervin,
Moore, Austin,
Moore, Don,
Gray,
Ankeny,
Ankeny,
Oelwein,
Oelwein,
Sheldon,
Tainter,
Indianola,
Lake City,
Monticello,
Balwin,
Hinton,
Stanhope,
Stanton,
Radcliffe,
Mason City,
Rippey,
Randolph,
Riceville,
Ames,
Riverside,
Tingley,
Albia,
Indianola,
Emerson,
Burt,
Cresco,
Greenfield,
Wellsburg,
Newell,
Inwood,
Roldan,
Cresco,
Pilot Mound,
Clarksville,
Van Meter,
Ames,
Ames,
Des Moines,
Sidney,
Humboldt,
Gibson,
Bagley,
West Branch,
Maquoketa,
Dixon,
Grand Mound,
Kiron,
Olin,
Allerton,
Dysart,
Bradgate,
Anthon,
Lanesboro,
Inwood,
New London,
Algona,
Audubon.
Polk.
Polk.
Fayette.
Fayette.
O'Brien.
Mahaska.
Warren.
Calhoun.
Jones.
Jackson.
Plymouth.
Hamilton.
Montgomery.
Hardin.
Cerro Gordo.
Greene.
Fremont.
Mitchell.
Story.
Washington.
Ringgold.
Monroe.
Warren.
Montgomery.
Kossuth.
Howard.
Adair.
Grundy.
Buena Vista.
Lyon.
Story.
Howard.
Boone.
Butler.
Dallas.
Story.
Story.
Polk.
Fremont.
Humboldt.
Keokuk.
Greene.
Cedar.
Jackson.
Scott.
Clinton.
Crawford.
Jones.
Wayne.
Tama.
Humboldt.
Woodbury.
Carroll.
Lyon.
Henry.
Kossuth.

* Students also enrolled in other courses.
LIST OF STUDENTS

Moore, Leslie,
Morrison, Boyd,
Morrison, Joseph,
Morrison, Merlin C.,
Moser, E.,
Moulds, Jesse,
Mudra, Frank,
Muench, Raymond,
Oakland, Ferris M.,
Olson, Chris T.,
Olson, Elmer J.,
Olson, Otto,
Olson, Walton,
Osia, P. P.,
Ossian, Martin,
Osterhout, D. Van,
O'Toole, J. P.,
Overholtzer, Walter,
Owens, Clifford,
Palmer, E. M.,
Palmer, F. A.,
Papke, Lester,
Parrish, J. Ensley,
Parsons, Earl,
Passmore, Charles L.,
Paulson, Leonard,
Pavlin, Laurel,
Peckhan, Ralph W.,
Pedersen, Wilbur,
Pehrson, Oscar,
Pemberton, A. L.,
Pemberton, Verlin L.,
Petersen, Albert,
Petersen, Henry J.,
Petersen, Jens W.,
Petersen, Edgar,
Petersen, Aaron,
Petersen, Bertrand R.,
Petersen, Elmer M.,
Petersen, Ernest,
Petersen, Gerhard R.,
Petersen, Lloyd R.,
Petersen, Oscar,
Phillips, Harrison,
Picht, Clyde W.,
Pierrot, Victor,
Plaehn, Roy,
Platner, Harold C.,
Pollock, Wilbur,
Porter, C. Wayne,
Porter, Ray R.,
Potter, L. B.,
Pritchard, John,
Proffitt, Williard,
*Pruessing, E. J.,
Reckemmer, Herbert,
Reedfern, Ray,
New London,
Boone,
Cascade,
Adelphi,
Dallas,
Lake City,
Creston,
Paton,
Badger,
Soldier,
Huxley,
Kiron,
Calamus,
Rutland,
Stanton,
Orange City,
Letts,
Grand River,
Lake City,
Des Moines,
Eddyville,
Sabula,
Shenandoah,
Little York,
Clinton,
Alden,
Kingsley,
Cresco,
Kimballtown,
Kossuth,
West Branch,
West Branch,
Exira,
Sheldahl,
Nevada,
Exira,
Lanyan,
Badger,
Dayton,
Cherokee,
Story City,
Harcourt,
Stanhope,
Pleasantville,
Iowa Falls,
Weaver,
Dike,
Mt. Vernon,
College Springs,
Little York,
Colfax,
New Hampton,
Boone,
Pleasantville,
Sabula,
Oelwein,
Roscoe

Henry.
Boone.
Jones.
Polk.
Dallas.
Calhoun.
Union.
Greene.
Webster.
Monona.
Story.
Crawford.
Clinton.
Humboldt.
Montgomery.
Sioux.
Louisa.
Decatur.
Calhoun.
Polk.
Mahaska.
Jackson.
Fremont.
Warren.
Clinton.
Minnesota.
Plymouth.
Howard.
Shelby.
Des Moines.
Cedar.
Cedar.
Audubon.
Polk.
Story.
Audubon.
Webster.
Webster.
Webster.
Cherokee.
Story.
Webster.
Hamilton.
Marion.
Hardin.
Lee.
Grundy.
Linn.

* Students also enrolled in other courses.
Rehder, Albert
Reid, Kenneth
Reimann, E. E.
Reisch, J. J.
Remele, Guy
Rensink, Ed
Rensink, Harry
Rice, Richard
Richardson, Lee S.
Rickert, Frank
Rickert, Herman
Reece, Elmer
Riggs, Albert H.
Risler, J. L.
Robison, L. H.
Rock, Helmuth
Roggenbach, Frank H.
Roggenbach, R. F.
Roghair, Nick
Rogne, Burney
Rose, W. G.
Roszell, James B.
Roszell, Judd S.
Rucker, Willie
Russell, Elwood P.
Safford, Charles G.
Safley, Alford
Sandholm, Harry
Sar, Frank
Schaffer, E. W.
Schenck, Lloyd
Scholten, Gerret
Schonhorst, Willie
Schultz, Adolph
Schulze, Wesley
Sealine, Arnold
Searle, Roy
Seeger, Charles
Seely, Edmund H.
*Severson, Guy
*Severson, Walter
Shannon, Ray
Shields, Phil
Shupe; Roy
Siemens, Bert
Simmons, O. W.
Singer, Wm. L.
Sinnett, S. T.
Smilden, Ivar
Smith, C. B.
Smith, Earle M.
Smith, Fred C.
Smith, Lester V.
Smith, Olmer O.
Smith, Ray H.
Smith, Ryan J.
Smith, W. J. J.

Hawarden, Orient
Booneville, LeMars
Bagley, Hespers
Boyden, Tracy
Keota, Reinbeck
Lacona, Ames
Mitchellville, Dixon
Wisner, Orange City
Sandwich, Knoxville
Laporte City, Sidney
Oakwell, Taycheedah
Bedford, Dayton
Essex, Pierson
Kossuth, Boyden
Alleman, Silver City
Van Horn, Stanhope
Hawarden, Morley
Oswego, Soldier
Soldier, Bradyville
Dunlap, Audubon
Goldfield
Guthrie Center, Winthrop
Muscatine, Clear Lake
Anamosa, Alleman
Grant, Grant
Dunkerton, Griswold
Van Meter, Dallas

* Students also enrolled in other courses.
<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
<th>County</th>
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<tbody>
<tr>
<td>Snodgrass, Everett</td>
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<td>Snyder, Glen</td>
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<td>Soe, Peter</td>
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<td>Spear, Philip</td>
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<td>Spear, Wm.</td>
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<td>Spencer, M. D.</td>
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<td>Spurlin, Dean L.</td>
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<td>Spurrier, L. H.</td>
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<td>Stacy, Charles</td>
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<td>Standley, A. W.</td>
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<td>Stanley, R. E.</td>
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<td>Stamerd, Loraine</td>
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<td>Stanton, Paul</td>
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<td>Sternberg, Ira B.</td>
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<td>Stevens, Henry S.</td>
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<td>Strohbehm, John</td>
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<td>Storjohann, Gus</td>
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<td>Stuckey, C. A.</td>
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<td>Stuedemann, Edwin</td>
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<td>Taber, M. Louis</td>
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<tr>
<td>Tangen, Tosten</td>
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<tr>
<td>Teachout, Russell</td>
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<tr>
<td>Teagarden, Ralph</td>
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<tr>
<td>Tesdahl, Severt</td>
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<td>Thompson, Carl L.</td>
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<tr>
<td>Thompson, Floyd</td>
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<td>Thompson, Walter C.</td>
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<tr>
<td>Thorsen, O. M.</td>
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<tr>
<td>Tinderholt, Frindeof C.</td>
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<tr>
<td>Toft, Howard</td>
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<tr>
<td>Toyne, Guy</td>
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<tr>
<td>Treloar, John</td>
<td></td>
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<tr>
<td>Treloar, Marion</td>
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<tr>
<td>Tripp, Dayton F.</td>
<td></td>
<td></td>
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<tr>
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* Students also enrolled in other courses.
Newton, Leonard E.,
Nieman, W. E.,
Pierson, N.,
Strickler, W. A.,
Thompson, G. L.,
Trerichs, Theo,
*Watson, William,

Jasper. Neuburg,
Nebraska City, Nebraska.
Des Moines, Polk.
Skidmore, Missouri.
Lamont, Buchanan.
Ackley, Hardin.
Grinnell, Poweshiek.

LIST OF STUDENTS

ENROLLMENT FOR SHORT COURSE IN BUTTERMAKING

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Enrollment for Short Course in Home Economics

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<td>Frerichs, Hannah</td>
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<td>Mitchellville</td>
<td>Polk</td>
</tr>
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<td>Clarinda</td>
<td>Page</td>
</tr>
<tr>
<td>Hendrickson, Ruth E.</td>
<td>Brooklyn</td>
<td>Poweshiek</td>
</tr>
</tbody>
</table>
LIST OF STUDENTS

Hildreth, Merle L.,
Huntington, Elizabeth,
Ineck, Anna,
Ingram, Blanche,
Jacobson, Helena,
Jewell, Gladys E.,
Johnson, Esther,
Lerew, Mary,
Lockwood, Mrs. Fred F.,
Lundin Edith C.,
McConnell, Mrs. R. C.,
McKie, Mildred,
Moen, Pearl,
Mohr, Minnie,
Mott, Mrs. Harriet A.,
Munson, Stella A.,
Naylor, Mrs. E. C.,
Oberg, Ida,
*Osborn, Eleanor,
Palmer, Bernice,
Parsons, Eloise,
Pedersen, Gertrude,
Peterson, Margaret S.,
Reynolds, Jessamine,
Roberts, Jessie Mae,
Schwab, Mrs. J. W.,
Shedd, Mrs. Mary Currier,
Spurrer, Ethel,
Spurrer, Eva,
Stevens, Mary,
Struve, Cora M.,
Sutter, Irene,
Theune, Susie M.,
Thompson, Mabel,
Thompson, Vera,
Trimble, Vivian,
Trow, Polly,
Valen, Matilda,
Walker, Blanche.
Walker, Elizabeth A.,

Alleman, Polk.
Corning, Adams.
Ames, Story.
Clarinda, Page.
Inwood, Lyon.
Lake City, Calhoun.
Gowrie, Webster.
Ames, Story.
Wesley, Kossuth.
Rudd, Floyd.
Riceville, Mitchell.
Northboro, Page.
Inwood, Lyon.
Breda, Carroll.
Des Moines, Polk.
Maxwell, Story.
Stratford, Maxwell.
Madrid, Boone.
Ames, Story.
Mitchellville, Polk.
Clarinda, Page.
Clarinda, Page.
Story City, Story.
Clarinda, Page.
Ames, Story.
Ames, Story.
Ames, Story.
Ogden, Boone.
Ogden, Boone.
Boone, Boone.
Almont, Clinton.
Kelley, Story.
Breda, Carroll.
Northboro, Page.
Ankeny, Polk.
College Springs, Page.
Ames, Story.
Story City, Story.
Clarinda, Page.
Paton, Greene.

STUDENT ENROLLMENT AT IOWA STATE COLLEGE
Year 1912-13

1—Division of Agriculture.

Graduate Students:

Agronomy 1
Animal Husbandry 5
Horticulture and Forestry 3
Dairying 2 11

Senior Class:

Agronomy 19
Dairying 11
Animal Husbandry 54
Horticulture and Forestry 9
Agricultural Engineering 7
Agricultural Education 3
Home Economics 22
Science and Agriculture 1 126

Junior Class:
Agronomy 19
Dairying 9
Animal Husbandry 58
Horticulture and Forestry 13
Agricultural Engineering 9
Home Economics 46 154

Sophomore Class:
Agronomy 22
Animal Husbandry 100
Dairying 19
Horticulture and Forestry 17
Agricultural Engineering 22
Agricultural Education 7
Home Economics 76 263

Freshman Class:
Agriculture 289
Agricultural Engineering 51
Agricultural Education 12
Home Economics 167 519

Specials:
Agriculture 19 19

Irregular:
Home Economics 10 10

Short Courses:
Two Year Agriculture 183
One Year Dairying 35
One Year Poultry 0 218

Winter Short Courses:
Agronomy and Animal Husbandry 565
Farm Dairying 15
Creamerymen 80
Home Economics 61 721
<table>
<thead>
<tr>
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<th>65</th>
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<tr>
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2—Division of Veterinary Medicine.

<table>
<thead>
<tr>
<th>Senior Class</th>
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<tbody>
<tr>
<td>Junior Class</td>
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<tr>
<td>Sophomore Class</td>
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<td>Freshman Class</td>
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3—Division of Engineering.

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<tbody>
<tr>
<td>Mechanical Engineering</td>
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</table>

|  | 495 |
4—Division of Science.

Graduate Students 4
Senior Class 11
Junior Class 5
Sophomore Class 21
Freshman Class 26
Specials 4
Irregular 3 74 74

5—Division of Music.

College of Music 9
Unclassified 121 130 130

6—Summer School.

Total 128 128 128

SUMMARY OF GRADUATES 1912

Number of first degrees granted 1872-1912 ...................... 2891 223

Present Courses

Animal Husbandry Course, 1904-1912 .......................... 222 34
Agronomy Course, 1905-1912 ................................ 90 16
Horticulture and Forestry Course, 1904-1912 ................. 43 7
Dairying Course, 1904-1912 .................................. 44 5
Science and Agricultural Course, 1909-1912 .................. 2 0
Agricultural Engineering, 1910-1912 .......................... 6 3
Veterinary, 1880-1912 ......................................... 253 25
Mechanical Engineering Course, 1872-1912 .................... 280 21
Civil Engineering Course, 1872-1912 ........................... 493 43
Electrical Engineering Course, 1892-1912 ...................... 343 31
Mining Engineering Course, 1897-1912 ........................ 45 10
Ceramics, 1910-1912 ............................................ 4 2
Science Course, as related to the Industries, 1875-1912 ...... 481 11
Home Economics Course, 1907-1912 ............................ 60 23
Industrial Chemistry, 1910-1912 ............................... 2
## LIST OF STUDENTS

### Courses Discontinued

<table>
<thead>
<tr>
<th>Course</th>
<th>Students</th>
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<tbody>
<tr>
<td>Agricultural Course, leading to Degree B. S., 1872-1880</td>
<td>102</td>
</tr>
<tr>
<td>Agricultural Course, leading to Degree B. S. A., 1883-1888 and 1894-1904</td>
<td>86</td>
</tr>
<tr>
<td>Science and Agriculture Course, leading to Degree B. S., 1889-1890 and 1909-1911</td>
<td>47</td>
</tr>
<tr>
<td>General Science Course for Ladies, 1872-1880 and 1904</td>
<td>48</td>
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<tr>
<td>General and Domestic Science Course, leading to Degree of B. L., 1887-1899</td>
<td>93</td>
</tr>
<tr>
<td>General and Domestic Science Course, leading to Degree of B. Ph., 1899-1900</td>
<td>21</td>
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<td>General and Domestic Science Course, leading to Degree of B. S., 1901-1908</td>
<td>78</td>
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<tr>
<td>Agronomy Course, leading to Degree B. Ag., 1891-1898</td>
<td>50</td>
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<tr>
<td>Higher Degrees, 1872-1912</td>
<td>179</td>
</tr>
<tr>
<td>Master of Scientific Agriculture</td>
<td>55</td>
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<tr>
<td>Master of Science</td>
<td>41</td>
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<tr>
<td>Other Master’s Degrees</td>
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</tr>
<tr>
<td>Engineers</td>
<td>56</td>
</tr>
<tr>
<td>Honorary Degrees</td>
<td>12</td>
</tr>
<tr>
<td>Advanced Degrees in Veterinary</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Students: 2891 233
Index

Accredited Schools, Admission from ........................................ 38
Administrative Officers ...................................................... 8
Advanced Standings ............................................................ 55
Agricultural Courses .......................................................... 40
Certificates ............................................................................. 43
Engineering Courses ............................................................. 40
Examination for ...................................................................... 44
Irregular College Students ...................................................... 57
One Year Course in Dairying .................................................. 348
One Year Course in Poultry Husbandry .................................. 348
Graduate Study .................................................................... 68
Requirements for .................................................................... 39
Science Courses .................................................................... 40
Special Students ..................................................................... 56
Transfer ................................................................................. 42
Two Year Course in Agriculture ............................................. 348
Two Year Course for Homemakers ......................................... 348
Two Year Trade School Work in Engineering ......................... 348
Veterinary Course ................................................................. 40
Agricultural Chemistry.
  Department of ................................................................. 286
  Descriptive Courses ......................................................... 288
Agricultural Courses ............................................................. 82
Agricultural Education .......................................................... 137
Agricultural Engineering ....................................................... 128
Agronomy .............................................................................. 86
Animal Husbandry ............................................................... 99
Dairying ................................................................................. 95
Dairying, One Year Course .................................................. 354
Electives ................................................................................. 156
Extension Work ..................................................................... 164
Graduate Study ...................................................................... 70
Home Economics .................................................................... 145
Horticulture and Forestry ....................................................... 110
Poultry Husbandry .............................................................. 102
Poultry Husbandry, One Year Course .................................. 352
Winter Short Courses .......................................................... 373
Two Year Course in Agriculture ........................................... 349
Two Year Course for Homemakers ........................................ 358
Agricultural Education.
  Course, Four Year ................................................................ 138
  Department of .................................................................... 137
  Descriptive Courses ......................................................... 141
Agricultural Engineering.
  Course, Four Year ................................................................ 131
  Department of .................................................................... 128
  Descriptive Courses ......................................................... 134, 351, 376
  Graduate Study .................................................................... 74
  School of Silo Construction ................................................. 377
  Winter Short Course .......................................................... 376
Agricultural Experiment Station ............................................. 160
  Station Staff ....................................................................... 23
Agricultural Extension .......................................................... 164
  Extension Staff .................................................................... 26
Agricultural Journalism ......................................................... 142
  Descriptive Courses ......................................................... 143
Agricultural Scholarships ...................................................... 84, 130
Agricultural Short Courses ................................................... 346
Agriculture, Division of ......................................................... 82
Agronomy (See Farm Crops and Soils).
  Department of .................................................................... 86
  Four Year Course ............................................................... 88
Alumni Association ............................................................... 64
Animal Husbandry.
  Department of .................................................................... 99
  Descriptive Courses ......................................................... 107, 351, 373
  Four Year Course ............................................................. 103
  Graduate Study .................................................................... 72
  Winter Short Course .......................................................... 373
Bacteriology.
  Department of .................................................................... 306
  Descriptive Courses ......................................................... 308, 365
  Graduate Courses ............................................................. 75
Board of Education ............................................................... 7
Botany.
  Department of .................................................................... 295
  Descriptive Courses ......................................................... 296, 365
  Entrance Requirements .................................................... 39
  Graduate Work .................................................................... 76
  Winter Short Course .......................................................... 378
Buildings ................................................................................. 32
Calendar .................................................................................. 5
Ceramics and Clay Working.
  Course, Four Year ................................................................ 263
  Department of .................................................................... 260
  Descriptive Courses ......................................................... 266
Chemical Engineering.
  Course, Four Year ................................................................ 268
  Department of .................................................................... 267
  Descriptive Courses ......................................................... 271
Chemistry.
  Agricultural ......................................................................... 288, 365
  Chemical Engineering ......................................................... 291
  Department of .................................................................... 286
  Engineering ......................................................................... 290
  Graduate .............................................................................. 77
  Home Economics ............................................................... 290
  Industrial .............................................................................. 291
  Science ................................................................................. 292
  Veterinary ............................................................................ 294
Civil Engineering.
  Course, Five Year ................................................................ 218
  Course, Four Year ................................................................ 214
  Department of .................................................................... 209
  Descriptive Courses ......................................................... 222
Classification and Standings .................................................. 59
Clay, Robinson & Co. Fellowship ........................................... 84
Credits.
  For Admission ..................................................................... 40
  For Advanced Standings ..................................................... 55
  From Other Colleges and Universities ............................... 42
  For Practical Work in Agriculture ....................................... 84
Committees.
  State Board of Education .................................................. 7
  Faculty ................................................................................... 11
Dairying.
  Course, Four Year ................................................................ 96
  Course, One Year ................................................................ 354
  Department of .................................................................... 95
  Descriptive Courses ......................................................... 98, 355, 376
  Graduate Work .................................................................... 72
  Winter Short Course .......................................................... 376
Degrees.
  Bachelors ............................................................................. 30, 131, 267
  Doctors .................................................................................... 30, 169
INDEX

Geology.
Department of .................................. 300
Descriptive Courses .................................... 257, 301
Graduate Work ....................................... 78

German.
Descriptive Courses ..................................... 324
Entrance Requirements .................................. 39

Good Roads (see Iowa State Highway Commission.)

Government ......................................... 61
Graduate Work ........................................
Agricultural Division ................................... 70
Engineering Division ................................... 69
Fees .................................................... 68
Science Division ....................................... 75
Graduate Students ..................................... 390
Graduates, Summary of ................................ 450
Graduating Thesis ...................................... 62
Grands, College ....................................... 32

History.
Department of ....................................... 317
Descriptive Courses .................................... 317, 367
Entrance Requirements ................................ 39

Home Economics.
Course, Four Year ..................................... 147
Department of ....................................... 145
Descriptive Courses .................................... 151, 377
Electives .............................................. 155, 156
Two Year Trade Courses for Homemakers ............. 348
Winter Short Course ................................... 377

Honor Students ....................................... 391

Horticulture and Forestry.
Course, Four Year ..................................... 114
Department of ....................................... 110
Descriptive Courses .................................... 116, 375
Graduate Work ........................................ 73
Winter Short Course ................................... 375

Hospital ............................................... 62

Iowa State Highway Commission ....................... 25

Library ............................................... 63, 328
Descriptive Courses .................................... 329

Literary Contests, Honors in .......................... 387

Literary Societies ..................................... 65

Literature.
Department of ....................................... 313
Descriptive Courses .................................... 315, 366
Location ................................................ 31
Manual Labor .......................................... 41
Margaret Hall ......................................... 32, 58
Masters' Degrees ....................................... 68

Mathematics.
Department of ....................................... 282
Descriptive Courses .................................... 283, 368
Entrance Requirements ................................ 39

Mechanical Engineering.
Course, Five Year ...................................... 201
Course, Four Year ...................................... 196
Department of ....................................... 192
Descriptive Courses .................................... 205

Military Science and Tactics.
Department of ....................................... 327
Descriptive Courses .................................... 328
Roster of Cadet Corps .................................. 389

Mining Engineering.
Course, Five Year ...................................... 250
Course, Four Year ...................................... 246
Department of ....................................... 243
Descriptive Courses .................................... 254

Modern Languages.
Department of ....................................... 323
Descriptive Courses .................................... 323, 369
Entrance Requirements ................................ 39

Music.
Descriptive Courses .................................... 337

Masters .................................................. 68

Departments Maintained ................................ 60

Division of
Agriculture ............................................. 82
Engineering ............................................. 186
Science .................................................. 278
Veterinary .............................................. 168

Economic Science.
Department of ....................................... 310
Descriptive Courses .................................... 310, 366
Graduate Work ......................................... 78

Electives.
Agricultural Courses .................................... 156
Entrance Requirements ................................ 41
Science Courses ........................................ 279

Electrical Engineering.
Course, Five Year ...................................... 237
Course, Four Year ...................................... 233
Department of ....................................... 231
Descriptive Courses .................................... 241

Engineering Courses.
Chemical Engineering, Four Year ........................ 260
Course .................................................. 267
Civil Engineering, Five Year Course ................... 218
Civil Engineering, Four Year Course ................... 214
Descriptive Courses .................................... 191, 362
Electrical Engineering, Five Year Course .............. 237
Electrical Engineering, Four Year Course .............. 233
Mechanical Engineering, Five Year Course ............. 201
Mechanical Engineering, Four Year Course ............. 197
Mining Engineering, Five Year Course ................. 250
Mining Engineering, Four Year Course ................. 246

Two Year Trade School Work in Engineering ........... 360

Engineering, Division of ................................ 186
Experiment Station ....................................... 274
Station Staff ............................................ 27
Engineering Extension Staff ............................ 27

English.
Department of ....................................... 313
Descriptive Courses .................................... 314, 366
Entrance Requirements ................................ 39

Enrollment of Students ................................ 390

Examination Periods ................................... 45
Requirements .......................................... 39, 348

Examinations.
Entrance ................................................ 44
For Back Work .......................................... 60
Expenses ................................................ 57
Faculty .................................................. 11

Farm Crops.
Descriptive Courses .................................... 90, 356
Graduate Work ......................................... 71

Winter Short Courses .................................. 374
Fees and Expenses ..................................... 37, 373
Five Year Courses ..................................... 30
Forensic League ........................................ 65

French.
Descriptive Courses .................................... 323
Entrance Requirements ................................ 39
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of</td>
<td>336</td>
</tr>
<tr>
<td>Tuition</td>
<td>342</td>
</tr>
<tr>
<td>Musical Organizations</td>
<td>66</td>
</tr>
<tr>
<td>Officers of Administration</td>
<td>8</td>
</tr>
<tr>
<td>Officers of Instruction</td>
<td>11</td>
</tr>
<tr>
<td>Organization and History</td>
<td>28</td>
</tr>
<tr>
<td>Photography</td>
<td>144</td>
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<tr>
<td>Physical Culture</td>
<td></td>
</tr>
<tr>
<td>Department of</td>
<td>332</td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>333</td>
</tr>
<tr>
<td>Physical Training</td>
<td></td>
</tr>
<tr>
<td>Department of</td>
<td>329</td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>330, 369</td>
</tr>
<tr>
<td>Physics and Illuminating Engineering</td>
<td></td>
</tr>
<tr>
<td>Department of</td>
<td>258</td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>258, 370</td>
</tr>
<tr>
<td>Poultry Husbandry</td>
<td>102, 353</td>
</tr>
<tr>
<td>Course, One Year</td>
<td>352</td>
</tr>
<tr>
<td>Graduate Work</td>
<td>73</td>
</tr>
<tr>
<td>Winter Short Course</td>
<td>374</td>
</tr>
<tr>
<td>Practical Work</td>
<td>84</td>
</tr>
<tr>
<td>Prizes, Clay Robinson &amp; Co.</td>
<td>84</td>
</tr>
<tr>
<td>Professional Degrees</td>
<td>69</td>
</tr>
<tr>
<td>Psychology</td>
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</tr>
<tr>
<td>Department of</td>
<td>320</td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>320</td>
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<td>Publications</td>
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<td>65</td>
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<td>65</td>
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<td>Public Speaking</td>
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</tr>
<tr>
<td>Department Courses</td>
<td>322</td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>322, 370</td>
</tr>
<tr>
<td>Religious Life of College</td>
<td></td>
</tr>
<tr>
<td>Scholarships, Agricultural</td>
<td>84</td>
</tr>
<tr>
<td>Science, General</td>
<td></td>
</tr>
<tr>
<td>Course, Four Year</td>
<td>279</td>
</tr>
<tr>
<td>Electives</td>
<td>279, 281</td>
</tr>
<tr>
<td>Entrance Requirements</td>
<td>39</td>
</tr>
<tr>
<td>Graduate Work</td>
<td>75</td>
</tr>
<tr>
<td>Scope of Instruction</td>
<td>29</td>
</tr>
<tr>
<td>Short Courses</td>
<td></td>
</tr>
<tr>
<td>Enrollment</td>
<td>444</td>
</tr>
<tr>
<td>Junior Winter</td>
<td>378</td>
</tr>
<tr>
<td>One Year Dairying</td>
<td>354</td>
</tr>
<tr>
<td>One Year Poultry Husbandry</td>
<td>348</td>
</tr>
<tr>
<td>School of Silo Construction</td>
<td>377</td>
</tr>
<tr>
<td>Summer School</td>
<td>384</td>
</tr>
<tr>
<td>Two Year Course in Agriculture</td>
<td>249</td>
</tr>
<tr>
<td>Two Year Course for Homemakers</td>
<td>348</td>
</tr>
<tr>
<td>Two Year Trade School Work in Engineering</td>
<td>348</td>
</tr>
<tr>
<td>Winter</td>
<td>373</td>
</tr>
<tr>
<td>Winter, Engineering Lines</td>
<td>379</td>
</tr>
<tr>
<td>Soils</td>
<td></td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>92, 358, 375</td>
</tr>
<tr>
<td>Graduate Work</td>
<td>71</td>
</tr>
<tr>
<td>Winter Short Course</td>
<td>375</td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
</tr>
<tr>
<td>Descriptive Courses</td>
<td>326</td>
</tr>
<tr>
<td>State Board of Education</td>
<td>7</td>
</tr>
<tr>
<td>State Teachers' Certificate</td>
<td>388</td>
</tr>
<tr>
<td>Student Enrollment</td>
<td>394</td>
</tr>
<tr>
<td>Summary of</td>
<td>447</td>
</tr>
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