

COLLEGE OF  
Agriculture and Biological  
Sciences  
1969-1970

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no.2  
April  
1969  
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SOUTH DAKOTA STATE UNIVERSITY, BROOKINGS, SOUTH DAKOTA 57006



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# UNIVERSITY CALENDAR — 1969-70

The regular University Year is Divided into Fall and Spring Semesters of approximately seventeen weeks each. The Summer Session is eight weeks.

## 1969 FIRST SEMESTER

- Sept. 7, 8, 9, Sun., Mon., Tues.—New Student Days.
- Sept. 10, 11, Wed., Thurs.—Registration.
- Sept. 12, Fri.—Beginning of Classes.
- Sept. 19, Fri.—Last day to initiate registration.
- Sept. 26, Fri.—Last day to add a course.
- Oct. 14, Tues.—Last day to submit a graduation card.
- Oct. 14, Tues.—Last day for make-up exams to remove undergraduate incompletes. Grades due for removal of incompletes in Admissions and Records Office on Oct. 16, Thursday.
- Oct. 18, Sat.—Hobo Day, University of South Dakota.
- Oct. 20, Mon.—No Classes.
- Nov. 5, Wed.—Fall term deficiency reports due.
- Nov. 11, Tues.—A holiday—Veterans Day.
- Nov. 19, Wed.—Last day course may be dropped without a grade.
- Nov. 26, Wed.—Classes close at 12:30, Thanksgiving Recess.
- Dec. 1, Mon.—Classes resume.
- Dec. 19, Fri.—Classes close at 12:30, Christmas Recess.

## 1970 SECOND SEMESTER

- Jan. 26, 27, Mon., Tues.—Registration.
- Jan. 28, Wed.—Beginning of Classes.
- Feb. 4, Wed.—Last day to initiate registration.
- Feb. 11, Wed.—Last day to add a course.
- Feb. 27, Fri.—Last day to submit graduation cards.
- Feb. 27, Fri.—Last day for make-up exams to remove undergraduate incompletes. Grades due for removal of incompletes in Admissions and Records Office on March 3, Tuesday.
- Mar. 20, Fri.—Spring term deficiency reports due.
- Mar. 25, Wed.—Last day of classes—Easter Recess.
- Mar. 31, Tues.—Classes resume.
- April 3, Fri.—Last day course may be dropped without a grade.
- May 22, 23, 25, 26, 27, Fri., Sat., Mon., Tues., Wed.—Semester Exams.
- May 29, Fri.—Grades due at 10:00 a.m.
- May 31, Sun.—Eighty-fourth annual commencement, 7:30 p.m.

## 1970

- Jan. 5, Mon.—Classes resume.
- Jan. 16, 17, 19, 20, 21, Fri., Sat., Mon., Tues., Wed.—Semester Exams.
- Jan. 23, Fri.—Grades due at 10:00 a.m.
- Jan. 24, Sat.—Graduation at 10:00 a.m.

## 1970 SUMMER SESSION

- June 8, Mon.—Registration.
- June 8, Mon.—Beginning of Classes at 1:00 p.m.
- July 31, Fri.—Summer Session closes.
- Aug. 1, Sat.—Graduation at 7:30 p.m.

## 1969-70 CALENDAR

June, 1969

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29	30					

July, 1969

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August, 1969

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September, 1969

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October, 1969

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November, 1969

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December, 1969

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January 1970

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March, 1970

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April, 1970

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May, 1970

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June, 1970

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July, 1970

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August, 1970

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September, 1970

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BULLETIN

# South Dakota State University

BROOKINGS, SOUTH DAKOTA 57006

ANNUAL CATALOG NUMBER 1969-70

COLLEGE OF

## Agriculture and Biological Sciences

1969-1970



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# College of Agriculture and Biological Sciences

DUANE C. ACKER, Dean

The academic program in the College of Agriculture and Biological Sciences is two fold: One portion deals with the traditional field of agriculture and the other biological sciences. A core curriculum is available in each of these two broad fields of endeavor.

The agricultural work at South Dakota State University is of four kinds—resident instruction, research, extension, and statewide services. Experiments and investigations for the benefit of agriculture are carried on in connection with problems of livestock (cattle, horses, poultry, sheep and swine), soils, field crops, veterinary science, horticultural crops, agricultural economics, plant pathology, rural sociology and mechanized agriculture. The results of research form the basis for classroom instruction, for extension work, and for a means of answering inquiries coming to the College. The Extension Service makes the work of instruction statewide by bringing results of research to every home in the state.

The work in biological sciences is located mainly in the departments of Bacteriology, Botany-Biology, Entomology-Zoology, and Wildlife Fisheries Science. One also must realize that biological science is an integral part of all departments that deal with plant and animal sciences. Many of our future biology teachers, wildlife biologists, plant and animal physiologists and geneticists will find the program in biological sciences a fruitful one to follow.

Biological science includes all technical and professional occupations dealing with the basic fields of plant and animal life, collectively called biology. Such public agencies as high schools, colleges and universities, park services, fish and wildlife agencies, etc., are all demanding educated individuals in the field of biological sciences. More leisure and a desire of people "to get out of doors" has put extreme pressure on outdoor recreational facilities. Many programs in biological science are designed to meet this need. The biology teacher in the secondary schools as well as the college teacher of biology, botany, entomology, bacteriology, plant physiology and zoology will all find programs for them in the College of Agriculture and Biological Sciences.

Agriculture includes technical, professional, and business occupations dealing with the producing, processing, and distribution of farm products. The agricultural teachers, the agricultural researchers, the men and women who produce and supply the farmer with his complex needs, the farmers and ranchers themselves, the processors of the farm products, and the retailers are all a part of modern day agriculture. All told, they add up to nearly 40% of the 65 million employed people in the U. S., making agriculture the nation's biggest single industry.

The aim of resident instruction is to prepare men and women for successful work and leadership in the various phases of agriculture and biological science and to further the development of well-rounded, educated individuals capable of assuming responsible positions in our society. The curricula, while designed for today, provide the principles necessary for that of tomorrow, for a sound program in general education is included. All curricula lead to the Bachelor of Science Degree.

Most students in the College of Agriculture and Biological Sciences will be required to take a basic core of courses. The greater share of these courses should be taken during the first and second years of college.

If they wish, freshmen may enter these curricula without specifying a major. Students, however, should make their choice of major and option by the last semester of the sophomore year. The purposes, objectives, and requirements of the various majors and options are outlined in the discussions under the various departments. If at any time a student desires a change in major and/or option, he should report to the Director of Resident Instruction for adviser reassignment.

All students must complete a minimum of 25 semester hours of credit in courses numbered 300 or above to qualify for the B.S. degree. Mathematical Analysis 164-254 may be counted toward the total.

At the discretion of the various departments a minimum of 24 semester credit hours shall constitute a major; sixteen semester hours shall qualify a student for a minor.

The core curricula which follow include the over-all college and University requirements. A student should make every effort to complete these requirements as early as possible in his four-year program.

### Core Curriculum in Agriculture

Leading to the degree Bachelor of Science

Physical Education, HPER 101 or 121 .....	2
Communications .....	11 or 12
English, Engl 103 or 113 or 143 and 303 .....	6
Fundamentals of Speech, Sp 103 .....	3
Publicity Methods, J 322 or Ad- vanced Exposition, Engl 350 .....	2 or 3
Social Science .....	9
Introduction to Sociology, RS 153 .....	3
Principles of Economics, Econ 203 .....	3
National Government, PolS 213 or State and Local Govern- ment, PolS 243 .....	3
Humanities and/or Social Science electives* .....	8
Science and Mathematics .....	20
General Chemistry, Ch 114 or 164† .....	4
Algebra, Math 113 or Algebra and Trigonometry, Math 145 .....	3 or 5
Introductory Physics, Phy 104 or Elementary Physics, Phy 114 or General Physics, Phy 195 .....	4 or 5
Biological Science‡ .....	6
Science and Math Elective to total 20 hours§ .....	
Group I Courses in Agriculture (See list following) .....	12
Departmental and Option require- ments and General electives .....	73-74
Total Hours for Graduation .....	136

### Group I Courses in Agriculture

A minimum of 12 credits from courses listed below must be selected and should be completed during the first two years. Some departments require all or specific courses, while others leave the selection entirely to the student and the adviser.

Course	Credit
Crop Production, PS 103 .....	3
Soils, PS 213 .....	3
Introduction to Animal Science, AS 103 .....	3
Livestock Management, AS 203, or Animal Nutrition, AS 243 .....	3
Elements of Dairying, DS 103 .....	3
Dairy Foods, DS 323 .....	3
Farm Management, Econ 234 or Agricultural Economics, Econ 383 .....	4 or 3
Introduction to Entomology, Ent 103 .....	3

\*See page 49 for approved listing.

†Those students following Bacteriology, Botany, Entomology, Plant Science, Pre-Veterinary Science or Zoology majors or science options in other majors must take Ch 164.

‡Students must choose courses from the Departments of: Bacteriology, Botany-Biology, Entomology, Zoology and the field of Plant Pathology unless specified in the departmental requirements.

§Most departmental curricula will have specific requirements in this area, but for those that do not, the courses should be selected from the fields of bacteriology, botany-biology, chemistry, entomology, geology, mathematics, physics, plant pathology and zoology. Courses in Group I which are of a basic science nature (Ent 103, PS 102 or 234) cannot be counted toward this requirement unless they are over and above the 12 credit minimum for Group I courses.

General Horticulture, Ho 103.....	3
General Forestry, Ho 112 or Farm Forestry, Ho 313.....	3
Farm Mechanics, MA 202 or Farm Power and Machinery, MA 213 or	3
Electricity for Farm and Home, MA 222 or Soil and Water Mechanics I, MA 342 .....	2 or 3
Plant Pathology in Human Affairs, PS 102 or Plant Pathology, PS 234.....	2 or 4
Poultry Management, AS 303.....	3

IN ADDITION TO THE BASIC PROGRAM AS OUTLINED ABOVE, THREE OPTIONS ARE POSSIBLE UNDER THE CORE IN AGRICULTURE. THESE OPTIONS ARE BUSINESS, SCIENCE AND PRODUCTION.

**BUSINESS OPTION**

This option is for students who plan to enter any of the business phases of agriculture, i.e., sales, administration, public relations, technical advances, etc. Those interested in farming and ranching might also consider this option for each is becoming a significant business enterprise. Students selecting this option will complete the general requirements listed in the College Core for Agriculture plus the following additional requirements to complete their work for a Bachelor of Science Degree. The more specific requirements are listed under the appropriate option in each departmental curriculum.

Course	Credits
Principles of Economics II, Econ 213 .....	3
Principles of Accounting I, Econ 223.....	3
Business Management, Econ 343 .....	3
Business Electives** .....	12

\*\*The business electives must be chosen from the following courses:

- Principles of Accounting II, Econ 233
- Business Law I, Econ 303
- Marketing, Econ 323
- Money and Banking, Econ 333
- Business Finance, Econ 363
- Managerial Use of Accounting Data, Econ 373
- Statistics, Econ 353 or equivalent
- Marketing Agricultural Products, Econ 463

**SCIENCE OPTION**

This option is for the student who desires a strong emphasis in the physical and biological sciences. He will, therefore, be more able to cope satisfactorily with the rapidly

occurring scientific advances of the day. This option will also place a student in a good position to do graduate work in most agricultural fields. Students majoring in this option will complete the general requirements listed in the College Core in Agriculture plus the following additional requirements. The more specific requirements are listed under the appropriate option in each departmental curriculum.

Chemistry .....	10
Mathematics and/or Physics .....	6
Biological Science†† .....	9

††Courses must be selected from at least 2 of the following areas: Bacteriology, Botany and Biology, Entomology, Zoology, and Plant Pathology.

**PRODUCTION OR TECHNICAL  
OPTION**

This option is for the student who desires a broad and more general education in Agriculture. Those who plan to return to the farm, do county extension work, or serve as fieldmen for breed associations and crop improvement associations will find this to be the logical option. This option also serves the student well who plans to enter any of the areas of production, such as dairy herd supervisor, greenhouse operator or into the various Federal and State agencies upon graduation. No further courses beyond the General Core for Agriculture are required by the College. The more specific requirements beyond the Core are listed under the appropriate option in each departmental curriculum.

### Core Curriculum in Biological Science

Leading to the degree Bachelor of Science

Physical Education, HPER 101 or 121.....	2	General Bacteriology, Bac 204.....	4
Communications .....	12	Genetics, Bio 303 .....	3
English, Engl 103 or 113 or 143, 303 and 350.....	9	Other Science and Mathematics .....	29-33
Fundamentals of Speech, Sp 103.....	3	Algebra and Trigonometry, Math 113-133 or 145 .....	5-6
Social Science .....	9	Elementary Physics, Phy 114-124 or General Physics, Phy 195, 215.....	8-10
Introduction to Sociology, RS 153.....	3	General Chemistry, Ch 164, 171, 173 .....	8
Principles of Economics, Econ 203 .....	3	Organic Chemistry, Ch 134, 224 or 310 .....	4-5
National Government, PolS 213 or State and Local Government, PolS 243 .....	3	Chemistry elective .....	4
Humanities and/or Social Science .....		Departmental Requirements and General Electives .....	59-63
Electives* .....	8	Total Hours toward Graduation.....	136
Biological Science .....	13		
Biology, Bio 113, 123.....	6		

\*See page 49 for approved listing.

### The Curriculum in Agricultural Science

This curriculum meets present day requirements in the basic sciences. Students completing it will be prepared to engage in graduate work or to enter specialized research laboratories. It is important that the student recognize the value of this program for his particular qualification early in his school career. The student entering this curriculum will have a suitable adviser assigned by the Director of Resident Instruction. This adviser will be responsible for the student's program throughout his undergraduate college work. The student must maintain a superior academic standing to complete the program satisfactorily.

College Algebra and Trigonometry, Math 145.....	5
Mathematical Analysis I, Math 155.....	5
Agricultural Electives .....	5

<b>Sophomore Year</b> .....	<b>Credits</b>
General Bacteriology, Bac 204 .....	4
Introduction to Sociology, RS 153 .....	3
Fundamentals of Speech, Sp 103 .....	3
Mathematical Analysis II-III, Math 165-254 .....	9
Quantitative Analysis, Ch 214 .....	4
Principles of Economics I, Econ 203 .....	3
Agricultural Electives .....	8

<b>Junior Year</b> .....	<b>Credits</b>
Junior Composition, Engl 303 .....	3
Advanced Exposition, Engl 350 .....	3
General Physics I-II, Phy 195-215 .....	10
Genetics, Bio 303 .....	3
National Government, PolS 213 .....	3
Agricultural Electives .....	8
Electives .....	9

<b>Senior Year</b> .....	<b>Credits</b>
Organic Chemistry, Ch 310-320 .....	10
Foreign Language .....	8
Statistics Elective .....	3
General Electives .....	13

<b>Freshman Year</b> .....	<b>Credits</b>
Freshman Composition, Engl 103 or 113 or 143 .....	3
Physical Education, HPER 101 or 121 .....	2
Biology, Bio 113-123.....	6
General Chemistry, Ch 164.....	4
General Chemistry Laboratory, Ch 171.....	1
General Chemistry, Ch 173.....	3

### Agricultural Education (AgEd)

Professor Gadda; Instructor Pollmann

The National Vocational Education Acts require and provide for training of teachers of vocational agriculture. This work has been assigned to South Dakota State University, and has been approved by the State Board of Education and by the Division of Vocational Education of the U. S. Office of Education. Accordingly, the College of Agriculture and Biological Sciences and the College of Arts and Science cooperate in offering such teacher preparation. Students preparing to teach enroll in all required core

courses in the College of Agriculture and Biological Sciences. They earn a major in Agricultural Education, with supporting preparation in technical agriculture, basic sciences, and communications skills to make up the total requirement. Teachers of Vocational Agriculture in South Dakota receive the appropriate certificate to teach in high school, issued by the State Department of Public Instruction. The Professional Education requirement is 22 semester credits in Education including Student Teaching in



Vocational Agriculture. The student teaching is done in designated Agriculture departments of high schools in South Dakota.

Students enrolled in this curriculum must file an application with the Agricultural Education Office prior to enrolling in professional Education courses. Admission to

such courses is based on the following minimum qualifications: (1) An all-university G.P.A. of 2.0 for admission to Education courses, and 2.2 for student teaching; (2) Acceptable university entrance scores; (3) Satisfactory personal, moral, psychological and physical qualifications.

### Curriculum in Agricultural Education

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	Soil and Water Mechanics I, MA 342.....	2	
Freshman Composition, Engl 103 or 113 or 143.....	3		Animal Nutrition, AS 243.....	3	3
General Horticulture, Ho 103.....	3		Humanities or Social Science Elective*.....	2	
Physical Education, HPER 101.....	1	1	Principles of Economics I-II, Econ 203-213..	3	3
Crop Production, PS 103.....	3	3	Welding, ES 131.....	1	
Introduction to Animal Science, AS 103....	3		Seminar in Agricultural Education, AgEd 351.....	1	
Elements of Dairying, DS 103.....	3		Introduction to American Education, Ed 302	2	
Plant Pathology in Human Affairs, PS 102 or Introduction to Entomology, Ent 103..	2-3	3	Educational Psychology, Ed 312.....	2	
Biology, Bio 113-123.....	3	3	Woodworking, IAE 153.....	3	
General Chemistry, Ch 114 or Ch 164.....	4		Junior Composition, Engl 303.....	3	
Algebra, Math 113.....	3				
Elective.....	2		<b>Senior Year</b>	<b>F</b>	<b>S</b>
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Farm Building Mechanization, MA 423 or Soil and Water Mechanics II, MA 453.....	3	
Introduction to Physics, Phy 104.....	4		Humanities or Social Science Elective*.....	2	
Soils, PS 213.....	3	3	Teaching Agricultural Mechanics, AgEd 202.....	2	
Weed Control, PS 233.....	3		Special Methods in Vocational Agriculture, AgEd 453.....	3	
Meat and Meat Processing, AS 213.....	3		Program Planning in Vocational Agriculture, AgEd 454.....	4	
Introduction to Sociology, RS 153.....	3	3	Student Teaching in Vocational Agriculture, AgEd 458.....	8	
General Bacteriology, Bac 204.....	4		Farm Management, Econ 234 or Agricultural Economics, Econ 383.....	4-3	
Elementary Organic Chemistry, Ch 134.....	4		National Government, PolS 213 or State and Local Government, PolS 243.....	3	
Fundamentals of Speech, Sp 103.....	3	3	Genetics, Bio 303.....	3	
General Psychology, Psy 203.....	3		Publicity Methods, J 322 or Advanced Exposition, Engl 350.....	2	
Electricity for Farm and Home, MA 222....	2		*Humanities may be chosen from the fields of Art, Foreign Languages, Literature, Music, Philosophy and Religion.		
Elective.....	2				
<b>Junior Year</b>	<b>F</b>	<b>S</b>			
Poultry Management, AS 203.....	3				
Animal Diseases and Their Control, Vet 403	3				
Farm Power and Machinery, MA 213.....	3				

### Agricultural Extension (AgExt)

The Agricultural Extension program concerns study and training for positions in the Cooperative Extension Service as County Agents or Home Economics Agents.

Students who wish to qualify for Extension work as County Agents should give consideration in selection of electives to the following courses. Those which have the asterisk (\*) should be given priority consideration.

Course, Department, Number	Credits
*General Psychology, Psy 203.....	3
Educational Psychology, Ed 312.....	2
*Leadership, RS 262.....	2
Leadership and Group Organization, RS 633.....	3
The Rural Community, RS 403.....	3

Public Speaking, Sp 323.....	3
*Discussion, Sp 312.....	2
Parliamentary Procedure, Sp 361.....	1
Farm Management, Econ 234.....	4
Management in Family and Personal Living, MHE 273.....	3
Public Administration, PolS 333.....	3
*Publicity Methods, J 322.....	2

Two Agricultural Extension courses are offered to provide broader training in Extension for the personnel employed in the Cooperative Extension Service or those interested in that field.

The courses in various college departments will be offered as the need arises and the department can undertake the instruction.

**400 Field Practice Training in Extension 2-5 credits**

This course is available to a limited number of students majoring in agriculture or home economics who are interested in Extension work and have completed the junior class. Students will be assigned to a county during the summer for a period of time based upon the convenience of the student. The course will provide training and actual experience in Extension

philosophy, methods, organization and procedures. Arrangements with Extension staff must be made prior to registration.

**600 Special Problems in Extension 2-6 credits**

Individually assigned investigative problems in Extension. Individual conference with laboratory and/or field work. Arrangements with Extension staff must be made prior to registration.

**General Agriculture**

Arlington Eddy

Although primarily arranged for students of agriculture who have not selected a major field of study and for those individuals who may stay in college less than four years, this curriculum can lead to a Bachelor of Science

degree in agriculture. Two options are included in this program of studies: A four-year degree program and a two-year schedule of instruction. Credits earned in any given semester will apply toward a Bachelor of Science degree.

**Curriculum in General Agriculture, Four-Year Degree Program**

This degree course consists of approximately one-fourth agriculture; one-fourth basic science; one-fourth social science, communications, and humanities; and one-fourth elective subjects. When qualifying for a Bachelor of Science degree a student may, through a wise choice of electives, complete courses in a business option, prepare for graduate study, or enroll in special areas of study such as plant and/or animal science.

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143.....	3	
Physical Education, HPER 101.....	1	1
Crop Production, PS 103.....		3
General Chemistry, Ch 114 or Ch 164.....		4
Introduction to Animal Science, AS 103.....	3	
Free Electives .....	10	9
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
Algebra, Math 113.....	3	
Farm Management, Econ 234.....		4
Fundamentals of Speech, Sp 103.....	3	
Introduction to Entomology, Ent 103.....	3	3

Principles of Economics I, Econ 203.....	3	
Soils, PS 213.....	3	
Plant Pathology in Human Affairs, PS 102.....		2
Free Electives .....	5	8

<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303.....		3
Animal Nutrition, AS 243.....	3	
Biology, Bio 113-123.....	3	3
Elementary Organic Chemistry, Ch 134.....	4	
General Bacteriology, Bac 204.....		4
Introduction to Sociology, RS 153.....		3
Livestock Feeding, AS 251.....	1	
National Government, PolS 213 or State and Local Government, PolS 243 ...	3	
Humanities or Social Science Elective.....		2
Free Electives .....	4	2

<b>Senior Year</b>	<b>F</b>	<b>S</b>
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....		2
Genetics, Bio 303.....	3	
Introductory Physics, Phy 104 or Elementary Physics I, Phy 114.....	4	
Humanities and/or Social Science Electives.....	3	3
Statistics I, Econ 353 or Mathematics Elective .....		3
Free Electives .....	7	9

**Curriculum in General Agriculture, Two-Year Certificate Program**

This option usually includes all courses listed in the freshman and sophomore years of the degree program of studies. It is especially arranged for students who plan to study agriculture for less than four years. A certificate of completion is awarded to students who earn 66 semester credits and 125 grade points.

# Departments of Instruction

## Animal Science (AS)

Professors Menzies, Wahlstrom, Carlson, Dinkel, Embry, Kamstra, Kohler, Kohlmeier, Morgan; Emeritus Professor Johnson; Associate Professors Bush, Gartner, Lewis, Luther, McCarty, McCone; Assistant Professors Costello, Plumart, Whetzal; Instructors Guenther, Libal

The Department of Animal Science offers instruction leading to the Bachelor of Science degree with majors in Animal Science, Range Management or Poultry Science.

### Animal Science Major

Students majoring in Animal Science get instruction in animal breeding, feeding and nutrition, management, selection, judging, marketing, meats and wool. Courses pertain to beef cattle, horses, sheep and swine under both farm and ranch conditions. Students may choose any one of three options in Animal Science: (a) Business Option, (b) Production Option, and (c) Science Option. Students are encouraged to supplement their class and laboratory work with practical ex-

perience in the line of work which they plan to pursue after graduation.

Students who major in Animal Science receive basic training for farm and ranch operation, county extension and 4-H club agents, teaching in colleges, research work, State and Federal agricultural programs, livestock marketing agencies, livestock association fieldmen, packing industry, feed companies and agricultural representatives for business-  
es interested in agriculture.

### Curriculum in Agriculture, Animal Science Major

Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	Algebra, Math 113 or Algebra and Trigonometry, Math 145	3 or 5
Freshman Composition, Engl 103 or 113 or 143	3		Advanced Exposition, Engl 350 or Publicity Methods, J 322	2 or 3
Physical Education, HPER 101	1	1	General Bacteriology, Bac 204	4
Introduction to Animal Science, AS 103	3		Livestock Evaluation, AS 212	2
Introduction to Sociology, RS 153		3	Livestock Judging, AS 222	2
Biology, Bot 113-123	3	3	Carcass Evaluation, AS 232	2
Elective and option courses	6	11	Livestock Marketing, AS 312	2
	16	18	Feed Technology, AS 353	3
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	AS Production Courses, AS 322, 323, 403, 413, 423, 443	8 or 9
Animal Nutrition, AS 243		3	Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195	4 or 5
Meat and Meat Processing, AS 213	3		Anatomy, Z 203	3
Fundamentals of Speech, Sp 103		3	Mammalian Physiology, Z 304	4
Principles of Economics I, Econ 203	3		General Electives	18-23
National or State and Local Government, PolS 213 or 243		3		
Elective and option courses	10	9		
	16	18		79
<b>Junior and Senior Years</b>	<b>F</b>	<b>S</b>	<b>Science Option</b>	<b>Credits</b>
Junior Composition, Engl 303	3		Introduction to Entomology, Ent 103	3
Genetics, Bio 303	3		General Chemistry, Ch 164	4
Principles of Animal Breeding, AS 324		4	Soils, PS 213	3
Animal Science Seminar, AS 401		1	General Chemistry, Ch 173	3
Humanities and/or Social Science Electives	4	4	General Chemistry Laboratory, Ch 171	1
Electives and option courses	24	25	Organic Chemistry, Ch 134 or 310	4 or 5
	34	34	Algebra, Math 113, Plane Trigonometry Math 133, Analytic Geometry, Math 143 or Algebra and Trigonometry, Math 145 and Mathematical Analysis I, Math 155	9 or 10
			Quantitative Analysis, Ch 214	4
			General Bacteriology, Bac 204	4
			Elementary Physics I, II, Phy 114-124 or General Physics I, II, Phy 195-215	8 or 10
<b>Production Option</b>				
Crop Production, PS 103				
General Chemistry, Ch 114 or Ch 164	4			
Organic Chemistry, Ch 134	4			
Farm Management, Econ 234	4			
Soils, PS 213	3			
Mechanized Agriculture elective	2			

Advanced Exposition, Engl 350.....	3
Anatomy, Z 203.....	3
Mammalian Physiology, Z 304.....	4
AS Production Courses, AS 322, 403, 413, 423	5 or 6
General Electives .....	18-23
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	82

**Business Option**

	<b>Credits</b>	
Crop Production, PS 103.....	3	
General Chemistry, Ch 114 or Ch 164.....	4	
Organic Chemistry, Ch 134.....	4	
Farm Management, Econ 234.....	4	
Algebra, Math 113 or Algebra and Trigonometry, Math 145.....	5	
Publicity Methods, J 322.....	2	
Livestock Evaluation, AS 212.....	2	

Livestock Marketing, AS 312.....	2
Feed Technology, AS 353.....	3
AS Production Courses, AS 322, 323, 403, 413, 423, 443.....	8 or 9
Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195.....	4 or 5
Communications Elective .....	3
Anatomy, Z 203.....	3
Industrial Sociology, RS 382.....	2
Principles of Economics II, Econ 213.....	3
Principles of Accounting I, Econ 223.....	3
Business Management, Econ 343.....	3
Economics Electives*.....	12
General Electives .....	17-19
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	79

\*To be chosen from: Econ 233, 303, 323, 333, 353, 363 and 373.

**Range Management Major**

A curriculum in Range Management is offered for those interested in ranching or in range management positions in the Bureau of Land Management, Bureau of Reclamation, Extension Service, Forest Service, Na-

tional Park Service, State and Federal Land Appraisal Agencies and research and graduate work in many institutions of higher education in United States.

**Curriculum in Agriculture, Range Management Major**  
Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	
Freshman Composition, Engl 103 or 113 or 143.....	3		
Physical Education, HPER 101.....	1	1	
General Chemistry, Ch 114.....	4		
Organic Chemistry, Ch 134 or Ch 310.....	4-5		
Biology, Bio 113-123.....	3	3	
Algebra and Plane Trigonometry, Math 113-133 or Algebra and Trigo- nometry, Math 145.....	5 or 3	3	
Electives .....	3-5	8-9	
	<hr/>	<hr/>	
	17	17	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	
Introduction to Animal Science, AS 103.....	3		
Agrostology, Bot 213.....		3	
Basic Taxonomy, Bot 204.....	4		
Genetics, Bio 303.....		3	
Animal Nutrition, AS 243.....	3		
Livestock Feeding, AS 251.....	1		
Geology, PS 243.....		3	
Soils, PS 213.....	3		
Crop Production PS 103.....	3		
Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195.....	4 or 5		
Fundamentals of Speech, Sp 103.....	3		
Electives .....		1	
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	17	17	
<b>Junior Year</b>	<b>F</b>	<b>S</b>	
Junior Composition, Engl 303.....	3		
Principles of Range Management, AS 323.....	3		

Range Ecosystems, AS 343.....	3		
Plant Ecology, Bot 404.....	4		
Soil Genesis, Classification and Survey, PS 414.....	4		
Forage Crops and Pasture Management, PS 313.....	3		
Soil and Water Mechanics I, MA 342.....	2		
Wildlife Management, WL 404.....	4		
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....	2		
Principles of Economics I, Econ 203.....	3		
General Forestry, Ho 112 or Dendrology, Ho 213 or Forest Ecology, Ho 273.....	3		
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	17	17	
<b>Special Summer Session</b>			<b>Su</b>
Range Analysis, AS 333.....	3		
Field Studies in Range Management, AS 352.....	2		
<b>Senior Year</b>	<b>F</b>	<b>S</b>	
Range Improvement, AS 432.....		2	
Range Management Planning, AS 442.....		2	
Beef Cattle Production, AS 423.....		3	
Sheep and Wool Production, AS 413.....	3		
Farm Management, Econ 234.....	4		
Plant Physiology, Bot 424.....	4		
Introduction to Sociology, RS 153.....	3		
National or State and Local Government, PolS 213 or 243.....		3	
Humanities or Social Science Electives.....		4	
General Electives .....	4		
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	18	14	

### Poultry Science Major

Poultry Science deals with the application of scientific principles to problems encountered in the production, processing and marketing of poultry products. Students who are trained in the basic sciences and their relationship to the poultry industry find many and varied areas of employment. Other students may select one or more courses dealing with poultry to supplement their training in other departments.

As poultry enterprises become larger, they also become more specialized. This increases the need for trained persons who can deal effectively with the detailed problems that must be met. The number of inquiries for persons with such training has exceeded the available supply for many years.

Students who major in Poultry Science may select one of three different options. The technical option offers a broad type of train-

ing with flexibility provided by a number of elective credits. The business option calls for a concentration of training in such areas as business law, accounting, management, statistics, and finance. The science option emphasizes training in mathematics, physics, and chemistry, and is planned to prepare the able student for further study at the graduate level.

Chicken or turkey hatcheries, commercial egg production, poultry and egg processing and marketing, and manufacture and distribution of feeds and equipment are some of the areas which provide opportunities for poultry graduates. Teaching and research agencies regularly recruit persons with such training. Government agencies concerned with inspection and market news services provide additional opportunities.

#### Curriculum in Agriculture, Poultry Science Major Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143 .....	3	
Fundamentals of Speech, Sp 103 .....		3
Physical Education, HPER 101 or 121 .....	1	1
General Chemistry, Ch 114 or Ch 164 .....	4	
Introduction to Sociology, RS 153 .....		3
Biology, Bio 113-123 .....	3	3
Group I Courses .....	3	3
Elective and Option Courses .....	3	4
	17	17
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
Poultry Management, AS 263 .....	3	
Principles of Economics I, Econ 203 .....	3	
National Government, PolS 213 or State and Local Government, PolS 243 .....		3
Humanities or Social Science Electives .....	3	3
General Bacteriology, Bac 204 .....		4
Animal Nutrition, AS 243 .....	3	
Anatomy, Z 203 .....	3	
Mammalian Physiology, Z 304 .....		4
Elective and Option Courses .....	2	3
	17	17
<b>Junior and Senior Years</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303 .....	3	
Genetics, Bio 303 .....	3	
Poultry Products Technology, AS 362 .....	2	
Seminar, AS 401 .....	1	
Research Problems, AS 600 .....	2	
Livestock Reproduction, AS 443 .....	3	
Animal Diseases, Vet 403 .....	3	
Advanced Exposition, Engl 350 or Publicity Methods, J 322 .....	2 or 3	
Humanities or Social Science Electives .....	2	
Poultry Breeding, AS 353 .....	3	
Poultry Feeding, AS 483 .....	3	
Electives and Option Courses .....	17	23 or 24
	34	34

In addition to the above courses which are required for each student in Poultry Science, the following courses are required under the respective options:

#### Production Option

	Credits
Algebra, Math 113 .....	3
Elementary Organic Chemistry, Ch 134 .....	4
Introductory Physics, Phy 104 .....	4
Poultry Products Evaluation, AS 272 .....	2
Hatchery Management, AS 363 .....	3
Feed Technology, AS 353 .....	3
General Electives .....	33-34
	52-53

#### Business Option

Algebra, Math 113 .....	3
Elementary Organic Chemistry, Ch 134 .....	4
Introductory Physics, Phy 104 .....	4
Poultry Products Evaluation, AS 272 .....	2
Hatchery Management, AS 363 .....	3
Feed Technology, AS 353 .....	3
Principles of Economics II, Econ 213 .....	3
Principles of Accounting I, Econ 223 .....	3
Business Management, Econ 343 .....	3
Economics Courses, Econ 233, 303, 323, 333, 353, 363, 373 or equivalent .....	12
General Electives .....	12-13
	52-53

#### Science Option

Chemistry Electives .....	12
Math Electives .....	9
Elementary Physics I, Phy 114 .....	4
General Electives .....	27 or 28
	52 or 53

**UNDERGRADUATE COURSES**

**103 Introduction to Animal Science 3(2,2) FS**

General principles of livestock industry. Adaptation, breeding, feeding, marketing, classification, selection of market and breeding types of beef cattle, horses, sheep and swine.

**111 Horsemanship 1(0,2) S**

Types of breeds of riding horses, gaits, grooming, equipment, rations; basic riding instruction with English and Western type equipment.

**202 Meat Selection and Utilization 2(1,2) S**  
(Offered in 1971)

Not open to AS majors. Selection and identification of meat cuts for consumer. Palatability, grading, inspection and storage of meat products. Alternate years.

**203 Livestock Management 3(2,2) F**

Not open to AS majors. Principles of livestock management. Recommendations for feeding and breeding systems, disease and sanitation, housing, space requirements and other practices. P, 103.

**212 Livestock Evaluation 2(2,0) F**

Evaluation of market classes of beef cattle, sheep and swine on foot and in the carcass. Judging and evaluating breeding animals, including horses. Preparation for judging competition. P, 103.

**213 Meat and Meat Processing 3(3,0) FS**

Survey of meat industry. Composition of meat animals. Product identification, preservation, cooking, nutritive value, pricing and curing.

**221 Meat Processing Laboratory 1(0,3) FS**

Provides experience and training in meat animal slaughter, wholesale and retail cut preparation and meat processing techniques.

**222 Livestock Judging 2(0,4) S**

Type studies and selection for individual excellence; judging and oral discussion of classes of beef cattle, horses, sheep and swine. P, 212.

**232 Carcass Evaluation 2(0,4) S**

Techniques used in evaluating carcasses of meat animals. Meat grading and judging. P, 212.

**243 Animal Nutrition 3(3,0) FS**

Principles of animal nutrition. Functions of various nutrients; digestion and metabolism of nutrients by different animal species. Ch 134 desirable antecedent.

**263 Poultry Management 3(2,2) FS**

Development and organization of the poultry industry, its economic importance and relation to total agriculture. Biology of the fowl. Management practices with emphases upon the genetic, nutritional, disease, housing and equipment aspects.

**272 Poultry Products Evaluation 2(0,4) F**

Basis of selecting poultry for egg or meat production. Market qualities and grades of eggs, live and dressed poultry. P, 203.

**301 Advanced Livestock Judging 1(0,2) F**

Continuation of 222. Trips to purebred herds; participation in American Royal and International Livestock Judging Contest. P, 222.

**311 Meat Grading and Selection 1(0,2) F**

Identifying, judging and grading carcasses and cuts; training in writing reasons; participation in intercollegiate meat judging contests. P, 212, 232.

**312 Livestock Marketing 2(2,0) S**

Livestock marketing methods, involving problems of transportation, terminal market practices, methods of selling; factors determining livestock prices; selling purebred livestock. P, 103.

**322 Horse Production 2(1,2) S**

Feeding, breeding and management principles for draft and light horses. P, 103, 243.

**323 Principles of Range Management 3(3,0) F**

Range management with the principles underlying science presented within framework of ecosystem. Desirable antecedents, Bot 204; PS 213.

**324 Principles of Animal Breeding 4(3,2) S**

Application of genetics to improvement of farm animals. Emphasis on occurrence, origin, use and control of variation in economically important traits of farm livestock. P, Bio 303.

**333 Range Analysis 3(1,4)**

Summer Field Session (Offered in 1971)

Theory and practice of range surveys as used by various administrative and research organizations for determination of range condition, trend, utilization and recommended stocking rate. Surveys will be conducted by students on various ranches in western South Dakota. P, 323; Bot 204, 213. Alternate years.

**343 Range Ecosystems 3(3,0) S (Offered in 1971)**

Range management and ranching problems in different grazing regions of the United States. Ecology, forage value and grazing response of principle range plants of each region are studied. P, 323; Bot 204, 213. Alternate years.

**352 Field Studies in Range Management 2(0,4)**

Summer Field Session (Offered in 1971)

Extended field trip for study of range sites and condition classes in different grazing regions and to examine range research projects and action programs. P, 343. Alternate years.

**353 Feed Technology 3(3,0) FS**

Classification and nutritional characteristics of feedstuffs; methods of evaluating feedstuffs; principles of ration formulation and balancing for farm animals; preparation, processing, handling and storage of feedstuffs and feed regulation and control. P, 243.

**362 Poultry Products Technology 2(1,2) F**

(Offered in 1971)

Procurement, processing, packaging, and distribution of poultry products. Factors determining quality, their identification and control. Quality maintenance and storage. P, 203. Alternate years.

**363 Hatchery Management 3(2,2) S**

(Offered in 1970)

Incubation principles and equipment. Embryonic development. Egg supply, sales, and related enterprises. Sexing, brooding, and disease control. Plant operation and management. P, 203. Alternate years.

**373 Poultry Breeding** 3(2,2) S (Offered in 1971)

Applications of genetics in poultry breeding. Inbreeding, crossing, hybridizing, progeny testing, family selection. Performance records and testing methods. Limitations for breeder. Alternate years. P, Bio 303.

**401 Animal Science Seminar** 1(1,0) FS

Review of current research, discussions and reports. Limit 2 credits. P, senior standing.

**403 Swine Production** 3(2,2) S

Feeding, breeding and management principles for swine production. Breeds of swine, production trends and equipment for hog production. Student participation in management techniques. P, 103, 243. Desirable antecedent, 353.

**413 Sheep and Wool Production** 3(2,2) F

Feeding, breeding and management principles for maximum production of meat and wool in farm and range flocks. P, 103, 243. Desirable antecedent, 353.

**423 Beef Cattle Production** 3(2,2) S

Feeding, breeding and management principles for beef cattle production under farm and ranch conditions. P, 103, 243. Desirable antecedent, 353.

**432 Range Improvement** 2(2,0) S

Methods of improving ranges: livestock control, mechanical treatments, reseeding, range plant control and related topics. Field examination of range improvement programs. P, 323.

**442 Range Management Planning** 2(1,2) S

Planning problems and student preparation of plans for cattle and sheep ranches with emphasis on comparison of alternative range improvement practices. P, 323 and senior standing.

**443 Livestock Reproduction** 3(2,2) F

To study the basic physiological processes of reproduction in domestic animals, factors affecting and methods of improving reproductive efficiency. Desirable antecedent, Z 304.

**483 Poultry Feeding** 3(2,2) S (Offered in 1971)

Nutritional requirements, deficiency disease, formulation of diets, and effects of diets upon quantity, quality, and efficiency of poultry egg production. P, 203, AS 243. Alternate years.

**600 Research Problems** 1-3 FSSu

Investigation of problems in following areas with results submitted as technical paper:

1. Animal breeding
2. Nutrition
3. Meats
4. Livestock Production
5. Poultry
6. Range Management
7. Reproductive Physiology

**GRADUATE COURSES**

**601 Wild Lands Seminar** 1(1,0) S

Guest lectures and review of current research and action programs in use of wild lands. P, 323 and senior standing. Limit 2 credits.

**602 Wool Technology** 2(1,2) S (Offered in 1971)

Factors relating to wool production and market-

ing. Grading wool, properties of wool and wool technology. P, 413. Alternate years.

**610 Special Topics in Poultry Science** 1-3 FS

Advanced study of one or more selected topics such as nutrition, physiology, research methodology, or marketing.

**614 Meat Technology** 4(2,4) S (Offered in 1970)

Basic physical, chemical, microbiological and histological characteristics of meat and effects of various processing methods on meat products and byproducts. P, 213. Alternate years.

**702 Experimental Procedure** 2(2,0) S

Research methods and planning of experimental work, necessary records, interpretation of results and presentation of material. P, PS 614 or equivalent.

**703 Animal Nutrition** 3(3,0) S (Offered in 1971)

Principles of nutrition in relation to growth, reproduction, lactation, fattening and work. P, Ch 615 or Ch 705. Alternate years.

**712 Advanced Animal Breeding** 2(1,2) S

(Offered in 1970)

Methods of data analysis for developing efficient breeding plans. Calculation and use of correction factors, heritability estimates, genetic correlations, selection indices and inbreeding charts. P, 324, PS 614 or equivalent courses. Alternate years.

**713 Population Genetics** 3(3,0) S (Offered in 1971)

Genetic structure of populations and forces affecting this structure. P, 324 or equivalent. Alternate years.

**722 Animal Nutrition Laboratory** 2(0,6) S

(Offered in 1971)

Laboratory methods course involving demonstration and practical work in techniques used in animal nutrition research. P, Ch 615 or Ch 705. Alternate years.

**723 Ruminology** 3(3,0)

See Dairy Science 723 for description.

**743 Advanced Physiology of Reproduction**

3(2,2) (Offered in 1970)

Anatomical and physiological processes of reproduction in domestic animals with special emphasis on research techniques and the findings of recent research. P, 443.

**751 Graduate Seminar** 1(1,0) FS

Reports and discussion of current research in animal science. Maximum of two credits for M.S. and four credits for Ph.D.

**753 Poultry Genetics** 3(3,0) S

Population studies in poultry breeding. Physiological expression of genetic characteristics. Heritability coefficients. Comparison of and theoretical bases for different breeding systems. P, 353, 473.

**761 Nutrition Seminar** 1(1,0) FS

Reports and discussion of current research in nutrition. Maximum of two credits.

**773 Nutritional Interrelationships** 3(3,0) F

Relationships between nutrients in metabolism, Substitution and sparing effects. Comparing metabolic significance of required nutrients for different animal species.

**790 Thesis in Animal Science** 5-7 as arranged

## Bacteriology (Bac)

Professors Pengra, Middaugh; Associate Professors Parikh, Prochazka; Instructors Gadberry, Wainscott

The curriculum in Bacteriology is designed to give the student a good background knowledge in the field of Microbiology and allied science courses as well as an opportunity for a liberal University education.

Three curricula are available through the department. A Bachelor of Science in Agriculture, Major in Bacteriology and a Bachelor of Science in Biological Science, major in Bacteriology are offered in the College of Agriculture and Biological Sciences. A Bachelor of Science with a major in Bacteriology is also available in the College of Arts and Science.

Graduation from any of these curricula equips a student for technical work in any of a number of fields such as hospital or clinical laboratories, food technology or fermentation industries among others. With the properly selected electives the graduate is prepared to enter graduate school to pursue a Master's or Doctor's degree.

The department policy of requiring a minimum of Bacteriology and other courses is followed so that the student may select allied science courses that suit his aims and enable him to select courses outside science to help him secure a broad, well rounded education.

### Curriculum in Agriculture, Bacteriology Major Leading to the degree Bachelor of Science

*(See also curriculum in Bacteriology in College of Arts and Science)*

Freshman Year	F	S		F	S
Freshman Composition, Engl 103 or 113 or 143	3		Cytology and Nutrition, Bac 304		4
Algebra, Math 113 and Plane Trigonometry, Math 133 or Algebra and Trigonometry, Math 145	3		Principles of Economics I, Econ 203	3	
General Chemistry, Ch 164, 171, 173	4	3	Introduction to Sociology, RS 153		3
Biology, Bio 113-123	3		Group I Agriculture Elective	3	
Fundamentals of Speech, Sp 103			<b>Junior Year</b>	<b>F</b>	<b>S</b>
Physical Education, HPER 101 or 121	1	1	Elementary Physics, Phy 114-124	4	4
Electives	3(1)	3(6)	Group I Agriculture Electives	3	3
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	*Humanities Electives	4	4
Soils, PS 213		3	Bacteriology Elective	3	
Organic Chemistry, Ch 224-234 or Organic Chemistry, Ch 134 and 4 more hours of chemistry	4		Junior Composition, Engl 303	3	
National Government, PolS 213		3	Advanced Exposition, Engl 350		3
General Bacteriology, Bac 204	4		Biochemistry, Ch 244	4	
			<b>Senior Year</b>	<b>F</b>	<b>S</b>
			Seminar, Bac 431	1	1
			Genetics, Bio 303		3
			Bacteriology Electives	4	7
			Electives	12	5
			*Foreign Language strongly recommended.		

### Curriculum in Biological Science, Bacteriology Major Leading to the degree Bachelor of Science

Freshman Year	F	S		F	S
Algebra, Math 113 and Plane Trigonometry, Math 133 or Algebra and Trigonometry, Math 145	5 or 3	3	Principles of Economics I, Econ 203	3	
General Chemistry, Ch 164, 171, 173	4	4	Introduction to Sociology, RS 153	3	
Biology, Bio 113-123	3	3	Elective	3	6
Freshman Composition, Engl 103 or 113 or 143	3		<b>Junior Year</b>	<b>F</b>	<b>S</b>
Fundamentals of Speech, Sp 103		3	Elementary Physics I-II, Phy 114-124	4	4
Physical Education, HPER 101 or 121	1	1	*Humanities Electives	4	4
Electives	3(1)	3(6)	Junior Composition, Engl 303	3	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Advanced Exposition, Engl 350		3
Organic Chemistry, Ch 224-234 or Organic Chemistry, Ch 134 and 4 more hours Chemistry	4		Biochemistry, Ch 244	4	
National Government, PolS 213		3	Bacteriology Elective	3	
General Bacteriology, Bac 204	4		Elective		2
Cytology and Nutrition, Bac 304	4		Genetics, Bio 303	3	
			<b>Senior Year</b>	<b>F</b>	<b>S</b>
			Seminar, Bac 431	1	1
			Bacteriology Electives	4	7
			Electives	9	9
			Biological Science Elective	3	
			*Foreign Language strongly recommended.		



## UNDERGRADUATE COURSES

- 204 General Bacteriology** 4(2,4) FSSu  
General principles of basic and applied Microbiology. P, Ch 104, 114 or 164.
- 304 Cytology and Nutrition** 4(2,4) S  
Morphology, cytology, nutrition, metabolism and growth of microbial cells. P, 204 and consent of instructor.
- 313 Dairy Microbiology** 3(2,3) F  
(See description in Dairy Science.)
- 314 Environmental Microbiology** 4(2,4) S  
Microbiology of air and water including industrial, animal and domestic wastes. P, 204.
- 353 Food Microbiology** 3(2,3) F  
Microbiology of fresh and processed meats, dairy products, vegetables and modern convenience foods. Laboratory quality study of food preservation, processing spoilage. P, 204.
- 403 Immunology** 3(1,4) S  
Immunological responses of man and animals, including hypersensitivity, allergy, autoimmunity and immune responses to tissue transplantation. Immunoglobulin molecules and mechanism of their synthesis. Laboratory study of active and passive immunity, serological procedures and preparation of Biologicals. P, 204.
- 414 Pathogenic Microbiology** 4(2,4) F  
Epidemiology, etiology, clinical manifestations and diagnosis of animal and human diseases. P, Bac 204.
- 424 Mycology** 4(2,6) FS  
(See description in Plant Science.)
- 431 Seminar** 1(1,0) FS  
Presentation of topics based on bacteriological literature in scientific journals.

- 444 Soil Microbiology** 4(2,4) F (Offered in 1970)  
Microbial flora of agricultural soils and biochemical changes brought about by this flora. P, 204 and PS 213. Alternate years.

## GRADUATE COURSES

- 600 Microbiology Problem** 1-4 credits FSSu  
Research problem in Microbiology. Four credits maximum. P, senior standing and consent of instructor.
- 603 Virology** 3(2,3) F  
Viral and rickettsial diseases of animals, biochemical and biophysical properties of viral agents, viral replication in tissue culture, immune mechanism against virus diseases. The role of viral vaccines and antiviral drugs. P, 403 and consent of instructor.
- 604 Advanced Dairy Microbiology** 4(2,4) S  
(See description in Dairy Science.)
- 624 Systematic Bacteriology** 4(2,4) S  
(Offered in 1970)  
Bacterial nomenclature and taxonomic relationships among bacterial families and genera. Practical laboratory identification and maintenance of bacteria. P, 304, alternate years.
- 701 Graduate Seminar** 1(1,0) FSSu  
P, graduate standing. Two credits maximum.
- 704 Bacterial Metabolism** 4(2,4) F (Offered in 1969)  
Biological oxidations, fermentation mechanisms, metabolism of nitrogenous compounds, aerobic respirations, enzyme inductions and laboratory techniques. P, Bac 204 and Ch 244. Alternate years.
- 714 Industrial Microbiology** 4(2,4) S  
(Offered in 1971)  
Techniques for production of microorganisms and their biochemical products of commercial importance. Laboratory studies with molds, yeasts, and bacteria to produce antibiotics, organic acids. P, 204; Ch 244. Alternate years.
- 790 Thesis in Microbiology** 5-7 FSSu

## Botany and Biology (Bot-Bio)

Professors Myers, Holden, Miller (Emeritus), Morgan, Taylor; Associate Professor Hutcheson; Assistant Professors Morrill, Olson, Chen, Whalen; Instructor McMullen

Botany is the scientific study of plants. The Department of Botany offers some introductory courses which are intended to fill in the student's cultural background in plant biology and prepare him to appreciate the role of plants in his environment and economic life. Other courses in this department are intended to prepare him for more specialized courses in this or related departments

and to prepare him for various professions in plant research, plant industry, or teaching.

The Botany Major is intended primarily for preparation of students with professional competence in botanical and biological work, who will normally complete graduate work in these fields as well.

Students in other majors take background courses in botany in preparation for more advanced work in their own fields.

**Curriculum in Agriculture, Botany Major**  
**Leading to the degree Bachelor of Science**  
*(See also curriculum in Botany in College of Arts and Science)*

<b>Freshman Year</b>	<b>F</b>	<b>S</b>			
Freshman Composition, Engl 103 or 113 or 143.....	3		Plant Anatomy, Bot 413.....		3
Physical Education, HPER 101 .....	1	1	Botanical Techniques, Bot 303.....		3
General Chemistry, Ch 164-171-173.....	4	4	Principles of Economics I, Econ 203.....	3	
Algebra, Math 113.....	3		Biology elective .....		3
Plane Trigonometry, Math 133.....	3		Genetics, Bio 303.....	3	
Biology, Bot 113-123.....	3	3	Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195.....	4-5	
Electives .....	3	6	Group I Electives .....		3
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Humanities and/or Social Science Electives		4
National Government, PolS 213 or State and Local Government, PolS 243.....	3		<b>Senior Year</b>	<b>F</b>	<b>S</b>
Introduction to Sociology, RS 153.....	3		General Bacteriology, Bac 204.....	4	
Fundamentals of Speech, Sp 103.....	3		Elective in Botany.....	4	
Plant Kingdom, Bot 203.....	3		Seminar, Bot 401.....		1
Basic Taxonomy, Bot 204.....	4		Electives* .....	9	16
Elementary Organic Chemistry, Ch 134 .....	4		<b>Major in Botany</b> —Bio 113, 123, Bot 203, 204, 404, 413, 424, and Bio 401. Total 24 credits.		
Humanities and/or Social Science Electives	4	4	<b>Minor in Botany</b> —Bio 113, 123; Bot 203, and 204, plus enough electives to make 16 credits.		
Group I Electives.....	4	5			
<b>Junior Year</b>	<b>F</b>	<b>S</b>			
Junior Composition, Engl 303 .....		3	*Students who expect to continue their study at the graduate level should include among their electives a foreign language, together with additional mathematics and science courses. Those who expect to teach in high school should consult with the head of the Education Department before registering for the first term of their junior year.		
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....	2-3				
Plant Physiology, Bot 424.....	4				

**Botany (Bot)**

**UNDERGRADUATE COURSES**

- 203 Plant Kingdom** 3(2,2) FS  
Survey of the major plant groups, their origins and evolutionary contributions. P, recommended Bio 123.
- 204 Basic Taxonomy** 4(2,4) FSSu  
Principles of phylogeny, classification and nomenclature; demonstrations, field study and laboratory practice in collecting, preserving and identifying plants. Open to all students.
- 213 Agrostology** 3(2,2) S  
Systematic study of grasses, their phylogeny, classification and nomenclature; laboratory practice in recognition and identification of grasses. Open to all students.
- 303 Botanical Techniques** 3(0,6) S  
Preparation of plant organs and tissues for critical study; production of visual aids; biological photography. P, Bio 123.
- 323 Aquatic Seed Plants** 3(2,2) F  
Systematic study of aquatic seed-plants, their classification and nomenclature; laboratory and field practice in identification and recognition of common aquatic plants. P, Bio 123.
- 404 Plant Ecology** 4(3,2) F Alternate Su  
Descriptions of plant communities, their dynamics and distribution. Environmental factors and their relationships with plants. Field trips. P, Bio 123.
- 413 Plant Anatomy** 3(0,6) F  
Developmental anatomy of seed plant axis and its appendages. Emphasis on structural fitness of tissues and organs for functions they perform. P, Bio 123.
- 424 Plant Physiology** 4(2,4) FSu  
Fundamental plant functions and adjustments. P, Bio 123, desirable antecedent Ch 114, 134.

**GRADUATE COURSES**

- 604 Growth and Development** 4(1,6) S  
(Offered in 1970)  
Relations of light, temperature, water, wind, growth regulators, nutrients and other factors to various stages of plant growth and development. P, 424, Ch 134. Alternate years.
- 614 Advanced Plant Physiology** 4(1,6) S  
(Offered in 1971)  
Role of organic and inorganic compounds in plant nutrition. Emphasis on photosynthesis, respiration, metabolism, and other cellular processes. P, 424, Ch 134. Alternate years.
- 524 Morphology of Non-Vascular Plants** 4(2,4) F  
Life histories and evolutionary relationships of principle orders of lower plants. P, Bio 123.
- 643 Morphology of Vascular Plants** 4(2,4) S  
Life histories and evolutionary relationships of principle orders of vascular plants. P, Bio 113-123.
- 644 Advanced Plant Ecology** 4(3,2) S Alternate Su  
Theoretical analysis of the trophic-dynamic or energy relationships of communities with emphasis on productivity. Literature readings. Laboratory work in techniques of community analysis. Field trips.
- 653 Aspects of Morphogenesis** 3(0,6) S  
Determinative differentiation in growing points of plant axis. P, 413 or 634.
- 703-713 Advanced Taxonomy** 3(2,2) FS  
Detailed study of families of higher plants; professional methods of taxonomic research and publication. P, consent of instructor.
- 790 Thesis in Botany** 5-7 as arranged FSSu

## Biology (Bio)

Most people are agreed on what biology is because its name, the study of life, states its objective. Also, most people agree that biology should project an image of unity and a conceptual body of knowledge to people not in the field as well as to students who may become interested in the field. Today, in our era of expanding knowledge, it is virtually impossible to treat each and every area of biology alike. Therefore since no specific area is to be emphasized, it becomes necessary to build a course, core, and curriculum which the specialized areas may use as a foundation. This is the purpose of the following curriculum in biology.

This program stresses the unity of biology by emphasizing the principles and concepts

that make biology a science. It is designed to leave the student with an understanding of living matter, and the interaction of living matter and environment, from molecules to man, from Atom to Adam. It is designed to form the foundation upon which a specialized area can be built. Last, but not least, it is designed to build a new edifice of biology by firmly embedding the new ideas within the context of the solid principles of the past.

It is especially emphasized that this is the most desired pathway for prospective teachers who wish to major or minor in biology. The core makes up the courses required for a minor in biology. The core consists of the following courses: Bio 113, 123, 283, 293, and 303. In addition Bio 603 is recommended for teacher training only.

### Curriculum in Biological Science, Biology Major Leading to the degree Bachelor of Science (See also curriculum in Biology in College of Arts and Science)

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	
Freshman Composition, Engl 103 or 113 or 143 .....	3	or 3	
Physical Education, HPER 101 or 121 .....	1	1	
General Chemistry, Ch 164, 173, 171 .....	4	4	
Algebra, Math 113 and Plane Trigonometry, Math 133 .....	3	3	
Biology, Bio 113, 123 .....	3	3	
Electives .....	3	6	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	
Fundamentals of Speech, Sp 103 .....	3		
Principles of Economics, Econ 203 .....		3	
Organic Chemistry, Ch 134 or 224 .....	4		
General Bacteriology, Bac 204 .....		4	
Organismic and Population Biology, Bio 283 .....	3		
Molecular and Cellular Biology, Bio 293 .....		3	
Introduction to Sociology, RS 153 .....	3		
Major* and elective courses .....	2-3	7	
<b>Junior Year</b>	<b>F</b>	<b>S</b>	
Physics, Phy 114-124 or 195-215 .....	4-5	4-5	
Genetics, Bio 303 .....	3		
Chemistry elective .....		4	
National Government, PolS 213 .....		3	
Genetics Laboratory, Bio 301 .....	1		
Junior Composition, Engl 303 .....		3	
Social Science and/or Humanities Electives .....	3		
Major* and elective courses† .....	3-5	4	
<b>Senior Year</b>	<b>F</b>	<b>S</b>	
Advanced Exposition, Engl 350 .....	3		
Seminar, Bio 401, Bac 431 or Z 401 .....	1(3)		
Major* and elective courses .....	15	17	

**Major in Biology**—Bio 113, 123, 283, 293, 301, 303 and 401, Bac 204. Bio 603 recommended (if teaching option is followed) plus electives to make 24 credits.

**Minor in Biology**—Bio 113, 123, 283, 293, 301, and 303 and Bio 603 recommended if teaching option is followed. Total of 18 credits required.

\*A minimum of 24 hrs. in Biological Science may constitute a major.

†If a student plans to teach biology he should consult with the head of the Education Department in the College of Arts and Science.

### UNDERGRADUATE COURSES

#### 113 Biology 3(2,3 F)

Concepts of modern biology as they are related to living organisms. Emphasis on molecular and cellular organization of living organisms.

#### 123 Biology 3(2,3) S

Concepts of modern biology as they are related to living organisms. Emphasis on the organism and interrelation of organisms.

#### 283 Organismic and Population Biology 3(2,2) F

The integrating mechanisms that are the hallmark of the organism will be treated, i.e. (1) organism response to their environment, (2) internal transport and homeostasis, and (3) the ontogenetic history of the organisms. P, Bio 123.

#### 293 Molecular and Cellular Biology 3(2,2) S

The cell will be viewed as a population of molecules which is organized into a population of subcellular entities, the interactions between these giving rise to the integrated cell. It will include a broad sweep of cell organization and behavior. P, Bio 123.

#### 301 Genetics Laboratory 1(0,2) FSSu

Laboratory experiments with *Drosophila* and other organisms, illustrating probability, meiosis, sex linkage, independent assortment, crossing over and interference and biochemical genetics. Optional—to be taken concurrently with Bio 303. P, Bio 123.

**303 Genetics 3(3,0) FSSu**

To acquaint the student with the nature transmission and function of genetic material, developing both classical and contemporary views. P, Bio 123.

**401 Seminar 1(1,0) FS**

Review of literature and/or original investigations on various biological problems. P, two years of course work in biological science.

**407 Biology for Secondary Teachers 7(4,8) Su**

Open to NSF institute participants. Designed to familiarize teachers with objectives, content, laboratory experiences of an investigatory nature. P, minor in biology or equivalent desirable antecedent Organic Chemistry.

**420 Biological Problems 2-4 cr FSSu**

Solution of individually assigned investigative problems in biology making use of techniques acquired in foundation courses. Individual conferences

and laboratory, greenhouse, or field work. P, adequate background for assigned problem.

**GRADUATE COURSES**

**603 The Process Approach in Science Teaching**

3(3,0) FS

This course is designed to help the teacher and prospective teacher identify and teach certain processes deemed fundamental to science and scientific behavior. The emphasis will be not primarily of subject matter but on the general elements of the process which characterize the scientific method of analysis.

**701 Graduate Seminar 1(1,0) FS**

Reports and discussions of original and contemporary research. P, graduate standing.

**720 Biological Research Problem 2-4 cr FSSu**

Introduction to Biological Research.

**Dairy Science (DS)**

Professors Young, Baker, Dracy, Spurgeon, Totman (Emeritus), Voelker; Associate Professor Bartle; Assistant Professors Parsons, Schingoeth, Seas

The demand for well trained dairy graduates far exceeds the supply. The dairy industry is big business, with approximately \$12 billion being spent for dairy products in the U. S. each year. In addition to positions within the industry, there are opportunities in related fields such as inspection and grading, feed or equipment sales, education, breed association representatives, health department, or quality control.

Dairy Science students may choose a major in Dairy Manufacturing or in Dairy Production. Under the curriculum in Agriculture, each of the majors offers a general technical program, with several electives in fields of the student's choice. In addition, an option in Science or Business is available with either of the majors; the Dairy Manufacturing major also offers an option in Equipment Maintenance. The Dairy Manufacturing major offers a program under the curriculum in Biological Sciences which involves more courses in chemistry and biological sciences and fewer courses in agriculture. By proper choice of major and option the student should be able to prepare himself for the kind of work in the dairy industry or related field that is most interesting to him and for which his individual talents are best suited. Faculty members in this department

welcome the opportunity to discuss these options and job opportunities with students.

The new Dairy and Bacteriology Building provides excellent facilities such as classrooms, laboratories, and a reading room for students. A well equipped modern dairy processing plant and sales room make it possible for students to obtain a considerable amount of practical experience while they are learning the principles of dairy processing methods. Several students have opportunities to work part-time in the processing plant and thus earn part of their University expenses.

The recently completed Dairy Research and Production unit houses a herd of the Holstein and Brown Swiss breeds and is a center for research in feeding, breeding, and management of a dairy herd. Equally important, it is the site for basic student training in dairy cattle evaluation and other aspects of dairy farming. The milk produced at the Research and Production unit is hauled in a bulk tanker to the dairy processing plant to be processed and sold as fluid milk, ice cream, butter or cheese. These products are used in campus eating facilities. Like the processing plant, the Research and Production unit offers opportunities for students to work part time and gain practical experience while earning part of their expenses.

**Curriculum in Biological Science, Dairy Manufacturing Major**  
Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	National Government, PolS 213 .....	3		
Freshman Composition, Engl 103 or 113 or 143 .....	3		Humanities or Social Science Elective .....	2-3		
Physical Education, HPER 101 .....	1	1	<b>Junior and Senior Years</b>	<b>F</b>	<b>S</b>	
General Chemistry, Ch 164-171-173 .....	4	4	Junior Composition, Engl 303 .....	3		
Biology, Bio 113-123 .....	3	3	Advanced Exposition, Engl 350 .....		3	
Elements of Dairying, DS 103 .....	3		Food Bacteriology, Bac 353 .....	3		
Introduction to Sociology, RS 153 .....	3		Food Processing Equipment, MA 472 .....	2		
Fundamentals of Speech, Sp 103 .....	3	3	Agricultural Product Processing, MA 473 .....		3	
Humanities or Social Science Elective .....	3		Principles of Economics I-II, Econ 203-213 .....	3	3	
Elective .....	3	3	Principles of Accounting I, Econ 223 .....		3	
			Genetics, Bio 303 .....	3		
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Dairy Microbiology, DS 313 .....		3	
Algebra, Math 113 .....	3		Dairy Product Processing I-II, DS 315-325 .....	5	5	
Trigonometry, Math 133 .....	3	3	Technical Control of Dairy Products I-II, DS 223-423 .....	3	3	
General Bacteriology, Bac 204 .....	4	4	Dairy Plant Management, DS 443 .....		3	
Elementary Physics I-II, Phy 114-224 .....	4	4	Dairy Seminar, DS 401 .....	1		
Organic Chemistry, Ch 134 or 310 .....	4-5		Dairy Production elective .....	2-3		
Elementary Biochemistry, Ch 244 .....	4	1	Electives .....	9-9		
Dairy Products Judging, DS 201 .....	1					

**Curriculum in Agriculture, Dairy Manufacturing Major**  
Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	Humanities or Social Science Electives .....	3		
Freshman Composition, Engl 103 or 113 or 143 .....	3		Elective .....		3	
Physical Education, HPER 101 .....	1	1	<b>Junior and Senior Years</b>	<b>F</b>	<b>S</b>	
General Chemistry, Ch 114 or 164 .....	4		Junior Composition, Engl 303 .....	3		
Algebra, Math 113 or Algebra and Trigonometry, Math 145 .....	3-5		Advanced Exposition, Engl 350 or Publicity Methods, J 322 .....		2-3	
Elements of Dairying, DS 103 .....	3		Food Bacteriology, Bac 353 .....	3		
Introduction to Sociology, RS 153 .....	3	3	Food Processing Equipment, MA 472 .....	2		
Group I electives .....	3	6	Agricultural Product Processing, MA 473 .....		3	
Fundamentals of Speech, Sp 103 .....	3	3	Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195 .....	4-5		
Electives .....	3		Principles of Accounting I, Econ 223 .....		3	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Technical Control of Dairy Products I-II, DS 223, 423 .....	3	3	
Principles of Economics I-II, Econ 203-213 .....	3	3	Dairy Microbiology, DS 313 .....		3	
National Government, PolS 213 or State and Local Government, PolS 243 .....	3		Dairy Product Processing I-II, DS 315-325 .....	5	5	
Biology, Bio 113-123 .....	3	3	Dairy Plant Management, DS 443 .....		3	
Elementary Organic Chemistry, Ch 134 .....	4		Dairy Seminar, DS 401 .....	1		
Elementary Biochemistry, Ch 244 .....	4	4	Dairy Production elective .....	2-3		
General Bacteriology, Bac 204 .....	4	4	Humanities or Social Science Electives .....	2		
Dairy Products Judging, DS 201 .....	1	1	Electives .....	7-9	10-13	

**Curriculum in Agriculture, Dairy Production Major**  
Leading to the degree Bachelor of Science

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143 .....	3		Principles of Economics I, Econ 203 .....	3	
Physical Education, HPER 101 .....	1	1	National Government, PolS 213 or State and Local Government, PolS 243 .....		3
General Chemistry, Ch 114 or 164 .....	4	4	Elementary Organic Chemistry, Ch 134 .....	4	
Algebra, Math 113 or Algebra and Trigonometry, Math 145 .....	3-5		Soils, PS 213 .....	3	
Introduction to Sociology, RS 153 .....	3		Elementary Biochemistry, Ch 244 .....		4
Elements of Dairying, DS 103 .....	3		Dairy Products Judging, DS 201 .....		1
Crop Production, PS 103 .....	3	3	Introductory Physics, Phy 104 or Elementary Physics I, Phy 114 or General Physics I, Phy 195 .....	4-5	
Fundamentals of Speech, Sp 103 .....	3	3	Biology, Bio 113-123 .....	3	3
Dairy Cattle Evaluation, DS 212 .....	2	2	Humanities or Social Science Electives .....	3	2
Electives .....	2-4	3			

<b>Junior and Senior Years</b>	<b>F</b>	<b>S</b>
Animal Nutrition, AS 243.....	3	
Junior Composition, Engl 303.....	3	
General Bacteriology, Bac 204.....	4	
Dairy Microbiology, DS 313.....	3	3
Dairy Breeds, DS 303.....	3	
Farm Management, Econ 234.....	4	
Anatomy, Z 203.....	3	
Dairy Foods, DS 323.....	3	
Mammalian Physiology, Z 304.....	4	
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....	2-3	
Animal Diseases and Their Control, Vet 403	3	
Genetics, Bio 303.....	3	
Principles of Animal Breeding, AS 324.....	4	
Dairy Seminar, DS 401.....	1	
Dairy Farm Management, DS 433.....	3	
Dairy Cattle Feeding, DS 432.....	2	
Livestock Reproduction, AS 443.....	3	
Humanities or Social Science Electives.....	3	
Electives.....	6-7	8-9

The three options, or areas of specialization, have the following respective requirements in addition to those listed above.

**Business Option**

Principles of Economics II, Econ 213.....	3
Principles of Accounting I, Econ 223.....	3
Business Management, Econ 343.....	3
Plus 12 hours to be chosen from:	
Principles of Accounting II, Econ 233.....	3
Business Law I, Econ 303.....	3
Introduction to Marketing, Econ 323.....	3
Money and Banking, Econ 333.....	3
Statistics I, Econ 353, or equivalent.....	3
Business Finance, Econ 363.....	3
Managerial Use of Accounting Data, Econ 373.....	3

**Science Option**

Chemistry.....	6
Mathematics and/or Physics.....	6
Biological Science to be selected from the following areas: Botany, Entomology-Zoology or Plant Pathology.....	2

**Equipment Maintenance Option**

(Available with Dairy Manufacturing Major, Only)

Plane Trigonometry, Math 133.....	3
Analytic Geometry, Math 143.....	3
Farm Mechanics, MA 202.....	2
Electricity for Farm and Home, MA 222.....	2
Farm Building Mechanization, MA 423.....	3
Machine Shop, ES 121.....	1
Welding, ES 131.....	1
Engineering Graphics I, EG 112.....	2

**UNDERGRADUATE COURSES**

**103 Elements of Dairying 3(2,2) FS**

General scope of dairy industry. Essentials of successful dairy farm operation, production testing, feeding, and management of dairy herd. Composition of milk, testing of milk for butterfat, milk solids and sanitary quality, and an examination of nutritive value of dairy products.

**201 Dairy Products Judging 1(0,3) S**  
Judging quality of milk, butter, cheese, ice cream, and cottage cheese.

**212 Dairy Cattle Evaluation 2(0,4) S**  
Preparation of dairy cattle for shows and sales; methods of showing these animals. Judging major breeds of dairy cattle for type.

**223 Technical Control of Dairy Products I 3(1,4) F (Offered in 1970)**

Fundamental properties of milk and its products as they affect testing. Organization of dairy plant laboratory and maintenance of equipment. Common physical, chemical and microbiological intake and laboratory tests for procurement and grading of milk. Compositional tests for control of dairy products during processing. P, 103. Alternate years.

**303 Dairy Breeds 3(2,2) F**

Origin, genetics, characteristics, and development of major breeds of dairy cattle. Breeding and selection based on pedigrees, production records, type classification, and sire analysis. P, 103.

**313 Dairy Microbiology 3(1,4) S (Offered in 1971)**

Quality control problems during the production and processing of fluid milk for human use, including the role of regulatory agencies and quality standards. P, Bac 353. Alternate years.

**315 Dairy Product Processing I 5(4,3) F (Offered in 1969)**

Principles and practices in assembling, receiving, processing, and packaging milk and cream for beverage use; cultured milk and cream, frozen milk and cream; concentrated milks; and ice cream. Sanitation procedures used in dairy processing plants. P, 103; 223 desirable. Alternate years.

**321 Dairy Cattle Judging 1(0,2) F**

Judging major breeds of dairy cattle. Type classification. May include participation in International Dairy Cattle Judging Contest or National Collegiate Cattle Judging Contest. Maximum of two credits will be allowed for course. P, 212.

**323 Dairy Foods 3(3,0) F**

Survey of the dairy processing industry. Principles of processing and manufacturing dairy foods including quality standards and nutritive quality. For non-dairy manufacturing majors only.

**325 Dairy Product Processing II 5(4,3) S (Offered in 1970)**

Principles and practices in processing or manufacture of relatively nonperishable dairy products such as butter, cheese, dried milk, casein, lactose, and butter oil. P, 315. Alternate years.

**401 Dairy Seminar 1(1,0) F**

Review of scientific literature and other items of special interest to dairy majors. P, senior standing.

**421 Advanced Dairy Products Judging 1(0,3) F**

Quality evaluation of dairy products. Usually includes participation in National Collegiate Dairy Products Contest. P, 201.

**423 Technical Control of Dairy Products II**  
3(2,2) F

Physical and chemical properties of the various milk constituents and their effect on processing, testing, and nutritive value of milk and its products. Intentional or accidental additives, their effect and significance. Laboratory tests for process control or legal compliance. P, 223, Ch 134 or equivalent.

**432 Dairy Cattle Feeding 2(2,0) S** (Offered in 1970)  
Practical considerations involved in feeding dairy cattle. P, 103, AS 243. Alternate years.

**433 Dairy Farm Management 3(3,0) S**  
(Offered in 1971)

Dairy herd management practices, production testing, labor requirements, maintenance of buildings and equipment, crop systems, merchandising cattle and milk. Dairy farm capital, budgets, and credits; and factors affecting economic returns of dairy farming. P, senior standing or consent. Alternate years.

**443 Dairy Plant Management 3(3,0) S**  
(Offered in 1970)

Problems relating to general costs, buildings, equipment, merchandising, and other management factors of dairy processing plants. P, senior standing or consent of instructor. Alternate years.

**GRADUATE COURSES**

**604 Microbiology of Manufactured Dairy Products**  
4(2,4) F (Offered in 1970)

Role of microorganisms in manufacture and spoilage of manufactured dairy products. P, 313. Alternate years.

**614 Advanced Technical Control of Dairy Products**  
4(2,4) S (Offered in 1971)

Chemical changes that occur during manufacture and storage of dairy products; specialized tests to detect these changes and degree thereof; significance of such changes. P, consent. Alternate years.

**623 Physiology of Lactation 3(3,0) S**  
(Offered in 1971)

Anatomy and physiology of mammary glands. Factors affecting quality and quantity of milk. P, Z 304. Alternate years.

**680 Dairy Science Problems 1-3 FSSU**

Investigation of problems in dairy production or dairy manufacturing. Results submitted as a technical paper. P, consent of instructor.

**701 Seminar 1(1,0) S**

Problems in dairy production, dairy manufacturing, and related sciences. Maximum of 2 credits will be allowed toward either the Master of Science or Doctor of Philosophy degree.

**723 Ruminology 3(3,0)** (Offered in 1970)

Biochemical, physiological, and microbiological activity occurring in the rumen and the relation of rumen function to animal response. P, AS 703 or consent. Alternate years.

**761 Nutrition Seminar 1(1,0) F** (Offered fall only)

Reports and discussion of current research in nutrition. Limited to 2 credits.

**790 Thesis in Dairy Science** (as arranged)

**Economics (Econ)**

Professors Thompson, Aanderud, Cummins, Glover, Helfinstine, Kohlmeyer, Myers, Pengra (Emeritus) Smythe; Associate Professors Beck, Berry, Felberg, Gaarder, Greenbaum, Hermann, Hsia, Johnson, Leonard, Lockner, Matson, Osbun, Powers, Rose; Assistant Professors Allen, Gilbert, Kim, Micheel, Moberly, Sanderson, Sogn, Starler, Ullrich

Economics is a study of man and his efforts to acquire and use wealth and income. Work in this department is concerned not only with basic economic principles, but also with such specialized applications of economics as are found in agricultural economics, agricultural business, and industrial economics.

Teaching and research activities become current, meaningful, and important when they apply economic principles and analysis to problems such as taxation, farm and ranch management, marketing agricultural products, community development, irrigation, feasibility, or the strengthening of business and community services.

Two curricula leading to the Bachelor of Science degree are offered in the College of Agriculture and Biological Sciences. A student wanting to prepare for a career in a bus-

ness or industry related to agriculture should carefully consider the curriculum in Agricultural Business.

The curriculum in Agricultural Economics is somewhat more flexible. The larger number of elective credits may be used to prepare for graduate study, or to pursue additional courses in special-interest areas.

Reasonable substitutions within the spirit of these curricula may be made at the students' request by the Economics Department, with the approval of the Dean. Evidence, based upon vocational goals and needs may be required.

Students whose goals require little emphasis upon technical agriculture may consider the curricula offered in the College of Arts and Science.

**Curriculum in Agricultural Economics  
and  
Curriculum in Agricultural Business**  
Leading to the degree Bachelor of Science

*(See also curriculum in Economics in College of Arts and Science)*

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143.....	3	
Physical Education, HPER 101 or 121.....	1	1
Introduction to Sociology, RS 153.....		3
General Chemistry, Ch 114 or 164.....	4	
Algebra and Trigonometry, Math 145, or equivalent.....	5	
Mathematics for Social Sciences, Math 225	3	5
Group I Electives.....	3	3
Electives.....		5
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
Principles of Economics I-II, Econ 203, 213	3	3
Biology, Bio 113, 123.....	3	3
General Psychology, Psy 203.....		3
Fundamentals of Speech, Sp 103.....	3	
Introductory Physics, Phy 104 or Elementary Physics I, Phy 114.....	4	
Money and Banking, Econ 333.....		3
Group I Electives.....	3	3
Electives.....		2
<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303.....	3	
Intermediate Economic Analysis, Econ 433..	3	
National Government, PolS 213 or State and Local Government, PolS 243 ...	3	
Introduction to Literature, Engl 203.....		3
Intermediate Macroeconomics, Econ 423.....		3
Statistics I, Econ 353.....	3	
Philosophy Elective, Phil 202-204, or 462..		2-4
Agricultural Economics, Econ 383.....		3
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....		2-3
History Elective.....	3	
Electives.....	3	0-2
<b>Senior Year</b>	<b>F</b>	<b>S</b>
Economics Seminar, Econ 401.....	1	
Public Finance, Econ 413.....	3	
Marketing Agricultural Products, Econ 463		3
Humanities Elective.....		2
Political Science Elective, PolS 313, 323, 413, 423, 613 or 623.....		3
Electives.....	14	9

In addition to the above courses which are required by every student in Agricultural Economics, the following courses are required under the respective curricula.

**Agricultural Economics Curriculum**

	<b>Credits</b>
Principles of Accounting I, Econ 223.....	3
Quantitative Economics, Econ 314.....	4
Statistics II, Econ 443.....	3

**Agricultural Business Curriculum**

	<b>Credits</b>
Principles of Accounting I, Econ 223.....	3
Principles of Accounting II, Econ 233 or	

Managerial Use of Accounting Data, Econ 373	3
Business Management, Econ 343.....	3
Business Elective, Econ 313, 323, or 363.....	3
Business Law I, Econ 303.....	3

**UNDERGRADUATE COURSES**

**203 Principles of Economics I 3(3,0) FS**  
Analysis of U. S. economy. Emphasis on money and banking, Federal Reserve policy, national income, government spending, taxation, business fluctuations, and levels of employment and prices. Introduction to supply and demand, business organization, world trade, economic growth, and economic systems.

**213 Principles of Economics II 3(3,0) FS**  
Analysis of price as it allocates resources and distributes income. Theory of firm, supply and demand, economic efficiency, types of competition in markets, marginal productivity and wage determination; public interest in industry, agriculture, labor, and individual welfare. P, 203.

**223 Principles of Accounting I 3(3,0) FS**  
This course covers the basic accounting cycle; financial statements; asset valuation; accounting controls and concepts, payrolls, payroll taxes and an introduction to the corporate capital accounts. The emphasis is on the understanding of fundamental procedure and accounting theory.

**233 Principles of Accounting II 3(3,0) S**  
Accounting for partnerships and corporations; an introduction to cost accounting, budgeting, and other accounting reports for management, creditors, and investors. P, 223.

**234 Farm Management 4(3,2) FS**  
Farm or ranch business from viewpoint of continuous profit and efficiency. Basic principles of farm management applied to selection and combination of enterprises, level of production, size of business, labor efficiency, and machinery efficiency. Types of farming, tenure and leasing, risk, prices, credit and starting farming. Business and production records, their analysis and use in budgeting and planning future operations. Field trips.

**243 Personal Finance 3(3,0) FS**  
Survey of personal budgets, uses of consumer credit, savings institutions, protective aspects of property and life insurance, home ownership, investment programs.

**303 Business Law I 3(3,0) FS**  
The nature and classification of law, courts, court procedure, contracts, agency, negotiable instruments, and personal property.

**313 Business Law II 3(3,0) S**  
The law of partnerships, corporations, real property, security devices, insurance, wills and trust, and governmental regulation of business. P, 303.



**314 Quantitative Economics 4(4,0) F**

Examination of micro and macro models used in economics by use of elementary quantitative techniques. Topics studied will normally involve elasticity, revenue, cost, consumer choice, and income models. P, 213 and Math 113.

**323 Marketing 3(3,0) S**

Basic principles of marketing; market organization and the role of cooperatives; marketing functions; pricing; efficiency, and the role and management of marketing activities in today's business organization. P, 213.

**333 Money and Banking 3(3,0) FS**

Principles of money, banking, and credit, major types of financial institutions and their significant functions and policies. P, 203.

**343 Business Management 3(3,0) S**

An introductory study of the process of management. This includes the functions of planning, organizing, directing, controlling, and coordinating. The emphasis is on the business situation and thus other disciplines such as finance and marketing are discussed as they apply to the basic functions. P, 213, 223.

**353 Statistics I 3(2,2) FS**

Elementary statistical concepts, index numbers, tabular and graphical presentation, frequency distributions, measures of central tendency and variability, introduction to sampling error theory, time series, and simple regression and correlation. P, Math 113 or equivalent.

**363 Business Finance 3(3,0) F**

Capital and credit needs of business firms; principles and problems in extending and using business credit; analysis of financial statements; financial management; planning and financing capital structure; market for and investing in debt and equity securities. P, 213, 333 and three hours of accounting.

**373 Managerial Use of Accounting Data 3(3,0) F**  
(Offered in 1971)

Preparation, analysis and interpretation of accounting reports and the use of accounting data by the management of the firm in controlling and planning business activities. P, 223; 233 recommended. Alternate years.

**383 Agricultural Economics 3(3,0) S**

Application of production economics principles to problems of agricultural production. Input-output relationships; choice among levels of production; resource combination and cost minimization; enterprise combination; use of linear programming as a farm planning tool; costs of production; resource valuation; conservation of resources; effects of land tenure arrangements upon resource use; risk and uncertainty in agricultural production; supply of farm products. P, 213.

**393 and MHE 393 Consumers and the Market**  
3(3,0) FS

Factors important to families as purchasing agents and consumers: standardization of goods; grading, branding, labeling, packaging; advertising; consumer practices affecting cost; analysis of programs for con-

sumer protection; the market structure. Principles of maximization of consumer satisfaction. P, Econ 203.

**401 Economics Seminar 1(1,0) FS**

Economic problems of agriculture and related industries, with written or oral reports. At least one semester required of all economics majors. P, consent of instructor. Limited to 3 credits.

**403 Agricultural Finance and Appraisal 3(3,0) S**  
(Offered in 1970)

Capital and credit needs in agriculture; principles and problems in extending and using credit; analysis of financial statements; survey of agricultural credit institutions; valuation of agricultural land and buildings for loan and sales purposes. Field trips are required. P, 213 and 234; 333 recommended. Alternate years.

**413 Public Finance 3(3,0) FS**

Principles, problems and history of public revenues, public expenditures and public debt management. In addition, consideration will be given to problems of attaining an equitable distribution of burdens and benefits. P, 213.

**423 Intermediate Macroeconomics 3(3,0) FS**

Determinants of national income, employment and price level in free enterprise system with particular attention to aggregate consumption, investment and government spending. In addition, there will be brief consideration of methods of maintaining a high level of employment and income and related aspects of economic policy. P, 213.

**433 Intermediate Economic Analysis 3(3,0) FS**

Introduction to scope and method of economic analysis. Analysis of pricing process under varying degrees of competitive conditions and role of price in allocation of resources. Introduction to theory of income distribution. P, 213.

**443 Statistics II 3(2,2) FS**

Probability, point and internal estimation, tests of hypotheses, multiple regression and correlation, chi-square analysis, and analysis of variance. P, 353.

**453 Agricultural Policy 3(3,0) S**

Economic policies affecting agricultural prosperity; suggested means of improvement. Emphasis on national and regional problems and interrelationships affecting rural and national welfare. P, 433 or consent.

**463 Marketing Agricultural Products 3(3,0) S**

A study of the economics of marketing agricultural products. The economic basis of marketing; approaches to the study of marketing; the role of marketing and evaluation of the role; the dynamics of marketing; market structures and firm conduct; impact of contract farming, vertical and horizontal integration; futures trading, hedging and speculation; commodity and institutional problems of agricultural marketing; economic organization and functions of agricultural cooperatives; practices, problems, and factors affecting the success of agricultural cooperatives; government and agricultural marketing; current problems of agricultural marketing.

**473 General Insurance 3(3,0) S** (Offered in 1970)

A survey course in the field of insurance to serve as a common introductory course to the fire, casualty, surety, and life branches of the insurance business, and to aid the student in his personal, financial, job and business affairs. Alternate years.

**483 Market Prices 3(3,0) F** (Offered in 1970)

Principles of price determination with reference to special characteristics of agricultural products and markets; methods of price analysis and forecasting; theory of price stabilization and price discrimination and effect on income; analysis of programs and proposals to control agricultural prices by controlling production, market supplies, and foreign demands. P, 213. Alternate years.

**GRADUATE COURSES**

**603 Production Economics 3(3,0) S**

Theory of the firm and industry, with applications in agriculture, manufacturing, and trade. Input-output relations for economic decision-making using continuous models (marginal analysis) and discontinuous models (linear programming). P, 433 or consent.

**604 Econometrics 4(4,0) S** (Offered in 1970)

Application of mathematical economic theory and statistical procedures to economic data; empirical testing of economic theorems. P, 314. Alternate years.

**613 Economics of Modern Capitalism 3(3,0) F**

(Offered in 1969)

American economy as an organic entity; ownership and control of economic organizations; influence of power in economic groups; production, merchandising, pricing and financial strategies of economic groups. Positive and negative roles of government in economic regulation. P, 213. Alternate years.

**622 Statistics III 2(2,0) S** (Offered in 1971)

Sampling as technique in social science research, including history of sampling, design and planning of surveys, different types of sampling technique and methods of estimation, precision of estimates, and efficiency of sampling designs. P, 353. Alternate years.

**623 Advanced Farm Management 3(3,0) S**

(Offered in 1971)

Review of management principles, including decision making and problem recognition; obtaining control of resources; organizing farm; obtaining and evaluating outlook information; administering farm or ranch; effects of income taxes; farm incorporation; father-son arrangements, field trips to well-organized farms and ranches. P, 213 and 234 or consent. Alternate years.

**632 Advanced Economic Analysis 2(2,0) S**

(Offered in 1970)

Selected branches of microeconomics, including welfare theory and partial and general equilibrium. P, 433. Alternate years.

**633 Economics for High School Teachers**

(Workshop) Su

Basic course for preparation of high school economics instructors. Purposes of economic analysis, goals of a high school economics course, adaptation

of students' prior knowledge to economic analysis, application of graphic and mathematical tools to micro and macro economic analysis, behavioral vs. quantitative approaches to analysis, and interpretation of economic phenomena.

**643 International Trade 3(3,0) S** (Offered in 1971)

Factors affecting international flow of trade and balance of payments; trade controls and their influence on agricultural and domestic economy; significant current developments in trade and finance. P, 213. Alternate years.

**653 Comparative Economic Systems 3(3,0) F**

(Offered in 1969)

Organization, operation, and comparison of various types of economic systems, such as free private enterprise system, socialism, communism, and fascism. P, 213. Alternate years.

**663 Resource Economics 3(3,0) F** (Offered in 1969)

Economic analysis applied to problems in conservation and development of natural resources. Effect of programs on land-use. Land institutions, tenure, administration of public lands, water allocation, zoning, and alternative resource philosophies and policies. P, 213. Alternate years.

**673 History of Economic Thought 3(3,0) S**

Survey of economic theory; different schools of economic thought and economic environment which produced them. P, 433 or consent.

**683 Agricultural Marketing 3(3,0) S**

(Offered in 1970)

Economic analysis of marketing problems, functions and institutions; costs and efficiency in processing and marketing; industrial structure and government roles in processing and marketing. P, 433, 463. Alternate years.

**690 Special Problems 1-3(1-3,0) FS**

Advanced work or special problems in agricultural cooperation, agricultural finance, farm management, land economics, marketing, public finance, statistics. Open to qualified seniors and graduate students by consent.

**693 Economic Development 3(3,0) F**

(Offered in 1969)

Conditions necessary for capital formation and economic development with examination of development problem in selected area in U. S. and other countries. P, consent. Alternate years.

**701 Seminar in Economics 1(1,0)**

A maximum of 3 credits may be applied toward an advanced degree.

**702 Research Methods 2(2,0) F**

Methods, problems and principles involved in research work and sources of data for prospective research workers in economics.

**703 Advanced Macroeconomics 3(3,0) S**

(Offered in 1971)

Modern and advanced macroeconomic models, with a view toward understanding of progress of economic growth and maintenance of high level of income and employment. Alternate years.

**711 Current Theory 1(1,0) S**

One outstanding book in current economic theory studied intensively each semester.

**713 Theory of Markets 3(3,0) S (Offered in 1971)**

Study of the relationship between the structure of markets, including firm behavioral patterns, and market performance. Determination and analysis of performance standards. Alternate years.

**723 Economic Policy 3(3,0) F (Offered in 1970)**

Relations of economic policies to basic values, technical and institutional limitational factors; role and limitations of expert and theoretical analysis. Alternate years.

**790 Thesis in Economics as arranged**

**Entomology-Zoology (Ent,Z)**

Professors Walstrom, Hartwig, Huggins, Kirk, Ortman, Stoner; Associate Professors Greichus, Hamilton, Kieckhefer, Jones, McDaniel, Roller, Sutter, Swanson; Assistant Professors Balsbaugh, Haertel, Krysan; Instructors Branson, Calkins, Gustin, Thibodeau

Subjects offered by the Entomology-Zoology Department are planned to meet the needs of four groups of students: (1) Those who wish to major or minor in entomology, zoology, physiology, genetics, or in any two of these fields; (2) Those who feel the need for additional understanding of zoological science in connection with high school teaching; (3) Those who must have a fundamental training in the work of this department in order that they may pursue certain branches of study, such as animal science, horticulture, veterinary medicine, home economics, pharmacy, medicine, dentistry, nursing, etc.; (4) Those who desire merely to acquire knowledge of the fundamental facts and principles of entomology, zoology, or some phase of these branches of learning.

The work of this department is conducted by means of lectures, recitations, laboratory and field studies. The student is thus afforded, not only an opportunity to gain familiarity with the principles and theories discussed in the classroom, but also is encouraged to

put the theories to test and verify the principles in the field.

The laboratories are well supplied with the usual modern scientific equipment. Teaching aids and demonstration materials include many representative specimens, skeletons, charts, lantern slides, microscope slides, and a large collection of Riker mounts illustrating the life cycles of injurious insects.

The Northern Grain Insects Research Laboratory (Federal) is located about a mile north of the campus. It will afford to advanced undergraduate and graduate entomology students the opportunity to observe and in some instances to work with the most modern entomological research equipment available. The professional staff members of the laboratory hold faculty status at the University. Students majoring in entomology, especially those with graduate standing, are thus provided the opportunity to know and to work with an additional group of highly trained biological scientists in this important phase of zoology.

**Curriculum in Agriculture, Entomology Major**

Leading to the degree Bachelor of Science

(Also see Entomology curriculum in College of Arts and Science)

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	<b>Group I Course</b> .....	<b>3</b>
Freshman Composition, Engl 103 or 113 or 143.....	3	or 3	Introductory Physics, Phy 104 or Elementary Physics I, Phy 114.....	4
Physical Education, HPER 101 or 121.....	1	1	Elementary Organic Chemistry, Ch 134.....	4
Biology, Bio 113-123.....	3	3	Soils, PS 213.....	3
General Chemistry, Ch 164.....	4		Anatomy, Z 203.....	3
General Chemistry, Ch 173.....		3	Principles of Economics I, Econ 203.....	3
General Chemistry Laboratory, Ch 171.....		1	Fundamentals of Speech, Sp 103.....	3
Crop Production, PS 103.....	3		Algebra, Math 113.....	3
Introduction to Entomology, Ent 103.....	3	or 3	Zoological Literature, Z 201.....	1
Humanities or Social Science Elective.....	2		Elective.....	2
Plant Pathology in Human Affairs, PS 102	2			
Elective.....	2			
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	<b>Junior Year</b>	<b>F</b> <b>S</b>
General Agricultural Entomology, Ent 233..	3		Taxonomy of Insects, Ent 313.....	3
Introduction to Sociology, RS 153.....	3		Mammalian Physiology, Z 304.....	4
			Junior Composition, Engl 303.....	3
			General Bacteriology, Bac 204.....	4

National, or State and Local Government, PoS 213 or 243 .....	3	
Humanities or Social Science Elective .....	4	
Genetics, Bio 303 .....	3	
Entomology Electives .....	3	3
Principles of Animal Ecology, Z 302 .....	2	
Publicity Methods, J 322 .....	2	
<b>Senior Year</b> .....	<b>F</b>	<b>S</b>
Immature Insects, Ent 413 .....	3	
Statistics I, Econ 353 .....		3
Humanities or Social Science Elective .....		3
Entomology Seminar, Ent 401 .....	1	1
Elementary Biochemistry, Ch 244 .....	4	
Computer Languages, GE 343 .....		3
Insecticides, Ent 402 .....		2
Principles of Animal Taxonomy, Ent 442 .....		2
Electives .....	10	4

**Major:** (a) Must include minimum of: 12 credits of Group I courses; 8 credits of Social Science and/or Humanities electives; (b) Must include: Ent 103; Ent 233; Ent 313; Bio 303 and sufficient Department-approved upper-level entomology courses to total a minimum of 26 semester hours.

**Minor:** (a) As above.  
(b) Must include: Bio 113-123; Ent 103; Ent 313; Bio 303 and sufficient Department-approved upper-level entomology courses to total a minimum of 18 semester credits.

Students who expect to continue the study of Entomology on the graduate level should consider including among their electives, at least a year of French or German. Additional Math courses and Statistical Methods courses are also recommended.

Students who expect to teach in secondary schools should include such courses in the Department of Education as are required for teaching certification.

These curricula are designed to fit the needs of the average student. Where preparation for a special field is desired, substitutions may be made with the approval of the head of the department.

**UNDERGRADUATE COURSES**

**103 Introduction to Entomology 3(2,2) FS**  
Generalized study of structure, development, classification and control of insects. Basic entomological information prerequisite to further study in entomology.

**233 General Agriculture Entomology 3(2,2) S**  
Insects in relation to field crops, horticultural crops, livestock production, stored products, and other economic considerations; their life cycles, economic importance and control. P, 103.

**303 Medical Entomology 3(2,2) F (Offered in 1969)**  
Insects, mites and ticks which affect man; part they play in disease transmission; life cycles, habits, and control in relation to preventive medicine. P, 103. Alternate years.

**313 Taxonomy of Insects 3(1,4) F**  
Classification of insects. Emphasis on identification first to Order, then to Families. Each student makes insect collection, properly mounts, labels and identifies specimens. P, 103.

**401 Entomology Seminar 1(1,0) FS**  
Presentation of topics based on entomological liter-

ature in scientific journals. Open to advanced undergraduate students in entomology and related sciences. Maximum of 3 credits accepted. (Major students are urged to attend all seminar sessions during junior and senior years.)

**402 Insecticides 2(1,2) S**  
Formulation, chemistry, toxicology and application of common insecticides and miticides. Residue tolerances and legal aspects of sale and use of insecticides. P, Ent 103, Ch 134 or permission of instructor.

**403 Beekeeping 3(1,4) S**  
Habits and life cycle of honey bee; care of apiary; production, grading and marketing of honey; artificial insemination of queen bees; pollen identification and importance of bees to modern agriculture.

**413 Immature Insects 3(1,4) F**  
Taxonomy and habitat relationships of larval and nymphal stages of common insects of northern Great Plains area. Major emphasis is on those species of recognized economic importance, both beneficial and detrimental. P, 103 and 313.

**423 Acarology 3(1,4) S (Offered in 1970)**  
Comprehensive study of mites affecting plants and animals. Morphology, taxonomy, life cycles, disease transmission, and control methods are discussed. Techniques of collecting, preparation, and identification. Alternate years.

**433 Biological Control of Insects 3(2,2) F (Offered in 1969)**  
Comprehensive study of the use of biological methods to control insect populations. Importation, screening, introduction, and maintenance of predators and parasites; the epidemiology of diseases involving insects. P, Ent 103 or permission of the instructor. Alternate years.

**442 Principles of Animal Taxonomy 2(2,0) S (Offered in 1971)**  
Taxonomic concepts and procedures based on zoological evidence. Slanted primarily toward entomological problems. Application of zoological nomenclature based on the "International Code of Zoological Nomenclature." P, 313 or consent. Alternate years.

**GRADUATE COURSES**

**600 Entomology Research Problems 2-6 credits**  
Qualified students may investigate special entomological problems under supervision of members of departmental staff. Arrangements must be made with supervising staff member prior to registration. Undergraduate students limited to 2 credits. P, cumulative grade point average of at least 2.75 plus permission of supervisor.\*

**613 Insect Anatomy 3(2,2) F**  
Detailed anatomy of insects: integument, appendages, sense organs, and organ systems of representative larval, nymphal and adult forms. Consideration given to structural variation, embryology, and evolutionary relationships. P, 313 or its equivalent.

\*A total of not more than 6 credits in any combination of courses Ent 600 and Ent 700 may be counted toward requirement for the M.S. degree.

**623 Insect Physiology 3(2,2) S**  
 Fundamental physiological processes in insects. Normal and abnormal functioning of adult and immature stages, developmental physiology, physiology of behavior. P, Ch 134 and permission of instructor.

**643 Insect Ecology 3(2,2) S (Offered in 1970)**  
 Comprehensive study of insects in relation to their environment. Effects of microclimate and macroclimate on predators, parasites, diseases, reproduction, development, and feeding habits of insects. Techniques for determining various factors important to survival and reproduction in the insect's environment. P, 103, 313, Z 302. Alternate years .

**700 Taxonomy of Insect Groups 2-6 credits FS**  
 Taxonomic study of groups of insects. Student prepares report in which he gives technical description, and other information, of group under study. P, Ent 313. (See footnote on page 28.)

**701 Graduate Seminar in Entomology 1(1,0) FS**  
 Reports and discussions of topics of entomological

interest. Maximum of 3 credits accepted for M.S. degree. P, graduate status. (Major students are urged to attend all seminar sessions.)

**702 Insectary Methods 2(1,2) F (Offered in 1969)**  
 Methods of rearing insects under laboratory, greenhouse, and screenhouse or caged conditions; includes techniques of mass production of insects for use in biological control of insect pests. Alternate years.

**703 Insect Toxicology 3(2,2) S (Offered in 1971)**  
 Comprehensive study of insecticides and chemosterilants, their effects, antidotes, detection, and uses. The techniques of determining insecticide resistance in an insect population, insecticide residues, and radio-active tracers in laboratory and field populations. P, 402, Ch 134. Alternate years.

**790 Thesis in Entomology 5-7 credits for M.S. degree**  
 as arranged. Credits for Ph.D. degree to be determined by committee.

**Curriculum in Agriculture, Zoology Major**  
 Leading to the degree Bachelor of Science  
*(Also see Zoology curriculum in College of Arts and Science)*

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143 .....	3	or 3
Fundamentals of Speech, Sp 103 .....	3	3
Physical Education, HPER 101 or 121 .....	1	1
Biology, Bio 113-123 .....	3	3
Introduction to Sociology, RS 153 .....	3	3
General Chemistry, Ch 164 .....	4	
General Chemistry, Ch 173 .....	3	
General Chemistry Laboratory, Ch 171 .....	1	
Algebra, Math 113 .....	3	
Elective .....	3	or 1
Group I Course .....	3	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
National or State and Local Government, PolS 213 or 243 .....	3	
Anatomy, Z 203 .....	3	
General Bacteriology, Bac 204 .....	4	
Principles of Economics I, Econ 203 .....	3	
Group I Courses .....	3	3
Introductory Physics, Phy 104 .....	4	
Zoological Literature, Z 201 .....	1	
Elementary Organic Chemistry, Ch 134 .....	4	
Electives .....	1	1
<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303 .....	3	
Genetics, Bio 303 .....	3	
Embryology, Z 334 .....	4	
Mammalian Physiology, Z 304 .....	4	
Invertebrate Zoology, Z 424 .....	4	
Statistics I, Econ 353 .....	3	
Elementary Biochemistry, Ch 244 .....	4	
Vertebrate Zoology, Z 314 .....	4	
Electives .....	4	
<b>Senior Year</b>	<b>F</b>	<b>S</b>
Comparative Vertebrate Anatomy, Z 434 .....	4	
Humanities or Social Science Electives .....	4	4
Seminar in Zoology, Z 401 .....	1	1
Group I Course .....	3	
Publicity Methods, J 322 .....	2	
Electives .....	3	10

**Major:** (a) Must include minimum of: 12 credits of Group I courses; 8 credits of Social Science and/or Humanities electives; (b) Must also include Z 201; Z 203; Z 314; Z 324; Bio 303; and sufficient Departmental approved upper-level Zoology courses to total a minimum of 26 semester credits.

**Minor:** (a) As above. (b) Must include Z 314; Z 324; Bio 303; plus sufficient Department approved upper-level Zoology courses to total a minimum of 18 semester credits.

Students who expect to continue the study of Zoology on the graduate level should consider including, among their electives, at least a year of French or German. Additional Math courses and Statistical Methods courses are also recommended.

Students who expect to teach in secondary schools should include such courses in the Department of Education as are required for teaching certification.

These curricula are designed to fit the needs of the average student. Where preparation for a special field is desired, substitutions may be made with the approval of the head of the department.

**UNDERGRADUATE COURSES**

**113 Survey of Anatomy and Physiology 3(3,0) FS**  
 A survey of the general structure and function of the human body to provide a basic knowledge for the non-science student. This is a terminal course and is not to be considered as a prerequisite for other zoology courses. Credit for this course is not allowed if Z 203 and/or Z 304 are taken.

**201 Zoological Literature 1(1,0) S**  
 Literature sources used in various phases of zoological research; scientific journals, periodicals, indices, abstracting services; preparation and use of bibliographies.

**203 Anatomy 3(2,3) FS**

Structure of various systems of body as basis for physiology. Models and charts are used with references to skeletons. Injected and embalmed rats are used for a limited amount of dissection. Credit will not be allowed for both Z 113 and Z 203.

**302 Principles of Animal Ecology 2(2,0) F**

Animal ecology including succession, biomes, ecosystems, biotic communities, habitat types, energy flow in food chains, animal population dynamics and environmental factors affecting animals. Basic to many fields of animal sciences. P, Bio 113, 123.

**304 Mammalian Physiology 4(3,3) FS**

Comprehensive study of function of organizations; an explanation of physiological events in terms of physical and chemical processes that underlie them. For those students who need more intensive coverage of physiology in their major, and those who plan a professional career in this area or a related field. P, 203, Ch 154 or Ch 244 or Ch 134.

**313 Mammalogy 3(2,3) F**

Identification of game, furbearing, and small mammals; taxonomy of these groups, life histories and habits, preparation of study skins and skeletons; special reference to those occurring in Northern Great Plains area. P, Bio 113, 123.

**314 Vertebrate Zoology 4(3,2) F**

Structure and ways of life of the vertebrate classes. General anatomy, organ systems, and special characteristics of each class of vertebrates as well as detailed classification of the major taxa down to the family level. P, Bio 113, 123.

**323 Introduction to Medical Science 3(3,0) FS**

For Nursing College students, either at designated hospitals or on campus, as arranged. Pathology and clinical diagnosis measures in relation to causes of disease, diagnosis, treatment and control. P, 304.

**324 Invertebrate Zoology 4(3,2) S**

Phyla of invertebrate animals, emphasis placed on taxonomy, morphology, ecology, phylogenetic relationships, and economic importance. Some time is devoted to field work. P, Bio 113, 123.

**401 Seminar in Zoology 1(1,0) FS**

Presentation of topics based on zoological literature in scientific journals. Open to advanced undergraduate students in zoology and related sciences. Maximum of 3 credits accepted. (Major students are urged to attend all seminar sessions during junior and senior years.)

**403 Vertebrate Histology 3(1,6) F**

Alternate Su (Offered in 1970)

Comprehensive and detailed microscopic study of cells and fundamental tissues. Structures of organs and systems are stressed to integrate structure and function. P, Bio 113, 123.

**413 Histological Techniques 3(1,6) S**

Alternate Su (Offered in 1971)

Techniques of preparing animal tissue sections and slides for microscopic study. Students prepare, by several different methods, a number of slides of

various kinds of tissues and animals. P, Bio 113, 123.

**423 General Parasitology 3(2,3) F**

Survey is made of better known parasites belonging to various Phyla, their life histories, economic and medical importance. Laboratory work consists of study of morphology and life histories of representatives of each group, techniques of diagnosis of parasitic disease, and methods of preparation of whole mounts of parasites for microscopic examination. P, Bio 113, 123.

**434 Comparative Vertebrate Anatomy 4(2,4) S**

Theories of origin of Chordates and Vertebrates. Comparative analysis of vertebrate systems as they occur in various groups. Early Chordates, lamprey, shark, Necturus, and cat comprise laboratory specimens. P, Bio 113, 123.

**442 Principles of Animal Taxonomy 2(2,0) S**

(Offered in 1971)

See Ent 442 for description.

**GRADUATES COURSES****600 Zoological Research Problems 2-6 credits FS**

Qualified students may investigate special zoological problems under supervision of departmental staff. Arrangements must be made with supervising staff member prior to registration. Undergraduate students limited to 2 credits. Graduate students limited to 6 credits. P, cumulative grade point average of at least 2.75 plus permission of supervisor.

**602 Human Genetics 2(2,0) SSu (Offered in 1971)**

Subject matter of fundamental human heredity; to serve the specialist such as physician, nurse, public health worker, social worker, etc., and general student. Basic principles used as they pertain to genetics of man. P, Bio 303. Alternate years.

**604 Experimental Embryology 4(2,4) S**

(Offered in 1971)

A study and discussion of current concepts in experimental embryology. Students will conduct fundamental experiments in the laboratory to provide experience in working with living tissue and in observing embryological development. Each student is assigned one or two major areas in experimental embryology and is required to conduct a literature review and report on current developments. P, Bio 113, 123, Z 334. Alternate years.

**612 History and Philosophy of Zoology 2(2,0) F**

(Offered in 1969)

Early zoologists and their contribution to science. Controversial theories of past and their influence on growth of science of zoology; their relationship to modern zoological concepts. Biographies and works of great zoologists. P, Bio 113, 123. Alternate years.

**614 Endocrinology 4(3,3) F (Offered in 1969)**

A study of the effects of the secretions of the various glands of the body on the growth, development, metabolism, and reproduction of domestic animals. P, 304. Alternate years.

**654 Mammalian Anatomy 4(2,6) F**

Detailed dissection of cat as representative mammal. Comparisons with human body (skeleton, models, charts) given special attention. All systems are dissected and studied. For those students who need more comprehensive and detailed course in anatomy than is available in 203. P, Bio 113, 123.

**664 Advanced Systemic Physiology 4(3,3) F**

Various systems of the animal body; coordination and inter-relationships of systems; circulation, temperature regulation, muscle, and respiration. P, Z 304 and consent of instructor.

**674 Advanced Systemic Physiology 4(3,3) S**

Physiology of digestion, rumination, urine formation, reproduction, nervous system, endocrine glands, and special senses. P, 664 or consent of instructor.

**701 Graduate Seminar in Zoology 1(1,0) FS**

Reports and discussions of topics of zoological in-

terest. Maximum of 3 credits accepted. P, graduate status. Major students are urged to attend all seminars.

**703 Developmental Genetics 3(3,0) F**

(Offered in 1969)

Chemical nature of the gene and its chemical and physical action in development. P, Bio 113, 123, Bio 303 and Ch 134. Alternate years.

**713 Helminthology 3(2,2) S (Offered in 1970)**

Comprehensive study of worm parasites of vertebrate animals and of soil and plant nematodes. Morphology, taxonomy, life cycles, ecological relationships, and control methods are discussed. Techniques of collecting, preparation, and identification. P, Bio 113, 123, Z 324. Alternate years.

**790 Thesis in Zoology 5-7 credits, as arranged FSSU**

**Horticulture-Forestry (Ho)**

Professor Peterson; Associate Professors, Adams, Collins, Johnson, Prashar; Assistant Professor Herman

The Horticulture-Forestry Department offers training in the broad field of horticulture, landscape design work and park management. The department also offers a two-year curriculum in pre-forestry following which students transfer to another school to complete their forestry training.

Students in horticulture may select the production, business or science option depending on their interests. Extensive research plots in fruit, vegetables, woody ornamentals, herbaceous ornamentals, and shelterbelts provide excellent outdoor teaching aids. Greenhouses provide additional opportunities for the student.

Students in landscape design and park management find the new ornamental research and demonstration plots of much value. The campus itself and various parks in the area provide additional readily available teaching aids.

Graduates in horticulture, landscape design and park management hold responsible positions in the region and throughout the nation. They may be city, state or federal employees and supervisors, park superintendents, park planners, food processors, food and drug inspectors, and owners and operators of garden centers, greenhouses, florist shops and nurseries.

**Curriculum in Agriculture, Horticulture Major  
Leading to the degree Bachelor of Science**

<b>Freshman Year</b>	<b>F</b>	<b>S</b>		
Freshman Composition, Engl 103 or 113 or 143	3		State and Local Government, PolS 243	3
Introduction to Entomology, Ent 103	3		Introductory Physics, Phy 104†	4
Physical Education, HPER 101 or 121	1		Option and Elective Courses	3 10
Fundamentals of Speech, Sp 103	3		<b>Junior and Senior Years</b>	<b>F S</b>
General Chemistry, Ch 114 or Ch 164*	4		Junior Composition, Engl 303	3
Biology, Bio 113-123	3	1	Plant Propagation, Ho 363	3
General Horticulture, Ho 103	3	3	Advanced Exposition, Engl 350	3
Introduction to Sociology, RS 153	3	3	Horticulture Seminar, Ho 431	1
Algebra, Math 113†	3	3	Humanities or Social Science Electives	3 5
Option and Elective Courses	3	5	Option and Elective Courses	24 26
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>		
General Bacteriology, Bac 204		4	*Students planning to pursue the science option or graduate studies should elect Ch 164.	
Principles of Economics I, Econ 203	3		†Students planning to follow the Science Option may choose Math 113, 133, 143 or the Mathematical Sequence 145, 155.	
Soils, PS 213	3		‡Elementary Physics 114 is recommended for the Science Option.	
Plant Pathology, PS 234	4			
National Government, PolS 213 or				

In addition to the above courses which are required of all horticulture majors, the fol-

lowing are required under respective options.

### Horticulture Production Option

Students who select this option should have a knowledge of related subjects such as botany, chemistry, entomology and soils. The program is designed for those who plan to work in nurseries; fruit, vegetable or flower production; processing; and distribution.

	<b>Credits</b>
Soil Management, Fertility and Fertilizers, PS 323 .....	3
Basic Taxonomy, Bot 204 .....	4
Plant Physiology, Bot 424 .....	4
Elementary Organic Chemistry, Ch 134 .....	4
Genetics, Bio 303 .....	3
Horticulture Courses¶ .....	18
General Electives .....	14

### Horticulture Business Option

Students who plan to enter a business and need some horticultural background may be interested in this option. Sales, federal and state services, private business and other similar occupations may be entered by graduates who select this option.

	<b>Credits</b>
Principle of Economics II, Econ 213 .....	3
Principles of Accounting I, Econ 223 .....	3
Business Management, Econ 333 .....	3
Twelve additional hours to be chosen from the following: Econ 233, 303, 323, 333, 353, 363, and 373 .....	12
General Psychology, Psy 203 .....	3
Horticulture Courses¶ .....	18
General Electives .....	8

### Horticulture Science Option

Those who plan to do graduate work will find it advantageous to follow the science option. Additional courses may be taken as electives according to the interests of the student.

	<b>Credits</b>
Plant Physiology, Bot 424 .....	4
General Chemistry, Ch 173 and Ch 171 .....	4
Quantitative Analysis, Ch 214 .....	4
Elementary Organic Chemistry, Ch 134 or Organic Chemistry 310-320 .....	4-10
Genetics, Bio 303 .....	3
Horticulture Courses¶ .....	18
General Electives .....	13-7

¶In each option a minimum of 24 credits in Horticulture is required. All courses in Horticulture are subject to approval by the student's adviser.

## Curriculum in Agriculture, Landscape Design Major Leading to the degree Bachelor of Science

This program is for students who may be self employed, enter a variety of commercial fields, serve as federal, state or municipal employees where landscaping or related type of ornamental horticultural training is needed.

	<b>F</b>	<b>S</b>
<b>Freshman Year</b>		
Freshman Composition, Engl 103 or 113 or 143 .....	3	
Physical Education, HPER 101 or 121 .....	1	
Algebra, Math 113* .....	3	
Biology, Bio 113, 123 .....	3	
General Horticulture, Ho 103 .....	3	
Humanities or Social Science Elective .....	3	
Engineering Graphics, EG 113 .....	3	
General Chemistry, Ch 114 or Ch 164 .....	4	
Trigonometry, Math 133* .....	3	
Electives .....	4	
<b>Sophomore Year</b>		
Elementary Surveying, CE 202 .....	2	
Introductory Physics, Phy 104 .....	4	
Fundamentals of Speech, Sp 103 .....	3	
Introduction to Sociology, RS 153 .....	3	
Woody Plants, Ho 274 .....	4	
Engineering Surveys, CE 204 .....	4	
National Government, PolS 213 .....	3	
Drawing and Composition, Art 122 .....	2	
Design, Art 102 .....	2	
Architectural Drafting, EG 222 .....	2	
Electives .....	3	

	<b>F</b>	<b>S</b>
<b>Junior Year</b>		
Junior Composition, Engl 303 .....		3
Advanced Exposition, Engl 350 .....	3	
Ceramics, Art 272 .....	2	
Floral Design, Ho 262 .....	2	
Landscape Design I, Ho 303 .....	3	
Site Planning, Ho 333 .....	3	
Group I Electives in Agriculture .....	3	
General Psychology, Psy 203 .....		3
Principles of Economics I, Econ 203 .....		3
Turf Management, Ho 323 .....		3
Landscape Construction, Ho 423 .....		3
Herbaceous Plants, Ho 362 .....	2	
Electives .....		3
<b>Senior Year</b>		
Horticulture Seminar, Ho 431 .....	1	
Planning Public Grounds, Ho 353 .....	3	
Urban Sociology, RS 373 .....	3	
Introduction to Literature, Engl 203 .....	3	
History of American Art, Art 232 .....	2	
State and Local Government, PolS 243 .....	3	
Plant Propagation, Ho 363 .....		3
Landscape Design II, Ho 423 .....		3
Town and City Planning, Ho 422 .....	2	
Soils, PS 213 .....	3	
Group I Electives in Agriculture .....		3
Elective .....		3

\*Algebra and Trigonometry, Math 145 may be substituted for Math 113-133.



**Curriculum in Agriculture, Park Management Major**  
Leading to the degree Bachelor of Science

This program is designed for students who plan to enter professional park management. Increasing demand for parks and recreational facilities require trained people to plan and administer park and recreational programs. Graduates who have specialized in this option can expect to find employment with federal, state or local government agencies.

	F	S
<b>Freshman Year</b>		
Freshman Composition, Engl 103 or 113 or 143.....	3	
Physical Education, HPER 101 or 121.....	1	1
General Forestry, Ho 112 or General Horticulture, Ho 103.....	2-3	
Introduction to Entomology, Ent 103.....		3
General Chemistry, Ch 114 or Ch 164.....	4	
Biology, Bio 113-123.....	3	3
Algebra, Math 113.....		3
Introduction to Sociology, RS 153.....	3	
Fundamentals of Speech, Sp 103.....		3
Introductory Physics, Phy 104.....		4
<b>Sophomore Year</b>	F	S
Principles of Economics I-II, Econ 203-213.....	3	3
Plant Pathology, PS 234.....	4	
Herbaceous Plants, Ho 362.....	2	
Soils, PS 213.....	3	
Geology, PS 243.....		3
Dendrology, Ho 213.....		3
General Psychology, Psy 203.....	3	
Basic Parks Organization, Ho 222.....	2	
Principles of Accounting I, Econ 223.....		3

	F	S
<b>Junior Year</b>		
Junior Composition, Engl 303.....	3	
Soil and Water Mechanics I, MA 342.....	2	
Plant Propagation, Ho 363.....		3
Woody Plants, Ho 274.....	4	
Forest Ecology, Ho 273.....		3
Landscape Design I, Ho 303.....	3	
Humanities or Social Science Electives.....		2
Public Speaking, Sp 323.....	3	
Economics Electives*.....	3	3
Electives.....		6
	17	18

<b>Summer Session</b>		
Summer Practicum, Ho 410†.....		4
<b>Senior Year</b>	F	S
Public Administration, PolS 333.....		3
Advanced Exposition, Engl 350.....	3	
Planning Public Grounds, Ho 353.....	3	
State and Local Government, PolS 243.....	3	
Horticulture Seminar, Ho 431.....	1	
Economics Electives*.....	3	
Electives‡.....	(4)	
Parks Development, Ho 413.....		3
Arboriculture, Ho 473.....		3
Turf Management, Ho 323.....		3
Town and City Planning, Ho 422.....		2
Community Recreation, HPER 442.....		2

\*Nine credits to be elected from Econ 233, 303, 343, 353, 413 or 463.  
 †Students must elect either of the following: (1) Work two summers between the freshman and senior years in two different park systems approved by the Horticulture-Forestry Department. No credits allowed. (2) Summer Practicum in Park Management. (Required of all majors working less than two full summers.)  
 ‡For students not taking Summer Practicum.

**Curriculum in Agriculture, Pre-Forestry\***

The two-year pre-forestry curriculum in forest management is offered for students who expect to enter a school of forestry to complete the Bachelor of Science degree. Advantage of in-state tuition fees is thus accorded to resident student for two of the four years required for a degree. For students who are interested in other phases of forestry work such as wood technology, forest recreation, or lumber merchandising, it may be necessary to revise the designated two-year curriculum to meet the requirements of the selected forestry school degree program.

With the ever increasing emphasis placed on forestry by private industry such as lumber, pulp and paper, veneer, wood preservation and others, a broad and varied field of employment has been opened to graduate foresters. Federal, state, city and county agencies offer employment opportunities in

the field of administration, education, research and technical services.

	F	S
<b>Freshman Year</b>		
Freshman Composition, Engl 103 or 113 or 143.....	3	
Introduction to Sociology, RS 153.....	3	
Physical Education, HPER 101 or 121.....	1	1
Biology, Bio 113-123.....	3	3
Algebra, Math 113 or 145.....	3-5	
General Forestry, Ho 112.....	2	
Mathematical Analysis I, Math 155 or Mathematics for Social Sciences, Math 225 or Plane Trigonometry, Math 133.....		5-3
General Chemistry, Ch 114 or 164.....		4
Fundamentals of Speech, Sp 103.....		3
Humanities Electives.....		3
<b>Sophomore Year</b>	F	S
English Elective.....	3	
Introductory Physics, Phy 104 or 114.....		4
Introduction to Entomology, Ent 103.....		3
Basic Taxonomy, Bot 204.....		4

\*This curriculum may be adjusted to better fit the requirements of the forestry school where the student intends to complete his degree program.

Principles of Economics I, Econ 203 .....	3
Soils, PS 213 .....	3
Dendrology, Ho 213 .....	3
Geology, PS 243 .....	3
Elementary Organic Chemistry, Ch 134 .....	4
Elementary Surveying, CE 202 .....	2
Social Science or Humanities Elective .....	3

**UNDERGRADUATE COURSES**

**103 General Horticulture 3(2,2) FS**  
 General principles of fruit, vegetable and flower growing; planting and care of home grounds.

**112 General Forestry 2(2,0) F**  
 Introduction to forestry with main emphasis on American forestry. Brief description of forestry as a profession.

**213 Dendrology 3(2,3) S**  
 Identification, classification and characteristics of commercial forest trees of United States. Laboratory identification of South Dakota trees and shrubs.

**222 Basic Parks Organization 2(2,0) F**  
 (Offered in 1969)  
 History, organization, basic features, maintenance and budget arrangements of American parks. Alternate years.

**253 Vegetable Growing 3(2,2) F (Offered in 1969)**  
 Methods used by home gardeners and commercial growers in vegetable production. P, Ho 103 or PS 103. Alternate years.

**262 Floral Design 2(0,4) F**  
 Principles and methods of cut flower arrangement; use of flowers and plants in home; exhibiting and judging flowers and plants.

**273 Forest Ecology 3(3,0) S**  
 Basic factors controlling forest growth and development under natural conditions.

**274 Woody Plants 4(1,6) F**  
 Nomenclature, identification and classification of hardy coniferous and deciduous trees and shrubs, vines, and groundcovers. Landscape use as affected by inherent ornamental qualities, hardiness, environmental factors, and pests is emphasized. P, Ho 213 or consent of instructor.

**303 Landscape Design I 3(0,6) F**  
 Historical development, present trends and future possibilities of landscape design. Drawing techniques and small property designs are included as laboratory portion of course. P, Ho 274, CE 202 or consent of instructor.

**313 Farm Forestry 3(3,0) F (Offered in 1970)**  
 Brief history of U. S. forestry; tree and its environment; farm woodland forestry with emphasis on windbreaks and shelterbelts. Alternate years.

**323 Turf Management 3(2,2) S (Offered in 1971)**  
 Maintenance and culture of turfgrass for lawns, parks, golf courses, athletic fields and special purpose turf. P, PS 213 desirable. Alternate years.

**333 Site Planning 3(0,6) F (Offered in 1969)**  
 Technical work in preparing grading plans, computing areas of cut and fill, site selection, topographic analysis, soil and exposure analysis, surface and subsurface drainage and pedestrian and vehicular circulation. P, CE 204. Alternate years.

**343 Landscape Construction 3(0,6) S**  
 (Offered in 1970)  
 Design and construction of walks, terraces, fences, masonry walls, pool and landscape accessories. P, Ho 333. Alternate years.

**353 Planning Public Grounds 3(1,4) F**  
 (Offered in 1970)  
 Landscape design and planting of areas for public use. P, Ho 303. Alternate years.

**362 Herbaceous Plants 2(2,0) F (Offered in 1970)**  
 Culture of bulbs, annuals and perennials used for landscaping and home grounds. Alternate years.

**363 Plant Propagation 3(2,2) S (Offered in 1970)**  
 Commercial methods and theories of propagating plants by seeding, cuttings, layering and grafting. Alternate years.

**410 Summer Practicum in Park Management**  
 (4 credits Su)  
 Supervised training in actual on-the-site situations. Students will visit and study typical park situations in municipal, state and federal parks. P, consent of instructor.

**413 Parks Development 3(3,0) S (Offered in 1970)**  
 Study of existing parks and their functions. P, Ho 222. Alternate years.

**422 Town and City Planning 2(1,2) S**  
 (Offered in 1970)  
 Integration of residential areas, recreational facilities and other physical elements of midwestern towns and cities. Field trips will be made. P, Ho 353. Alternate years.

**423 Landscape Design II 3(0,6) S**  
 Advanced Landscape Design involving contemporary theories and complex problems. P, Ho 343, 353.

**431 Horticulture Seminar 1(1,0) F**  
 Scientific work pertaining to horticulture. Required of major students; each student limited to two credits.

**433 Fruit Production 3(2,2) F (Offered in 1970)**  
 Principles of fruit production, soil, moisture, fertility, temperature, nursery stock, fruit formation, fruit setting and pruning. P, Ho 103. Alternate years.

**453 Environment and Vegetable Crops 3(3,0) F**  
 (Offered in 1971)  
 Influence of environmental factors on economic plants with special emphasis on vegetable crops. P, consent of instructor. Alternate years.

**463 Greenhouse Management 3(2,2) S**  
 (Offered in 1971)  
 Construction, heating, and management of greenhouses. Laboratory work gives experience in greenhouse management. Field trips are made to commercial greenhouses. P, Ho 362 and PS 213.

**473 Arboriculture 3(1,4) (Offered in 1970)**  
 Shade and ornamental tree planting and care combined with dendrician practices. P. Bio 123. Alternate years.

**GRADUATE COURSES**

**600 Horticulture Problems 1-2 FS**

Special investigation for graduate students. Maximum of four hours credit. Open as elective to selected undergraduates.

**643 Horticultural Crop Breeding 3(2,2) S**

(Offered in 1971)

Application of principles of genetics and cytology

to improvement of horticultural crops. P, Bio 303. Alternate years.

**731 Graduate Seminar 1(1,0) F**

**732 Experimental Horticulture 2(2,0) S**

Principles, methods, equipment, organization and application of horticultural research. P, graduate standing.

**790 Thesis in Horticulture 5-7 FS**

**Journalism (J)**

Professor Phillips; Associate Professor Jess; Instructors Brown, Laird, Neal

The curriculum in Agricultural Journalism is designed for students who wish training in journalism with an agricultural background. This curriculum prepares students to become associated with agricultural magazines, farm papers, rural newspapers, college extension services, experiment stations,

and with firms employing writers and journalists trained in agriculture. Many of the graduates go into public relations work.

For Journalism course descriptions see Journalism in the College of Arts and Science.

**Curriculum in Agricultural Journalism  
Leading to the degree Bachelor of Science**

*(Also see Journalism curricula in College of Home Economics and Arts and Science)*

<b>Freshman Year</b>		<b>F</b>	<b>S</b>	<b>Junior Year</b>		<b>F</b>	<b>S</b>
Freshman Composition, Engl 103				Junior Composition, Engl 303	3	or	3
or 113 or 143	3	or	3	Newspaper Editing, J 302	2		
Physical Education, HPER 101 or 121	1		1	Editing Laboratory, J 311-321	1		1
General Chemistry, Ch 114	4			Magazine Production and Writing, J 380	1		
Algebra, Math 113 or Algebra and				Farm Power and Machinery, MA 213			3
Trigonometry, Math 145	3-5			Newspaper Advertising, J 352	3		2
Introduction to Sociology, RS 153			3	Poultry Management, AS 203	3		
Biological Science	3-4	3-4		Introduction to Entomology, Ent 103			3
Introductory Physics, Phy 104 or Elementary				Broadcast Journalism, J 343	3		
Physics I, Phy 114 or General Physics I,				Humanities and/or Social Science Electives	3		5
Phy 195		4-5		Electives*			
Crop Production, PS 103	3			<b>Senior Year</b>	<b>F</b>		<b>S</b>
Introduction to Animal Science, AS 103			3	Interpretive Reporting, J 423	3		
Electives				Law of the Press, J 473	3		
<b>Sophomore Year</b>	<b>F</b>		<b>S</b>	Journalism Seminar, J 431			1
Principles of Economics I-II, 203-213	3		3	Problems in Reporting, J 440	2	or	2
National Government, PolS 213	3			Problems in Editing, J 450	2	or	2
Soils, PS 213			3	Problems in Advertising and Management,			
Fundamentals of Speech, Sp 103			3	J 460	2	or	2
Elements of Dairying, DS 103			3	Electives*			
Newswriting and Reporting, J 243	3			Electives in Agriculture†			6
Typography, J 202	2			*Not more than 40 credits in journalism may be counted toward the degree, exclusive of J 362 and J 473.			
Press Photography, J 232	2			†Suggested electives in Agriculture: AS 243 Animal Nutrition; Ent 602 Insecticides; PS 233 Weed Control; Econ 323 Marketing; Econ 234 Farm Management; or PS 373 Plant Disease Control.			
General Horticulture, Ho 103			3				
Electives	4		2				

## Mechanized Agriculture (MA)

Professors Moe, DeLong, Myers, Wiersma; Associate Professors DeBoer, Lytle, Turnquist, Waelti; Assistant Professors Chu, Hanson, Hellickson, Spuhler, Young; Instructors Brosz, Dowding, Hoover, Madden, Onstad

The Mechanized Agriculture Major is a four-year major developed around the general Agriculture core curriculum. It is designed to give broad training in both Agricultural Sciences and Agricultural Mechanization. It prepares the student for farm management, extension work, farm machinery and equipment sales, sales or contracting

enterprises, farming, electric power use, work with federal agencies such as Soil Conservation Service, Agricultural Loan officer with banks and other fields related to Agriculture.

The Department offers courses in Weather Science which may be elected by students in all colleges.

### Curriculum in Agriculture, Mechanized Agriculture Major

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143	3	
Welding, ES 131	1	
Physical Education, HPER 101	1	1
Crop Production, PS 103	3	
General Chemistry, Ch 114 or 164		4
Algebra and Plane Trigonometry, Math 113-133 or Math 145	3 or 5	3
Introduction to Literature, Engl 203		3
Machine Shop, ES 121	1	
Biological Science Courses	3	3
Group I Electives*		3
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
National Government, PolS 213, or State and Local Government, PolS 243		3
Fundamentals of Speech, Sp 103	3	
Chemistry Elective (Not Ch 104)	4	
Introduction to Sociology, RS 153	3	
Analytic Geometry, Math 143	3	
Engineering Graphics, EC 113		3
Soils, PS 213		3
Farm Power and Machinery, MA 213	3	
Group I Electives		6
Elective of option course		3
<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303		3
Publicity Methods, J 322	2	
Electricity for Farm and Home, MA 222	2	
Principles of Economics I, Econ 203	3	
Soil and Water Mechanics, MA 342		2
Social Science and/or Humanities Elective	2	3
Elementary Physics I-II, Phy 114-124	4	4
Elective and option courses	4	5
<b>Senior Year</b>	<b>F</b>	<b>S</b>
Farm Building Mechanization, MA 423		3
Food Processing Equipment, MA 472	2	
Physical Climatology and Meteorology, AE 363	3	
Business Law, Econ 303	3	
Principles of Accounting I, Econ 223 or Farm Management, Econ 234		3-4
Social Science Electives	3	
Elective and option courses	6	11

**Major (30 credit hours):** MA 212, 222, 342, 423, 472; EG 112; ES 121, 131, 151; Phy 114; Math 133, 143.

**Suggested Electives:** In addition to electives from Group I, PS 312, 323, 313, 343, 372, 373, 452; AS 243, 251, 303; Bac 204; Econ 333, 343, 353; DS 223, 315, 433; MA 452, 473; Ent 102, 233; RS 202, 332, 382.

In addition to courses listed above which are required by every student majoring in Mechanized Agriculture, a minimum of an additional 15 semester hours are required under the Business, Science, Irrigation and Equipment and Processing options. Accordingly the elective program for each student must be planned with his counselor and approved by the Head of the Agricultural Engineering Department.

#### Business Option

Course	Credits
Principles of Economics II, Econ 213	3
Money and Banking, Econ 333	3
Business Management, Econ 343	3
Statistics I, Econ 353 or equivalent	3
Business Finance, Econ 363	3
Business or Economics Elective	3
Managerial Use of Accounting Data, Econ 373	3

#### Science Option

Course	Credits
General Bacteriology, Bac 204	4
Biological Science Elective†	3
Chemistry	4
Mathematics and/or Physics	4
Science Electives	6

#### Irrigation Option

Course	Credits
Soil and Water Mechanics, MA 452	2
Forage Crops and Pasture Management, PS 313	3
Soil Management, Fertility and Fertilizers, PS 323	3
Soil Physics, PS 452	2
Irrigation, Crop and Soil Practices, PS 483	3

\*Required from Group I electives for mechanized agriculture majors are a minimum of three credits in animal science and Plant Science 213 with a minimum of 12 credits from Group I.

†Courses must be selected from the following areas: Botany, Biology, Entomology-Zoology, Plant Pathology, Bacteriology.

Environment and Vegetable Crops, Ho 453 .....	3
Plant Pathology, PS 234 .....	4
Descriptive Micro-Climatology, AE 472 .....	2
Plant Kingdom, Bot 203 .....	3
Elementary Surveying, CE 202 .....	2
Mathematics and/or Physics, Chemistry .....	6

**Equipment and Processing Option**

(15 credits to be selected from following courses)  
**Course Credits**

Agricultural Product Processing, MA 473 .....	3
Seed Production and Processing, PS 312 .....	2
Food Bacteriology, Bac 353 .....	3
Dairy Product Processing I, DS 315 .....	5
Vegetable Growing, Ho 253 .....	3
Plant Pathology, PS 234 .....	4
Poultry Products Technology, AS 312 .....	2
Meat and Meat Processing, AS 213 .....	3
Experimental Foods, NFS 343 .....	3
Experimental Testing and Development in Food Science, NFS 353 .....	3

**UNDERGRADUATE COURSES**

**202 Farm Mechanics 2(1,2) FS**

Practical instruction in farm shop management, to include: safety, shop layouts, selection, care and use of hand and power farm shop tools and equipment.

**213 Farm Power and Machinery 3(2,2) FS**

Tractors and farm machinery from the standpoint of operation, repair, preventative maintenance, safety, cost of operation, and efficiency. Theoretical and practical aspects of calibration, hydraulic systems, fuels, lubricants, and power trains.

**222 Electricity for Farm and Home 2(1,2) FS**

Application of electricity on farm, circuits, wiring, lighting, appliances, operating principles of electric motors, organization and financing of rural electric cooperatives and distribution system plans.

**262 Auto Mechanics 2(1,2) F**

Engine tune-up, servicing and repairing engine accessories; testing valves, carburetors, ignition systems; installing new rings, valves and general work required of mechanics. Credit will not be given for both MA 262 and MA 213.

**342 Soil and Water Mechanics I 2(1,2) FS**

Engineering phases of soil and water conservation; elementary measurements and surveying, and their application to field problems; design and layout of conservation and irrigation practices.

**423 Farm Building Mechanization 3(2,2) FS**

Building materials and construction techniques for farm buildings with special attention to planning mechanization of livestock housing facilities, feeding operations, and manure removal systems. P, MA 222.

**452 Soil and Water Mechanics II 2(1,2) S**

Principles of conservation, irrigation, and drainage practices and their relationship to farm practices. P, MA 342, senior standing.

**472 Food Processing Equipment 2(1,2) F**

Principles of refrigeration, heat transfer, power transmission, instrumentation and materials handling applied to dairy and food processing equipment. Selection, operation, and maintenance of equipment. P, Math 113, senior standing.

**473 Agricultural Product Processing 3(2,2) S**

Equipment, its theory and function, operation, reliability and relationship to handling, storing, preserving, packaging, and processing agricultural products. P, MA 472.

**490 Special Problems 1-3**

Special problems in Mechanized Agriculture with engineering implication for studying, investigating, and reporting where satisfactory solution must be written up in final report. Selection and completion of special problems does not require background of professional engineering courses and limited to non-engineering students. Must have approval of adviser and head of department.

**GRADUATE COURSES**

**612 Advanced Farm Machinery 2(1,3) Su**

(Offered in 1970)

Operation, care, adjustment, new developments in farm machinery, with emphasis on field and farmstead machinery as related to needs of agricultural production. Alternate years.

**632 Advanced Farm Motors 2(1,3) Su**

(Offered in 1971)

Operation, selection, care, adjustment, and new development of internal combustion engines as applied to farm power units. Alternate years.

**652 Advanced Rural Electrification 2(1,3) Su**

(Offered in 1970)

Operation, selection, care, adjustment, and new developments in rural electric equipment; motors, fans, controls, wiring, pumps, grain handling equipment, and home and classroom lighting. Alternate years.

**672 Advanced Farm Structures 2(1,3) Su**

(Offered in 1971)

Materials for farm construction; construction methods and techniques; new developments in farm building. Alternate years.

Courses for Bachelor of Science Degree in Agricultural Engineering. (For full description of course offerings see College of Engineering.)

## Plant Science (PS)

Professors Moore, Brage, Carson, Derscheid, Fine, Kinch, Mankin, Nagel, Semeniuk, Shank, Shubeck, Stone, Wells, Westin, White; Associate Professors Albrechtsen, Buchenau, Colburn, Dybing, Gardner, Horton, Hovland, Jensen, Kenefick, Lunden, Olson, Price, Rumbaugh; Assistant Professors Erion, Evenson, Frazee, Gerloff, Kingsley, Otta, Strizke, Thysell; Instructors Geise, Stymiest, Ward, Weber.

The Plant Science Department was created by the combination of the Agronomy and Plant Pathology Departments in 1969. A primary goal of this Department is to prepare the student for leadership in industries and agencies related to crop production, soil management, and plant disease control or to prepare him for graduate study leading to a career in research and development. Graduates with training in plant sciences are eagerly sought by agri-business, private foundations, and federal and state agencies for employment in domestic and international agriculture. Training in plant science provides an excellent background for independent pursuits in farming or ranching.

Because of the many facets of the plant sciences, most students will elect one of the several optional programs that will allow in-depth study of a particular phase of plant science. Five options are offered in the Plant Science major: a) Production, b) Crop Science, c) Irrigation, d) Plant Pathology, and e) Soil Science. The curriculum contains a minimum of required courses. A broad choice of electives will enable the Plant Science student to select a particular area of study to fit his interests.

The choice of an option need not be made until the Sophomore year. This will enable the student to become familiar with the broad field of plant science and through consultation with faculty and advisors to develop an individual program that will satisfy his needs, interests, and aptitude.

### PRODUCTION OPTION

This option is designed for students interested in those aspects of plant science with farming, ranching, extension, and the processing or sale of seed, grain, fertilizers, or agricultural chemicals. The only course requirements are those listed under the Plant Science Major.

### CROP SCIENCE OPTION

A Crop Science Option is offered for students interested in advanced study of the more scientific aspects of crop production. In addition to the courses listed in the Plant Science Major, the student will need to take

Plant Science 234, 422, 432, four additional hours of Chemistry and three additional hours in Mathematics and/or Physics.

### IRRIGATION OPTION

This option is designed to provide the additional technology required for crop production and soil management under irrigation.

In addition to the courses specifically listed for a Plant Science Major, a student interested in the Irrigation Option will take the following courses; Plant Science 234, 323, 414, 432, 452, 483; Mechanized Agriculture 342, 452; Agricultural Engineering 363; Horticulture 453 and also complete 6 hours of Mathematics and/or Chemistry or Physics.

### PLANT PATHOLOGY OPTION

Plant pathology is offered for those students interested in an intensive study of plant diseases. Courses offered emphasize the recognition, development, and cause of diseases, and the means to control them. Because fungi, bacteria, and viruses are the principal biological agents of disease, and disease is an interaction between the plant and the agents, courses should be selected that strengthen this understanding.

In addition to the courses specifically listed in the Plant Science Major, the student will need to take Plant Science 234, 373, 404, 424, and 434.

### SOIL SCIENCE OPTION

A Soil Science Option is offered which will meet the requirements developed by the Soil Science Society of America. This option should be followed by students interested in fundamental aspects of soils. Graduates are prepared for employment in governmental services (such as U. S. Soil Conservation Service) and business and industrial concerns dealing with soils e.g., commercial research laboratories. Students considering graduate study of soils should meet the requirement of this option.

In addition to the courses specifically listed in the Plant Science Major a student will take Plant Science 243, Chemistry 214, three additional hours of Mathematics, four additional hours of Physics and twelve additional hours of soils.

**Curriculum in Agriculture, Plant Science Major**

Leading to the degree Bachelor of Science

All Plant Science Majors must complete at least 24 hours of course credit in Plant Science.

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	Animal Nutrition, AS 243.....	3
Freshman Composition, Engl 103 or 113 or 143 .....	3		Introductory Physics, Phy 104 or Elementary Physics, Phy 114 or	
Physical Education, HPER 101 or 121 .....	1	1	General Physics, Phy 195 .....	4 or 5
General Chemistry, Ch 164, 171, 173 .....	4	4	General Bacteriology, Bac 204 .....	4
Algebra and Trigonometry, Math 113, 133 or 145 .....	3	3	Electives .....	4
Biology, Bio 113, 123 .....	3	3	<b>Junior Year</b>	<b>F S</b>
Plant Pathology in Human Affairs, PS 102 or Plant Pathology, PS 234* .....	2 or 4		National Government, PolS 213 or State and Local Government, PolS 243 ..	3
Crop Production, PS 103 .....	3		Junior Composition, Engl 303 .....	3
Introduction to Sociology, RS 153 .....	3		Advanced Composition, Engl 350 .....	3
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Genetics, Bio 303 .....	3
Plant Kingdom, Bot 203 .....	3		Humanities and/or Social Science Electives	4
Soils, PS 213 .....	3		Electives, Major and Option Courses .....	7
Fundamentals of Speech, Sp 103 .....	3		<b>Senior Year</b>	<b>F S</b>
Organic Chemistry, Ch 134 or 310 .....	4 or 5		Undergraduate Seminar, PS 491 .....	1
Principles of Economics, Econ 203 .....	3		Plant Physiology, Bot 424 .....	4
Introduction to Entomology, Ent 103 .....	3		Electives, Major and Option Courses .....	12
				16

\*Those students following the Crop Science, Irrigation, or Plant Pathology options must take PS 234.

**Curriculum in Biological Science, Plant Pathology Major**

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	103 Crop Production 3(2,2) FS	
Freshman Composition, Engl 103 or 113 or 143 .....	3 or 3		Fundamental practices and principles; crop distri- bution; growth process; response to environment.	
Physical Education, HPER 101 or 121 .....	1	1	Grain and forage crops, including their distribution, use, improvement, growth, harvesting, and market- ing.	
General Chemistry, Ch 164-171-173 .....	4	4	<b>213 Soils 3(2,3) FS</b>	
Algebra and Trigonometry, Math 113-133 or 145 .....	3-5	3	Origin, development, physical properties, fertility and management of soils. P, Ch 114.	
Biology, Bio 113-123 .....	3	3	<b>233 Weed Control 3(2,2) F</b>	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	Identification of weed plants; growth, dissemina- tion, economic importance, and distribution. Chemi- cal and cultural methods of control and eradication. P, 103 or Ho 103.	
General Bacteriology, Bac 204 .....	4	4	<b>234 Plant Pathology 4(2,4) F</b>	
Plant Pathology, PS 234 .....	4		Principles underlying nature of causal agents and symptomology of plant diseases. Laboratory study and recognition of diseases. P, Bio 123 recommend- ed.	
Principles of Economics I, Econ 203 .....	3		<b>243 Geology 3(3,0) S</b>	
Fundamentals of Speech, Sp 103 .....	3		Fundamental geologic processes, including rock weathering, work of wind, ground water, streams, glaciers, lakes, ocean, volcanism, mountain forma- tion, origin of earth, minerals and rocks. P, Ch 114.	
Introduction to Sociology, RS 153 .....	3		<b>303 Seed Technology 3(2,2) S</b>	
Elementary Physics I-II, Phy 114-124 .....	4	4	Seed laws, seed testing rules and procedures. Seed anatomy, physiology, dormancy and the aging pro- cesses. Purity and germination interpretations and evaluations. Identification of crop and weed seeds. P, 103 or Ho 103.	
National or State and Local Government, PolS 213 or 243 .....	3		<b>312 Seed Production and Processing 2(2,0) F</b>	
Soils, PS 213 .....	3		Production and harvesting of seed crops. Seed pro- cessing and grading procedures and machinery. Con- ditioning, drying, storage, and marketing; produc- tion of certified and hybrid seed crops. P, 103, or Ho 103.	
Introduction to Entomology, Ent 103 .....	3			
<b>Junior Year</b>	<b>F</b>	<b>S</b>		
Junior Composition, Engl 303 .....	3			
Organic Chemistry, Ch 310-320 .....	5	5		
Mycology, PS 424 .....	4			
Plant Disease Control, PS 373 .....	3			
Genetics, Bio 303 .....	3			
Advanced Exposition, Engl 350 .....	3			
Electives* .....	4	6		
<b>Senior Year</b>	<b>F</b>	<b>S</b>		
Diseases of Field or Horticultural Crops, PS 404 or 414 .....	(4)	4		
Plant Physiology, Bot 424 .....	4			
Basic Taxonomy, Bot 204 .....	4			
Electives* .....	12-13	8-9		

\*These must include 8 hours of additional Social Science and/or Humanities electives.

**UNDERGRADUATE COURSES**

**102 Plant Pathology in Human Affairs 2(2,0) FS**  
Effect of plant diseases on crop production and human welfare; historical significance in man's progress and existence. General aspects of symptoms, cause and spread of plant disease organisms.

**313 Forage Crops and Pasture Management**

3(2,2) F

Grasses and legumes; their establishment, management and use for hay, pasture, and silage. P, 103.

**323 Soil Management, Fertility and Fertilizers**

3(3,0) F

Considerations and practices in soil management, including rotations, use of fertilizers and crop residue management to maintain and improve productivity. Chemical composition of soils, fertilizers and crops and relationships between soils and crops. P, 213.

**343 Grain Crops 3(2,2) F**

Distribution, adaptation, classification and culture of corn, wheat, oats, barley, rye, sorghums, flax, soybeans and other grain crops. Marketing and market quality determinations. P, 103, Bio 303.

**372 Soil Conservation 2(2,0) F**

Value of soil as natural resource; effects of soil physical properties, type of rainfall, vegetation, cultural practices on soil erosion. Methods of conservation of soil, water, and plant nutrients with special emphasis on agronomic practices. P, 213.

**373 Plant Disease Control 3(2,2) S**

Prevention and practical methods of control of important diseases including market and storage troubles caused by fungi, bacteria, viruses, nematodes and physiological causes; plant quarantine regulations, residue tolerance, etc. Laboratory devoted to types of equipment used in application of fungicides, specificity of fungicides, dosage, calibration of spray and dust applicators. P, 234.

**404 Diseases of Field Crops 4(3,2) S**

(Offered in 1970)

Major diseases of field crops and of tropical plants important to man's need: symptoms produced; life cycles of causal agents: bacteria, fungi, viruses, and nematodes; abiotic factors. Epiphytology will be emphasized. P, 234. Alternate years.

**414 Soil Genesis, Classification and Survey 4(3,4) S**

Factors and processes of soil formation and development. Field work on identification, classification, and mapping. Application of soil data in terms of land use capabilities. P, 213, 243.

**422 Crop Breeding 2(2,0) F**

Application of genetic principles and allied subjects used in breeding crop plants. P, 103, Bio 303.

**424 Mycology 4(2,6) F**

Structures, life histories and classification of fungi. P, Bio 123.

**432 Crop Ecology and Physiology 2(2,0) S**

Analysis of environmental factors and their interactions on growth and distribution of economic crops. Effects of manipulation of these factors on physiology of plant and quality of crop. P, Bot 424, or consent of instructor.

**434 Diseases of Horticultural Crops 4(3,2) F**

(Offered in 1970)

Major diseases of vegetables, fruits, landscape plants and turfs caused by bacteria, fungi, viruses, nematodes and abiotic factors. The epiphytology of these diseases is emphasized. P, 234. Alternate years.

**443 Soil Chemistry 3(2,3) F (Offered in 1970)**

Basic chemical phenomena in soil genesis, weathering, mineralization of organic matter and nutrition of plants. Reactions of soils with waters and soil amendments; colloidal properties as applied to soils; chemical characterization of soils in laboratory. P, 213, Ch 214. Alternate years.

**452 Soil Physics 2(2,0) S**

Physical properties of soils; interrelations of the solid, liquid and gaseous components of soils; soil-water-plant relationships. P, 213, Phy 104.

**462 Soil Morphology 2(2,0) S (Offered in 1970)**

Field studies involving writing detailed soil profile descriptions; correlation of soil profile characteristics with land use, management, and potential productivity. P, 213, 243. Alternate years.

**483 Irrigation—Crop and Soil Practices 3(3,0) S**

Management of South Dakota soils and crops under irrigation. Movement and storage of water in soil; cropping systems; crop varieties; use of legumes manures and commercial fertilizers. Soil acidity, salinity, and alkali. P, 213, Math 113.

**490 Special Problems 1 or 2 FSSU**

Assigned readings, research, and written reports, P, consent of instructor. Limit of 2 hours for B.S. degree.

**491 Undergraduate Seminar 1(1,0) FS**

Review of literature and original investigations in technical crop and soil bulletins and agronomic journals with written and oral reports. Two hours required for graduation.

**493 Disease Identification 3(1,6) Su**

Field trips, recognition and identification of plant diseases. P, 234 or consent of instructor.

**GRADUATE COURSES****603 Fungus Physiology 3(2,2) F (Offered in 1970)**

Nutritional and other requirements of fungi, including plant pathogens, for growth and reproduction; their intermediate metabolism and elaboration of chemical by-products. P, 424, Bac 204. Alternate years.

**614 Biometry 4(4,0) F**

Principles of statistical methods as applied to biological data with special reference to experimental design, reduction of experimental data and tests of significance and their interpretation. P, Math 113.

**633 Advanced Genetics 3(3,0) F**

Procedures in genetic studies, cytoplasmic influences, gene physiology, mutagenesis, chromosomal changes, linkage, and steps toward genetic code. P, Bio 303.

**634 Plant Nematology 4(2,4) F (Offered in 1970)**

Nematode diseases of plants with emphasis on collection, isolation, preservation, symptomatology, life histories, identification and control of plant parasitic nematodes. P, 234, Bio 123. Alternate years.

**663 Advanced Weed Physiology and Control**

3(3,0) F (Offered in 1970)

Physiological and ecological principles of weed control including methods of elimination. Chemistry and applications of herbicides. P, 233, Ch 134, Bot 424. Alternate years.



**672 Soil Mineralogy** 2(2,0) F (Offered in 1970)

Soil minerals and their identification. P, 213, 243. Alternate years.

**702 Phytopathogenesis** 2(2,0) F (Offered in 1971)

Fundamentals of infection and disease development, disease susceptibility or resistance of host, and how disease affects host development. Preparation and presentation of reports on pertinent topics. P, 404 and 424. Alternate years.

**703 Cytology** 3(2,2) F (Offered in 1970)

Physio-chemical nature of cell inclusions with reference to their role in heredity. P, consent of instructor. Alternate years.

**713 Cytogenetics** 3(2,2) F (Offered in 1969)

Nature and behavior of chromosomes in relation to heredity, with consideration of cytogenetic studies. P, consent of instructor. Alternate years.

**723 Advanced Plant Breeding** 3(3,0) S

(Offered in 1971)

Basic principles of quantitative variation in crop plants; method of analysis of effects due to genetic and environmental sources; and programs of improvement. P, 422, 614. Alternate years.

**724 Plant Virology** 4(2,4) S (Offered in 1970)

Virus diseases in plant with emphasis on nature and physical properties of virus, development of virus within host, symptom expression on plant, host range and variability between and within virus groups. Preparation and presentation of reports on pertinent topics. P, 404. Alternate years.

**725 Bacterial Phytopathology** 5(2,6) F

(Offered in 1970)

Detailed study of etiology and epiphytology of representative bacterial diseases emphasizing biology and control of pathogen. Preparation and presentation of reports on pertinent topics. P, 404. Alternate years.

**742 Advanced Soil Fertility** 2(2,0) F

(Offered in 1969)

Chemistry of soil-plant relationships; advanced theory and practice in use of fertilizers. P, 323. Alternate years.

**743 Advanced Soil Physics** 3(3,0) F

(Offered in 1969)

Mechanisms responsible for flow of heat, water, and air through soils; application of the principles of mathematics and physics to solution of specific prob-

lems of saturated and unsaturated water flow, heat flow, and aeration in soils. P, Math 333. Alternate years.

**745 Mycology** 5(2,6) F (Offered in 1970)

Advanced taxonomy of fungi. P, 424. Alternate years.

**753 Advanced Soil Chemistry** 3(3,0) S

(Offered in 1970)

Advanced chemical considerations of soil constituents in dynamic environment of soil; conditioning effects of climate and other environmental factors; characteristics, reactions, and importance of clay mineral and colloidal complex. P, 443. Alternate years.

**755 Mycology** 5(2,6) S (Offered in 1971)

Advanced taxonomy of fungi. P, 424. Alternate years.

**772 Advanced Soil Morphology and Genesis**

2(2,0) S (Offered in 1971)

Classification and nomenclature of soil; factors governing and processes active in soil development; soil geography. P, 414, 462. Alternate years.

**773 Design and Analysis of Experiments** 3(3,0) S

(Offered in 1970)

Organization and integration of research projects with application of statistical methods and experimental design. Use of analysis of variance and covariance, variance components, multiple and curvilinear regression for data reduction and interpretation. P, 614. Alternate years.

**780 Advanced Special Problems** 1 or 2 FSSU

Laboratory or field research with relevant literature reviews, conferences and reports. P, consent of instructor.

**781 Plant Science Seminar** 1(1,0) FS

Reports and discussions of current investigations in Plant Science (two credits required for M.S., three for Ph.D.).

**783 Phytopathogen Variability** 3(3,0) S

(Offered in 1970)

Variability in plant pathogens and related microorganisms as this contributes to our understanding of incidence of development of disease resistant strains of crop plants. Preparation and presentation of reports on pertinent topics. P, 404 and 424, Bio 303.

**790 Thesis** As arranged

## Rural Sociology (RS)

Professors Sauer, Chittick, Dimit, Riley; Assistant Professors Field, Lanham; Instructor Satterlee

The courses offered by the Rural Sociology department have been organized with three definite objectives in mind: (1) to offer a sequence of courses for those in the Agriculture and Biological Sciences, Arts and Science or other colleges who may wish to earn an undergraduate major or minor in sociology; (2) to meet the need for basic services courses that will be of interest and

practical help to students in any college of the University; (3) to offer sufficient courses in sociology of an advanced nature to fulfill the requirements for a major or minor toward a Master's degree or Doctor of Philosophy degree in Sociology.

Completion of the sociology curriculum provides basic training for rural and urban leaders. A wide variety of fields such as Ex-

tension work, Social Welfare and Social Security, Care and Treatment of Delinquents, Teaching and Research, Industry, and Government Service are open to sociology

majors. A sociology major leading to either a B.S. or B.A. Degree is available in the College of Arts and Science for students wishing to major in that college.

**Curriculum in Agriculture, Rural Sociology Major**

*(Also, see curriculum in Rural Sociology in College of Arts and Science)*

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143.....	3	
Physical Education, HPER 101 or 121.....	1	1
Chemistry, Ch 114-134.....	4	4
Introduction to Sociology, RS 153.....	3	3
Group I, Ag Electives.....	3	3
Fundamentals of Speech, Sp 103.....	3	
Electives.....	3	6

<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
Social Problems, RS 232.....	2	
Algebra, Math 113 or 145.....	3-5	
Biology, Bio 113-123.....	3	3
Group I, Ag Electives.....	3	3
Rural Sociology, RS 202.....	2	
Principles of Economics I, Econ 203.....	3	3
General Psychology, Psy 203.....	3	
General Anthropology, RS 213.....	3	3
Electives.....	3	3

<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303.....	3	
Intermediate Sociology, RS 393.....	3	
Principles of Economics II, Econ 213.....	3	3
National Government, PolS 213.....	3	3
Introduction to Research Methods, RS 363.....	3	3
General Bacteriology, Bac 204.....	4	
Statistical Methods I, Econ 353.....	3	
Group I, Ag Elective (Soils).....	3	
State and Local Government, PolS 243.....	3	
Introductory Physics, Phy 104.....	4	
Humanities Electives.....	3	

<b>Senior Year</b>	<b>F</b>	<b>S</b>
Advanced Exposition, Engl 350 or Publicity Methods, J 322.....	2	
Economics Elective.....	3	3
Humanities Electives.....	3	3
Natural Science Elective.....	3	
Sociology Electives, Upper Division.....	2	3
Electives, Upper Division.....	6	8

**Major:** RS 153, 202, 213, 232, 363, 393, and 11 additional elective sociology credits.

**Minor:** RS 153, 202, 232, and 9 additional sociology credits. Six credits must be numbered 300 or above. RS 213, 363, and 393 recommended as electives.

**Military** (optional) may be used as an elective.

**UNDERGRADUATE COURSES**

**153 Introduction to Sociology 3(3,0) FSSU**  
Prerequisite to most courses numbered above 153. Comprehensive study of society, with analysis of group life, and other forces shaping human behavior.

**202 Rural Sociology 2(2,0) FSSU**  
Rural society, rural communities, population composition and trends, social processes; social participation in rural organizations and agencies; and changing relationship between country and city in contemporary society. P, 153.

**213 General Anthropology 3(3,0) F**  
The study of fossil man, and the mutual influence of biology and culture upon human beings of the past and in the present. P, 153.

**222 Marriage 2(2,0) FSSU**  
Courtship and marriage period given special emphasis. Mate selection problems, adjustments in marriage, reproduction, child-parent relations, divorce, and later years of marriage.

**232 Social Problems 2(2,0) F**  
Present day problems in American society, such as crime, divorce, alcoholism, drug addiction, old age, physical and mental health—their significance and current methods of prevention and treatment. P, 153.

**243 Introduction to Social Work 3(3,0) F**  
The study of the history of social case work, and social services for children, the family, the aged, public welfare clients, the mentally ill, criminals, the school and the community. P, 153.

**253 Social Legislation 3(3,0) S**  
Principles underlying past and present legislation concerning civil rights, labor unions, marriage and divorce, birth control, child welfare including adoption, illegitimacy, juvenile court and various classes of dependents provided for in Social Security Act. P, 153.

**262 Leadership 2(2,0) F**  
Analysis of leadership and authority, qualities and types of leaders, and leadership problems and situations. P, 153.

**313 Cultural Anthropology 3(3,0) S**  
The study of specific prehistoric, historic and modern cultures, and anthropological theories of authority, status and role, groups, values, ideologies, technology, economics, kinship art, and modern evolution. P, 153 and 213.

**342 Race and Nationality Problems 2(2,0) S**  
America's minority groups: inter-racial and inter-cultural conflicts, accommodation and assimilation Sources of prejudice, current trends, and proposed solutions. P, 153.

**353 Population Problems 3(3,0) SSU**  
Theories of population: factors involved in birth rate, death rate, and migrations. Social consequences of population change; problems of population composition and population policy. P, 153.

**363 Introduction to Research Methods 3(3,0) F**  
The research process; selection and formulation of a research problem; elementary research design; data collection procedures; analysis and interpretation of data; and the preparation of a research report. P, 153 and consent of instructor.

**373 Urban Sociology 3(3,0) F**

Patterns of urban growth, demographic and ecological processes, institutions, folkways, dynamics of social class, and social problems of modern city and urban fringe areas. P, 153.

**382 Industrial Sociology 2(2,0) S**

Human relations in industry; factory social tensions and conflict; problems of personal adjustment; labor organizations; relations between industry and community; patterns of authority and communication applicable to most forms of social organization.

**393 Intermediate Sociology 3(3,0) F**

Analysis of structure and changes of society. Social relationship studied in terms of their specific forms, varieties, patternings, and systems. Social organizations studied in terms of sustaining forces and change. P, 153.

**403 The Small Town 3(3,0) S (Offered in 1970)**

Structure, activities, problems, resources and functions of rural community; methods and techniques of community organization; institutional services and leadership with economic and social relationships of the small town to both open country and urban centers. P, 153. Alternate years.

**413 Criminology 3(3,0) F**

Nature and causes of crime. Theories of punishment. Agencies and methods of arrest, conviction, and segregation of criminals. Jails, prisons and reformatories. Probation and parole. P, 153.

**433 The Family 3(3,0) F**

Development of family as social institution. Main emphasis on contemporary American family under rural and urban conditions, and impact of urbanization and industrialization upon various facets of family life. P, 153.

**442 Social Problems of the Aged 2(2,0) S**

(Offered in 1971)

Role of old people in various societies with major emphasis on adjustment problems among aged in contemporary American society. P, 153 and consent of instructor. Alternate years.

**GRADUATE COURSES****612 Social Thought 2(2,0) F (Offered in 1971)**

Brief survey of history and development of world's most important social theories and schools of social thought, evaluated in light of present knowledge. P, 153, 393. Alternate years.

**623 Social Organization 3(3,0) S (Offered in 1971)**

Elements of social organization. Analysis of social groups and complex social organizations. Examina-

tion of conditions and factors related to the integration and disintegration of social organizations. P, 393. Alternate years.

**632 Demographic Data and Analysis 2(2,0) F**

(Offered in 1970)

U. S. Census data and methods of analysis, vital registration, rates and ratios, life tables, measures of mortality, measures of fertility, measures of migration, estimates and projection of future population. P, 353 or consent of instructor. Alternate years.

**633 Leadership and Group Organization 3(3,0) S**

(Offered in 1972)

Emergency and types of leadership in group situations; analysis of leader-follower roles, functions and relationships in groups, and organizations. P, 153, and consent of instructor. Alternate years.

**643 Social Stratification 3(3,0) F (Offered in 1969)**

Factors in the development and organization of systems of social stratifications. Relationship of social mobility to social stratification. P, 393 or consent of instructor. Alternate years.

**683 Social Change 3(3,0) S (Offered in 1972)**

Theories concerning factors and processes in social-cultural change. Consideration of various interpretations of social-cultural change in terms of stages, cycles, and trends. P, 153, 393.

**690 Special Problems in Sociology 1-3(1-3) FSSu**

Advanced work or special problems in such areas as population, marriage and family, rural sociology, criminology, social organization or urban sociology. P, open to seniors and graduate students with sufficient background.

**703 Research Methods in Sociology 3(3,0) S**

(Offered in 1971)

Use of scientific method in sociological research; basic tools of research design; some special applications of statistical techniques to social data. P, 153, 393, and Econ 353 or Ed 613. Alternate years.

**713 Sociological Theory I 3(3,0) F (Offered in 1970)**

Critical examination of the main schools of sociological theory beginning with the system of August Comte and ending with World War II. P, 153, 393. Alternate years .

**723 Sociological Theory II 3(3,0) S**

(Offered in 1971)

Sociological theories from World War II to present. P, 153, 393. Alternate years .

**780 Seminars in Sociology 1-4 as arranged****790 Thesis in Sociology as arranged****Veterinary Science (Vet)**

Professor Weide; Professors Emeriti Harshfield, Taylor; Associate Professors Bailie, Bicknell; Instructors Bury, Kirkbride

The development of complex systems of livestock farming and transportation has greatly increased the opportunity for introduction of animal and avian diseases into herds and flocks. Livestock and poultry pro-

ducers must give attention to disease prevention and control in their farming and ranching operations. The courses in this department are planned to meet the demand for information in this field, as well as provide

basic information in ancillary areas, such as wildlife management.

South Dakota does not have a professional College of Veterinary Medicine. The pre-veterinary curriculum is offered for superior students who plan to enter a College of Veterinary Medicine in other states. Exceptional students may meet requirements in two years of pre-veterinary study. Many students require three years of pre-veterinary work, and some students complete a Bachelor of Science Degree before entrance into the pro-

fessional curriculum of Veterinary Medicine.

Entrance into the professional curriculum in a College of Veterinary Medicine rests with the individual applicant, and is based upon many factors, including his previous academic record. Keen competition should be anticipated, and the student should be aware of the difficulties involved in acceptance to a College of Veterinary Medicine. The Department of Veterinary Science makes every effort to counsel and assist the student.

**Suggested Pre-Veterinary Curriculum\***

<b>Freshman Year</b>	<b>F</b>	<b>S</b>	
Freshman Composition, Engl 103 or 113 or 143.....			3
Introduction to Sociology, RS 153.....			3
Humanities, GS 253.....		3	
General Chemistry, Ch 164.....	4		
General Chemistry, Ch 173.....		3	
General Chemistry Laboratory, Ch 171.....		1	
Biology, Bio 113-123.....	3	3	
Algebra, Math 113.....		3	
Plane Trigonometry, Math 133.....		3	
Physical Education, HPER 101.....	1	1	
Fundamentals of Speech, Sp 103.....		3	
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>	
National Government, PolS 213.....			3
Genetics, Bio 303.....			3
Organic Chemistry, Ch 310-320.....	5	3	

Elementary Physics I-II, Phy 114-124.....	4	4
Plant Kingdom, Bot 203.....		3
Introduction to Literature, Engl 203.....		3
Quantitative Analysis, Ch 214.....		4

\*This curriculum does not meet the pre-veterinary requirements of all Colleges of Veterinary Medicine. The student, on advice of his counselor, may alter the pre-veterinary curriculum to meet specific requirements of certain colleges.

**UNDERGRADUATE COURSES**

**403 Animal Diseases and Their Control 3(3,0) F**

A general study of diseases of livestock, poultry, and wildlife, with emphasis on sanitation, prevention and control. P, Bac 204.

**GRADUATE COURSES**

**600 Problems in Veterinary Science 1-3 as arranged.**  
Fall-Spring. P, Vet 403, consent of staff.

**Wildlife and Fisheries Sciences (WL)**

Professor Progulske; Associate Professor Linder; Assistant Professors Applegate, Nickum, Severson; Instructor Dahlgren

The curriculum in Wildlife and Fisheries Sciences offers professional training in fisheries, game, and related biological areas. It is designed to cover a broad spectrum of physical and biological science courses as well as social science, humanities, and other courses which are essential to understanding the relationship of man to his environment.

This curriculum prepares the student for a variety of positions with state and federal agencies such as state conservation organizations, U. S. Fish and Wildlife Service, U. S. Forest Service, U. S. National Park Service, U. S. Soil Conservation Service, U. S. Public Health Service, etc. By taking prescribed educational courses, students obtain cer-

tification to teach biology in secondary schools.

The Department of Wildlife and Fisheries Sciences offers both the Bachelor of Science and Master of Science degrees. A student who plans a career in research should complete the advanced degree. A scholastically high record in undergraduate studies is essential for admission to a graduate study program. Several programs including the Cooperative Wildlife Research Unit, Cooperative Fishery Unit, S. D. Experiment Station, and the Water Resources Research Institute are within the Department of Wildlife and Fisheries Sciences and offer opportunities for financial assistance to qualified students working for the graduate degree.

Curriculum in Biological Science, Wildlife and Fisheries Science Major

<b>Freshman Year</b>	<b>F</b>	<b>S</b>
Freshman Composition, Engl 103 or 113 or 143	3	or 3
Introduction to Literature, Engl 203	3	or 3
Introduction to Sociology, RS 153	3	
Biology, Bio 113-123	3	3
Algebra and Trigonometry, Math 145 and Mathematical Analysis I, Math 155	5	5
General Chemistry, Ch 164	4	
Conservation of Natural Resources, WL 202		
Physical Education, HPER 101	1	1
<b>Sophomore Year</b>	<b>F</b>	<b>S</b>
National Government, PolS 213	3	or 3
Organismic and Population Biology, Bio 283	3	
General Chemistry, Ch 171-173	4	
Principles of Economics I, Econ 203	3	
Elementary Physics, Phy 114-124	4	4
Elementary Organic Chemistry, Ch 134 or Organic Chemistry, Ch 310	4	4
Soils, PS 213	3	
Biological Science Elective	3	
Elective*	3	
<b>Junior Year</b>	<b>F</b>	<b>S</b>
Junior Composition, Engl 303	4	3
Elementary Biochemistry, Ch 244	4	
Mammology, Z 313	3	
Ichthyology, WL 313	3	
General Bacteriology, Bac 204	4	
Ornithology, WL 324	4	
Fundamentals of Speech, Sp 103	3	
Basic Taxonomy, Bot 204	4	
Anatomy, Z 203	3	
Elective*	3	
<b>Senior Year</b>	<b>F</b>	<b>S</b>
Wildlife Management, WL 404	4	
Genetics, Bio 303	3	
Mammalian Physiology, Z 304 or Plant Physiology, Bot 424	4	
Invertebrate Zoology, Z 324	4	4
Advanced Exposition, Engl 350	3	
Statistics I, Econ 353	3	
Humanities or Social Science Electives	3	2
Electives	3	6

\*A minimum of 9 hours of electives must be taken from a list of current suggested elective courses prescribed by the Department.

This curriculum fits the need of the average student. Where preparation for special fields is desired, substitutions may be made with the approval of the Head of the Department.

Students who expect to teach in secondary schools should include such courses in the Department of Education as are required for teaching certification.

Students who expect to do Journalism work in the field of wildlife following graduation should minor in Journalism. The following courses have been recommended by the Department of Journalism as a minimum for such a minor: J 202, 232, 243, 302, 311-321, 423, 473.

UNDERGRADUATE COURSES

202 Conservation of Natural Resources 2(2,0) S  
A survey course that presents the fundamental

concepts of conservation and the scientific basis of conservation. Examines the structure and functions of major resources-management agencies and organizations.

313 Ichthyology 3(2,3) F  
Characteristics and relationship of fish and fish-like vertebrates; adaptations, modifications, and life histories of major groups; identification of common species of game and forage fishes; economic and recreational importance of various groups. Special reference to fishes of North central and Northern Great Plains States. P, Bio 123.

324 Ornithology 4(2,4) S  
Identification of game and other birds; life histories, habits, special structural and physiological adaptations of various groups. Study of native and introduced birds of North America. P, Bio 123.

404 Wildlife Management 4(3,2) F  
Application of ecological principles to management of wild animals. Wildlife agencies and their function in wildlife management; refuge system; techniques of management; philosophy of wildlife conservation and biopolitics. P, 313, or permission of instructor.

GRADUATE COURSES

600 Wildlife Research Problems 1-2 credits, as ranged FS (Limit of 2 credits for B.S. degree; limit of 2 credits for M.S. degree)  
Qualified students may investigate special wildlife problems under supervision of departmental staff. Arrangements must be made with supervising staff member prior to registration. P, cumulative grad point average of at least 2.75 plus permission of supervisor.

603 Fisheries Science 3(2,3) F (Offered in 1970)  
Specific taxonomy and life histories, distribution, environmental requirements, habits, species, interrelationships, population statistics, economic and recreational importance of species. P, 313, 404. Alternate years.

613 Advanced Wildlife Management 3(2,3) S  
State and federal legislation pertinent to wildlife species and wildlife lands. State and federal agencies, their administration policies and programs. Regional management practices of game animals in the U. S. and foreign countries. P, 313, 404, Z 313.

623 Animal Ecology 3(1,6) F (Offered in 1970)  
Composition of environment and relationships of animals to their surroundings. Impact of ecological forces upon animals and responses elicited are examined in the field. P, permission of instructor. Alternate years.

624 Limnology 4(2,6) S  
Analysis of physical, chemical, and biological characteristics of lakes, ponds, and streams and factors and processes that operate in fresh water as dynamic systems. Methods of measuring and evaluating influences affecting aquatic life in fresh waters. P, Bot 424.

**701 Wildlife Seminar 1(1,0) FS**

Reports and discussions of current topics in wildlife research and management. Not more than 3 credits may be applied towards graduate degree.

**703 Wetlands Management 3(2,3) F**

(Offered in 1969)

Depletion and preservation of wetland areas during past and present years. Economic and recreational importance of wetlands. Need for coordinating land-use policies of various federal and state governmental agencies. Federal and state legislation as it relates to wetland management. Ecological analysis

of wetland area in eastern South Dakota. P, 313, 324, 404, Z 313. Alternate years.

**724 Aquatic Ecology 4(2,6) F (Offered in 1969)**

Qualitative and quantitative measurements of aquatic populations including primary production and biomass. Interrelationship of biotic and abiotic components of aquatic ecosystems. Productivity and factors affecting rates of transfer of energy and matter within aquatic communities will be stressed. Alternate years.

**790 Thesis in Wildlife 5-7 credits as arranged FSSu**

## **The Agricultural Experiment Station**

Duane C. Acker, Director

The Agricultural Experiment Station conducts investigations through organized research in Agriculture and Home Economics to find new facts with which to solve the problems of the farm, ranch, home and related businesses.

Research workers probe the unknown to discover the nature of living organisms and inert materials and their relation to man and his environment. New facts discovered through research are the basis of the teaching and Extension programs and are therefore the basis of progress.

The application of new facts brings new wealth and therefore the results of research benefit all citizens.

The research program is carried out through planned projects in the several departments of Agriculture and Home Economics.

The following departments have active projects in progress: Agricultural Engineering, Animal Science, Bacteriology, Botany-Biology, Dairy Science, Economics, Ento-

mology-Zoology, Horticulture, Plant Science, Rural Sociology, Station Biochemistry, and Veterinary Science in Agriculture and Biological Sciences; and Nutrition and Food Science, and Textiles and Clothing in Home Economics.

Research work is in progress at the main station located at Brookings and at branch stations located near Buffalo, Centerville, Cottonwood, Eureka, Highmore, and Redfield with cooperative work at the U. S. Field Station at Newell. Other important sites are located at Garden City, Presho, and Watertown.

The research program is supported with funds from State appropriations, Federal Grants, and Industrial Grants. Details of the source of funds and projects are published in the annual report of the Experiment Station.

The results of research are published in the "Farm and Home Research" quarterly, in bulletins, circulars, and the "Annual Report" all of which are available at the County Agents Office or by direct request.

## The Agricultural Extension Service

John T. Stone, Dean

Distinguishing South Dakota State as the Land-Grant College from other institutions of higher education in the state are its three basic programs of Cooperative Extension, the Agricultural Experiment Station and Resident Instruction.

The Cooperative Extension Service extends the campus of South Dakota State University to every community and the advantages of higher education to all the people. Through its county agricultural agents, home economics agents and supporting statewide specialists the Cooperative Extension Service disseminates the findings of research and encourages the application of knowledge to the solution of problems encountered in everyday living.

Much of the economic progress of the farmers and ranchers of the state can be traced to this unique type of informal out-of-school learning opportunity provided them for nearly 50 years by South Dakota State in cooperation with the U. S. Department of Agriculture and county governments.

Forty-two percent of the funds supporting Cooperative Extension educational programs are appropriations to South Dakota State University by the Legislature, 43 percent come from Federal appropriations and 15 percent from counties.

Extension program emphasis is constantly changing to meet the needs and opportunities of the people who help determine their instructional needs. The following broad areas of educational program objectives describe the scope of this service of South Dakota State University.

1. To promote efficient, competitive agricultural production and better business management of farm and ranch.
2. To encourage rural areas development, a total community effort to expand the economy of the state and create new employment opportunities for its citizens by putting knowledge and ideas to work.
3. To help people and firms develop new and better marketing methods that they may realize greater profits.
4. To expand the 4-H Club educational program with boys and girls. Over 18,000 young people are currently enrolled in 4-H Clubs in the state.
5. To stimulate improvements in home and family living through the home economics program with its 19,000 homemaker members.
6. To encourage a better understanding of public policy issues by conducting discussions and training local leaders.

The professional staff of the Cooperative Extension Service is dedicated to the task of assisting individuals and groups of people meet the challenge of change in farming, ranching, marketing, the home, state and nation. They use the press, radio, T.V., educational publications and individual contacts to inform and teach. Resident students are encouraged to become acquainted with Extension staff members on campus and to take advantage of the information available in Extension publications to enrich their regular course of study. Extension also offers rewarding career opportunities for college graduates.



## List of Courses for Humanities, Social Science, and Natural Science Requirements for the University

The following list of courses, divided into "Humanities," "Social Sciences," and "Natural Sciences," has been approved by the faculty. Courses appearing below may be used to meet College Core Requirements in these areas for the Bachelor's Degrees.

Most upper level courses and some lower level courses have prerequisites that must be recognized.

Some colleges and/or departments require courses in these areas. Such courses are spelled out under College or Departmental Information.

### HUMANITIES

#### Art

- 212 Visual Arts in Society
- 232 History of American Art
- 343, 353 History of Art
- 463 Art in the 20th Century

#### English

- All 100-400 level courses except the communications type courses (103, 113, 143, 350, 362 and 412)

#### Foreign Language

- All 100-400 level courses—the same courses may not be used to meet both the Humanities requirement and the Foreign Language requirement for B.A.

#### General Studies

- 253 Humanities

#### History

- All 100-400 level courses.

#### Management, Housing and Equipment

- 383 Family Housing

#### Music

- 102 Music Appreciation

- 203, 213 Advanced Music Theory

- 303, 313 Music History

- A maximum of 4 credits in Music participation —110, 120, 130, 140, 150, or 160

#### Nutrition and Food Science

- 102 Nutrition for Health

#### Philosophy

- 202 Elementary Logic
- 204 Introduction to Philosophy
- 213 Introduction to Ethics
- 313 History of Modern Philosophy
- 462 Philosophy of Science

#### Religion

- All 100-400 level courses

#### Speech

- 123 Introduction to Theatre
- 143 Stagecraft
- 193 Introduction to Film
- 353 Oral Interpretation
- 472 Playwriting
- 482 Development of Theatre
- A maximum of 4 credits in Speech Activities (251)

#### Textiles and Clothing

- 342 History of Costume

### SOCIAL SCIENCE

#### Child Development and Family Relations

- 122 Individual and the Family
- 223 Human Development and Personality
- 322 Dynamics of Family Development

#### Economics

- 203, 213 Principles of Economics
- 333 Money and Banking
- 393 Consumers and the Market
- 413 Public Finance
- 423 Intermediate Macroeconomics
- 433 Intermediate Economic Analysis
- 453 Agricultural Policy
- 483 Market Prices

#### Geography

- All 100-400 level courses but 104 and 114.

#### History

- All 100-400 level courses

#### Home Economics

- 212 Introduction to Family Living

#### Management, Housing and Equipment

- 273 Management in Family and Personal Living

#### Political Science

- All 100-400 level courses

#### Psychology

- All 100-400 level courses

#### Rural Sociology

- All 100-400 level courses

#### Textiles and Clothing

- 102 Costume Selection

#### Health Science

- 202 Contemporary Health Problems

*(Continued next page)*

**NATURAL SCIENCE COURSES**  
**(Suggested Electives for Non Science Majors)**

**Bacteriology**

- 204 General Bacteriology
- 304 Cytology and Nutrition

**Biology**

- 113, 123 Biology
- 283 Organismic & Population Biology
- 293 Molecular & Cellular Biology
- 303 Genetics

**Botany**

- 203 Plant Kingdom
- 204 Basic Taxonomy

**Chemistry**

- All 100-400 level courses

**Entomology**

- 103 Introduction to Entomology

**Geography**

- 104, 114 Physical Geography

**Mathematics**

- 113 Algebra

- 133 Plane Trigonometry
- 143 Analytic Geometry
- 145 Algebra and Trigonometry
- 155, 165, 254 Math Analysis
- 213 Descriptive Astronomy
- 225 Mathematics for Social Science
- 323 Math for Finance

**Nutrition and Food Science**

- 303 Human Nutrition

**Physics**

- All 100-400 level courses

**Plant Science**

- 102 Plant Pathology in Human Affairs
- 243 Geology

**Wildlife and Fisheries Sciences**

- 202 Conservation of Natural Resources

**Zoology**

- 113 Survey of Anatomy and Physiology
- 203 Anatomy
- 304 Mammalian Physiology
- 442 Principles of Animal Taxonomy

## COLLEGES AND DEPARTMENTAL ABBREVIATIONS

<b>AE</b> , Agricultural Engineering	<b>Fr</b> , French	<b>Mus</b> , Music
<b>Ag</b> , Agriculture and Biological Science	<b>GC</b> , Guidance and Counseling	<b>N</b> , Nursing
<b>AgEd</b> , Agricultural Education	<b>GE</b> , General Engineering	<b>NFS</b> , Nutrition and Food Science
<b>AgExt</b> , Agricultural Extension	<b>Geo</b> , Geography	<b>Pha</b> , Pharmacy
<b>AS</b> , Animal Science	<b>Ger</b> , German	<b>Phil</b> , Philosophy
<b>Bac</b> , Bacteriology	<b>GR</b> , General Registration	<b>Phy</b> , Physics
<b>Bio</b> , Biology	<b>GS</b> , General Studies	<b>PJ</b> , Printing and Journalism
<b>Bot</b> , Botany	<b>HE</b> , Home Economics	<b>PM</b> , Printing Management
<b>CD</b> , Child Development	<b>HEd</b> , Home Econ. Education	<b>PolS</b> , Political Science
<b>CE</b> , Civil Engineering	<b>HPER</b> , Health, Physical Education and Recreation	<b>PS</b> , Plant Science
<b>Ch</b> , Chemistry	<b>Hist</b> , History	<b>Psy</b> , Psychology
<b>DS</b> , Dairy Science	<b>Ho</b> , Horticulture	<b>Rel</b> , Religion
<b>Econ</b> , Economics	<b>HSc</b> , Health Science	<b>RS</b> , Rural Sociology
<b>Ed</b> , Education	<b>IAE</b> , Industrial Arts Education	<b>Rus</b> , Russian
<b>EE</b> , Electrical Engineering	<b>J</b> , Journalism	<b>A&amp;S</b> , Arts and Science
<b>EG</b> , Engineering Graphics	<b>Lib</b> , Library	<b>SecS</b> , Secretarial Science
<b>EM</b> , Engineering Mechanics	<b>MA</b> , Mechanized Agriculture	<b>Sp</b> , Speech
<b>Engl</b> , English	<b>Math</b> , Mathematics	<b>Span</b> , Spanish
<b>Ent</b> , Entomology	<b>ME</b> , Mechanical Engineering	<b>TC</b> , Textiles and Clothing
<b>ES</b> , Engineering Shops	<b>Mil</b> , Military	<b>Vet</b> , Veterinary Science
<b>FL</b> , Foreign Languages	<b>MHE</b> , Management, Housing, and Equipment	<b>WL</b> , Wildlife
		<b>Z</b> , Zoology

## MISCELLANEOUS ABBREVIATIONS

*Time and/or credit arranged	<b>L</b> , Laboratory	<b>R</b> , Recitation (Lecture)
<b>Cr</b> , Credit	<b>MTWTF</b> S, Days of Week	<b>S</b> , Spring Semester
<b>F</b> , Fall Semester	<b>P</b> , Prerequisite	<b>Su</b> , Summer Term

## Course Numbering System

In the departmental description of subjects, the following numbering system is used:

### 1. Non-credit courses

1-99 Pre-college or remedial level

### 2. Courses for Undergraduates (carry undergraduate credit only)

100-199 Freshman level

200-299 Sophomore level

### 3. Courses primarily for Undergraduates (open to graduate students for credit under restricted conditions with approval of graduate dean—see graduate catalog)

300-399 Junior level

400-499 Senior level

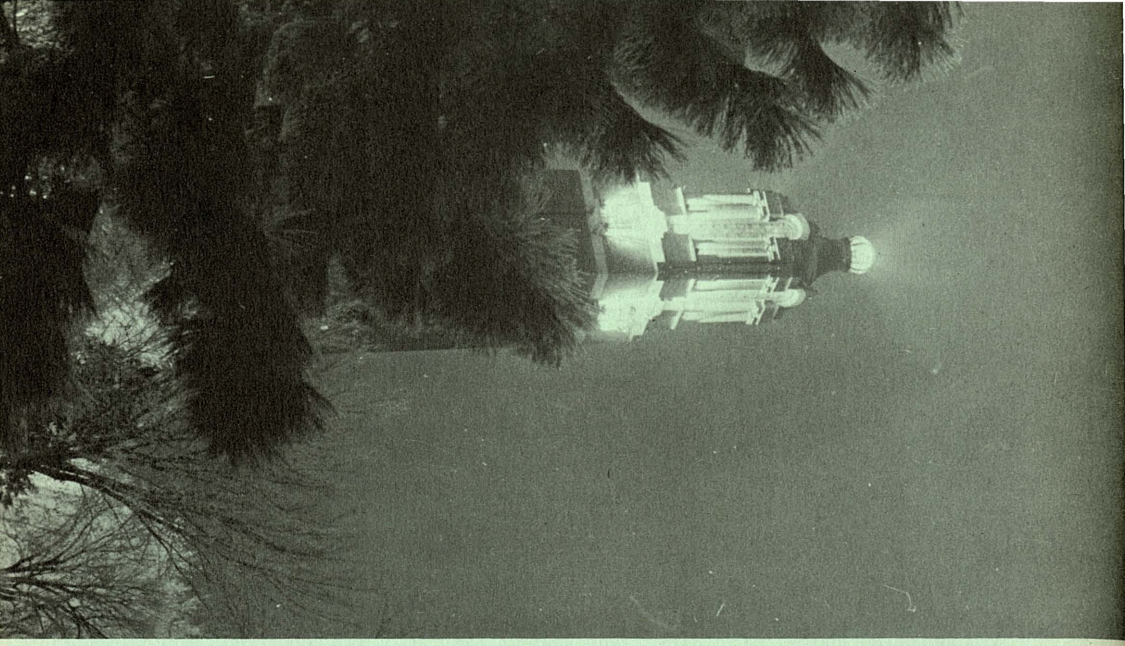
500-599 Fifth year pharmacy level

### 4. Courses primarily for graduate students (open to selected Junior and Senior undergraduate students on an elective basis only). Not open to Freshmen and Sophomores.

600-699 Graduate level

### 5. Courses for graduate students (graduate credit only)

700-799 Graduate level



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