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Administration of Iowa State University

The laws of the United States and of the State of Iowa provide for resident academic instruction, research and extension education, and for the management of Iowa State University of Science and Technology. The University and two other state educational institutions of higher learning are governed by the State Board of Regents, composed of nine members nominated by the Governor of Iowa and confirmed by the Senate of Iowa. The immediate regulation and direction of the academic, research, and extension activities of the University are delegated by the Board of Regents to the President and faculty of the University. The board appoints a Finance Committee whose members give their entire time to consideration of the financial activities of the institutions under Regents' direction.

STATE BOARD OF REGENTS

STANLEY F. REDEKER, President

DAVID A. DANCER, Secretary

MEMBERS OF THE BOARD

Terms expire June 30, 1967

WILBUR C. MOLISON............................................Grinnell
NED E. PERRIN................................................Mapleton
STANLEY F. REDEKER.........................................Boone

Terms expire June 30, 1969

JONATHAN B. RICHARDS........................................Red Oak
MRS. JOSEPH F. ROSENFIELD.................................Des Moines
MELVIN H. WOLF...............................................Waterloo

Terms expire June 30, 1971

CASEY LOSS ..................................................Algona
THOMAS A. LOUDEN............................................Fairfield
WILLIAM B. QUARTON......................................Cedar Rapids

Finance Committee

CARL GERNETSKY, Chairman................................Des Moines
DAVID A. DANCER, Secretary...............................Des Moines
DOYLE R. COTTRELL..........................................Des Moines
OFFICERS OF ADMINISTRATION

William Robert Parks, Ph.D.
President of the University

James H. Hilton, D.Sc.
President Emeritus

George C. Christensen, Ph.D.
Vice President for Academic Affairs

J. Boyd Page, Ph.D.
Vice President for Research
Dean of the Graduate College

Boyne H. Platt, B.S.
Vice President for Business and Finance

Instruction and Research

Floyd Andre, Ph.D.
Dean of College of Agriculture
Director of the Agriculture and Home Economics Experiment Station
Director of the Cooperative Extension Service in Agriculture and Home Economics

George R. Town, D.Eng.
Dean of the College of Engineering
Director of the Engineering Experiment Station
Director of Engineering Extension

Helen R. LeBaron, Ph.D.
Dean of the College of Home Economics

Chalmer J. Roy, Ph.D.
Dean of the College of Sciences and Humanities
Director of the Sciences and Humanities Research Institute

Dean of the College of Veterinary Medicine
Director of the Veterinary Medical Research Institute

Frank H. Spedding, Ph.D.
Director of the Institute for Atomic Research

Theodore A. Bancroft, Ph.D.
Director of the Statistical Laboratory

Virgil S. Lagomarcino, Ph.D.
Director of Teacher Education

Clair G. Maple, Ph.D.
Director of the Computation Center

Services

Arthur M. Gowan, Ph.D.
Director of Admissions and Records

Millard R. Kratochvil, A.M.
Dean of Students

J. C. Schilleletter, Ph.D.
Director of Residence

Gail Proffitt, M.D.
Director of the Student Health Service

Robert W. Orr, M.S.
Director of the University Library

Carl Hamilton, B.S.
Director of University Relations

Samuel A. McDowell
Treasurer

Joseph E. Marks, M.A., C.P.A.
Controller and Secretary

Delbert H. Ostermann
Director of Purchasing and Stores

Edgar P. Swanson, M.S.
Supervisor of Student Loans and Scholarships

Ben W. Schaefer, B.S.
Superintendent of Physical Plant

Jess N. Cole, B.S.
Personnel Officer
The Iowa State Campus
WEST CAMPUS

1. Friley Hall
2. Helser Hall
3. Clyde Williams Field
4. State Gymnasium
5. Westgate Hall
6. Beyer Hall
7. Naval Armory
8. Mechanical Engineering
9. Mechanics Laboratory
10. Hospital
11. Alumni Hall
12. Music Building
13. English Office Bldg
14. Beardshear Hall
16. Pearson Hall
17. Aerospace Engineering Lab.
18. Industrial Administration
19. Exhibit Hall
20. Engr. Experiment Station
21. Engineering Annex
22. Marston Hall
23. The Hub
24. Morrill Hall
25. Library
26. Service Building
27. Sweeney Hall
29. Computer Laboratory
30. Electrical Engineering Bldg.

CENTRAL CAMPUS

31. Memorial Union
32. Campanile
33. Curtiss Hall
34. Horticulture Building
35. Botany Greenhouse
36. Botany Building
37. MacKay Hall
38. Plant Sciences Building

39. Armory
40. Industrial Education
41. Agricultural Engineering
42. Chemistry
43. Atomic Research (Office and Lab. Bldg.)
44. Physics Building
45. Sciences Building
46. Biomedical Engineering Bldg.
47. Veterinary Medicine Quadrangle
48. Veterinary Diagnostic Lab.
49. Metallurgy Building
50. Research Building
51. Veenker Golf Course
52. Communications Building
53. Metals Development Bldg.

54. Genetics Laboratory
55. Insectary
56. Veterinary Medical Clinic
57. Horse Barns
58. Ruminant Nutrition Lab.
59. Cattle Barn
60. Judging Pavilion
61. Kildee Hall
62. Sheep Barn
63. Antigenic Laboratory
64. Hog Barn and Pavilion
65. Meat Laboratory

NORTH CAMPUS

56. Genetics Laboratory
57. Insectary
58. Veterinary Medical Clinic
59. Horse Barns
60. Ruminant Nutrition Lab.
61. Cattle Barn
62. Judging Pavilion
63. Kildee Hall
64. Sheep Barn
65. Antigenic Laboratory
66. Hog Barn and Pavilion

EAST CAMPUS

66. Agronomy Building
67. Agronomy Greenhouse
68. Central Stores
69. Power Plant
70. Press Building
71. Shattuck Theatre
72. Landscape Architecture Bldg.
73. Dairy and Food Industry Bldg.
74. East Hall
75. Women's Gymnasium
76. Oak Hall
77. Elm Hall
78. Child Development Bldg.
79. Linden Hall
80. Buchanan Hall
81. Birch Hall
82. Barton Hall
83. Freeman Hall
84. Lyon Hall
85. Roberts Hall
86. Welch Hall
87. The Knoll
88. Women's Residence Hall
Iowa State University of Science and Technology is located at Ames, just west of the geographic center of Iowa. In its centennial year, 1964, Ames had a population of 30,000 including University students.

As a result of Iowa State's vital contributions to the first large-scale release of atomic energy, the United States Atomic Energy Commission located a major research center at the University. The Iowa Highway Commission was first established at Iowa State, and kept its headquarters in Ames when it became a separate entity. Another important University-related agency, the United States Department of Agriculture's National Animal Disease Laboratory, was brought to Ames in 1956.

Covering one thousand acres of gently rolling prairie in the northwest sector of Ames, the University campus has been carefully developed to provide a pleasant, naturalistic setting for conveniently located facilities. Additional University facilities include farms and research areas near Ames and at strategic locations throughout the state.

Acquisition value of the Iowa State physical plant in 1965 was in excess of $80 million, including $65 million owned by the University and the rest by affiliated organizations. The University's anticipated expenditure in 1965-66 was approximately $58 million, of which state appropriations provided about one-third. The remainder came from fees, contracts, sales, private gifts and grants, federal funds and endowment.
FALL QUARTER 1965

September 6, Monday University Holiday, Offices Closed
September 8-12, Wednesday, 8:00 A.M. to Sunday Orientation Days
September 9-10, Thursday and Friday 8:00 A.M.-4:30 P.M. Registration
September 10, Friday, 1:00-5:00 P.M. Examinations to Secure Advance Standing or to Remove Incompletes
September 13, Monday Class Work Begins
September 14, Tuesday, 4:00 P.M. End of Fee Payment Period
September 23, Thursday, 4:00-6:00 P.M. Senior and Graduate English Examination

WINTER QUARTER 1966

November 30, Tuesday Examinations to Secure Advance Standing or to Remove Incompletes
November 30, Tuesday* Registration
December 1, Wednesday Class Work Begins
December 2, Thursday, 4:00 P.M. End of Fee Payment Period
December 9, Thursday, 4:00-6:00 P.M. Senior and Graduate English Examination
December 17, Friday, 6:00 P.M. Christmas Recess Begins
December 23-24, Thursday and Friday University Holidays, Offices Closed
December 31, Friday University Holiday, Offices Closed
January 3, Monday, 7:00 A.M. Class Work Resumes
January 14, Friday Mid-quarter Reports Due
January 14, Friday Final Date for Filing Diploma Cards
February 4, Friday Last Day Courses May Be Dropped
February 21, Monday Examinations Begin
February 25, Friday Examinations End
February 26, Saturday Graduation

*Students in residence preceding quarter will register during the examination week of that quarter
SPRING QUARTER 1966

March 7, Monday .................. Examinations to Secure Advance Standing or to Remove Incompletes
March 7, Monday* .................. Registration
March 8, Tuesday .................. Class Work Begins
March 9, Wednesday, 4:00 P.M. . . . . . . . End of Fee Payment Period
March 17, Thursday, 4:00-6:00 P.M. . Senior and Graduate English Examination

April 7, Thursday, 6:00 P.M. ...... Easter Recess Begins
April 8, Friday .................. Mid-quarter Reports Due
April 8, Friday .................. Final Date for Filing Diploma Cards
April 12, Tuesday, 7:00 A.M. .... Class Work Resumes

May 6, Friday .................. Last Day Courses May Be Dropped
May 23, Monday .................. Examinations Begin

May 28, Saturday .................. Graduation
May 30, Monday .................. University Holiday, Offices Closed

SUMMER QUARTER 1966

June 7, Tuesday .................. Registration
June 8, Wednesday .................. Class Work Begins
June 9, Thursday, 4:00 P.M. . . . . . . . End of Fee Payment Period
June 16, Thursday, 4:00 P.M. . . . . . . . Senior and Graduate English Examination

July 4, Monday .................. University Holiday
July 15, Friday .................. First Session Ends
July 16, Saturday .................. Graduation
July 18, Monday .................. Registration
July 19, Tuesday .................. Class Work Begins
July 20, Wednesday, 4:00 P.M. . . . . . . . End of Fee Payment Period
July 28, Thursday, 4:00 P.M. . . . . . . . Senior and Graduate English Examination

August 25, Thursday ............... Second Session Ends
August 26, Friday ............... Graduation

*Students in residence preceding quarter will register during the examination week of that quarter.
FALL QUARTER 1966

September 5, Monday .......... University Holiday, Offices Closed
September 7-11, Wednesday, 8:00 A.M. to Sunday .......... Orientation Days
September 8-9, Thursday and Friday 8:00 A.M - 4:30 P.M .......... Registration
September 9, Friday, 1:00-5:00 P.M .......... Examinations to Secure Advance Standing or to Remove Incompletes
September 12, Monday .......... Class Work Begins
September 13, Tuesday, 4:00 P.M .......... End of Fee Payment Period
September 22, Thursday, 4:00-6:00 P.M .......... Senior and Graduate English Examination

WINTER QUARTER 1967

November 28, Monday .......... Examinations to Secure Advance Standing or to Remove Incompletes
November 28, Monday* .......... Registration
November 29, Tuesday .......... Class Work Begins
December 1, Thursday, 4:00 P.M .......... End of Fee Payment Period
December 8, Thursday, 4:00-6:00 P.M .......... Senior and Graduate English Examination
December 16, Friday, 6:00 P.M .......... Christmas Recess Begins
December 23-26, Friday through Monday .......... University Holidays, Offices Closed
January 2, Monday .......... University Holiday, Offices Closed
January 3, Tuesday, 7:00 A.M .......... Class Work Resumes
January 13, Friday .......... Mid-quarter Reports Due
January 13, Friday .......... Final Date for Filing Diploma Cards
February 3, Friday .......... Last Day Courses May Be Dropped
February 20, Monday .......... Examinations Begin
February 24, Friday .......... Examinations End
February 25, Saturday .......... Graduation

*Students in residence preceding quarter will register during the examination week of that quarter.
### SPRING QUARTER 1967

- **March 6, Monday** .............. Examinations to Secure Advance Standing or to Remove Incompletes
- **March 6, Monday** .............. Registration
- **March 8, Wednesday, 4:00 P.M.** . End of Fee Payment Period
- **March 16, Thursday, 4:00-6:00 P.M.** . Senior and Graduate English Examination
- **March 23, Thursday, 6:00 P.M.** . Easter Recess Begins
- **March 28, Tuesday, 7:00 A.M.** . Class Work Resumes
- **April 7, Friday** .............. Mid-quarter Reports Due
- **April 7, Friday** .............. Final Date for Filing Diploma Cards
- **May 5, Friday** .............. Last Day Courses May Be Dropped
- **May 21, Monday** .............. Examinations Begin
- **May 26, Friday** .............. Examinations End
- **May 27, Saturday** .............. Graduation
- **May 30, Tuesday** .............. University Holiday, Offices Closed

### SUMMER QUARTER 1967

- **June 6, Tuesday** .............. Registration
- **June 7, Wednesday** .............. Class Work Begins
- **June 8, Thursday, 4:00 P.M.** . End of Fee Payment Period
- **June 15, Thursday, 4:00 P.M.** . Senior and Graduate English Examination
- **July 4, Tuesday** .............. University Holiday
- **July 14, Friday** .............. First Session Ends
- **July 15, Saturday** .............. Graduation
- **July 17, Monday** .............. Registration
- **July 18, Tuesday** .............. Class Work Begins
- **July 19, Wednesday, 4:00 P.M.** . End of Fee Payment Period
- **July 27, Thursday, 4:00 P.M.** . Senior and Graduate English Examination
- **August 24, Thursday** .............. Second Session Ends
- **August 25, Friday** .............. Graduation

*Students in residence preceding quarter will register during the examination week of that quarter.*
The Faculty

The General Faculty consists of the President, Vice Presidents, Deans, Director of Admissions and Records, Librarian, all professors and associate professors, and such other members of the University staff as the President may designate.

W. Robert Parks, President; Professor of Government
B.A., 1917, Berea; M.A., 1938, Kentucky; Ph.D., 1948, Wisconsin

Wayne E. Almquist, Instructor of English
B.A., 1957, Nebraska

Landy B. Altman, Associate Professor of Agricultural Engineering
B.S., 1940, North Carolina State; M.S., 1947, Georgia; Ph.D., 1960, Iowa State

Minoru Amemiya, Associate Professor of Agronomy
B.S., 1942, California; M.S., 1948, Ph.D., 1950, Ohio State

John R. Andersen, Assistant Professor of Veterinary Hygiene
D.V.M., 1959, Iowa State

Arthur L. Anderson, Professor of Animal Science
B.S., 1916, Minnesota; M.S., 1922, Iowa State

Arthur R. Anderson, Jr., Associate, Institute for Atomic Research
B.S., 1954, Loyola

Don M. Anderson, Professor of Modern Languages

Ernest W. Anderson, Professor of Aerospace Engineering and Head of the Department; Anson Marston Distinguished Professor in Engineering
B.S., 1926, North Dakota State; M.S., 1928, Ph.D., 1933, Iowa State

Glendon R. Anderson, Assistant Professor of Physical Education for Men; Head Basketball Coach
B.S., 1951, Colorado State

Irvin C. Anderson, Associate Professor of Agronomy; Associate Professor of Botany
B.S., 1951, Iowa State; M.S., 1954, Ph.D., 1957, North Carolina State

Jack M. Anderson, Assistant Professor of Mathematics
B.S., 1953, South Dakota; M.S., 1954, Ph.D., 1959, Iowa State

Lloyd L. Anderson, Associate Professor of Animal Science
B.S., 1957, Ph.D., 1961, Iowa State

Marvin A. Anderson, Professor of Agronomy; Associate Director of the Cooperative Extension Service
B.S., 1939, M.S., 1949, Ph.D., 1955, Iowa State

Paul M. Anderson, Associate Professor of Electrical Engineering
B.S., 1949, M.S., 1948, Ph.D., 1961, Iowa State

Peter S. Anderson, Instructor of English

Mukhtar Abdullah, Associate Professor of Biochemistry
B.S., 1950, M.S. 1952, Punjab (India); Ph.D., 1960, London (England)

Thomas S. Abney, Associate, Agriculture and Home Economics Experiment Station, Plant Pathology
B.S., 1960, M.S. 1964, Southern Illinois

William H. Abraham, Associate Professor of Chemical Engineering
B.Ch.E., 1952, Cornell; Ph.D., 1957, Purdue

Rosalie J. Ackerman, Instructor of Food and Nutrition
B.S., 1962, M.S., 1964, Iowa State

Harriet Adams, Professor of Applied Art
B.Des., 1930, Kansas; M.A., 1934, Western Reserve

William M. Adams, Associate Professor of Veterinary Obstetrics

Om P. Aggarwal, Associate Professor of Statistics
B.A., 1939, M.A., 1941 Delhi (India); Ph.D., 1953, Stanford

Donald L. Ahrens, Instructor of Agricultural Engineering
B.S., 1964, Iowa State

John M. Aikman, Professor of Botany
A.B., 1917, A.M., 1921, D.Sc., 1931, Nebraska Wesleyan; Ph.D., 1928, Nebraska

Gary L. Aitchison, Assistant Professor of Industrial Administration
B.A., 1956, State College of Iowa; M.A., 1961, Colorado State

Jack M. Alexander, Assistant Professor, Farm Manager
B.S., 1950, M.S. 1960, Iowa State

Edward S. Allen, Professor of Mathematics
A.B., 1909, A.M., 1910, Ph.D., 1914, Harvard

R. Scott Allen, Professor of Biochemistry; Professor of Animal Science
B.S., 1939, M.S., 1940, Brigham Young; Ph.D., 1949, Iowa State

Maurice W. Almfeldt, Professor of Engineering Graphics
B.S., 1953, Rhode Island State
RUSSELL D. ANDERSON, Instructor of Electrical Engineering  

VINCENT M. ANDERSON, Associate Professor, District Extension Director, Cooperative Extension Service  
B.S., 1924, Iowa State  

WILLARD R. ANDERSON, Assistant Professor of Agricultural Engineering  
B.S., 1950, M.S., 1952, Iowa State  

THOMAS K. ANDISON, Instructor of Industrial Administration  

FLOYD ANDRE, Professor of Entomology; Dean of the College of Agriculture; Director of the Agriculture and Home Economics Experiment Station; Director of the Cooperative Extension Service  
B.S., 1931, M.S., 1933, Ph.D., 1938, Iowa State  

ERIK I. ANDRESEN, Associate Professor of Animal Science  
D.V.M., 1954, Ph.D., 1963, The Royal Veterinary and Agricultural College (Denmark)  

CELIA L. ANDREW, Assistant Professor of Home Economics Education  
B.S., 1945, M.S., 1960, Iowa State  

ROBERT J. ANGELICI, Assistant Professor of Chemistry  
B.S., 1959, St. Olaf; Ph.D., 1962, Northwestern  

DONALD E. ANKER, Instructor, Technical Institute  
B.S., 1962, Iowa State  

CARL A. ARNBAL, Associate Professor of Engineering Graphics  
B.M.E., 1948, Minnesota; M.S., 1955, Kansas State  

JOHN M. ARNOLD, Assistant Professor of Zoology  
B.A., 1958, Ph.D., 1963, Minnesota  

LIONEL K. ARNOLD, Professor of Chemical Engineering  
A.B., 1920, Ellsworth; B.S., 1921, M.S., 1926, Ph.D., 1930, Iowa State  

RICHARD J. ARNould, Instructor of Economics  
B.S., 1963, M.S., 1965, Iowa State  

LOTTE ARNICH, Professor of Food and Nutrition  
B.S., 1944, Ph.D., 1952, California  

WILLIAM C. ARNWINE, Assistant Professor of Industrial Engineering  
B.S., 1954, Oklahoma State; M.S., 1962, Iowa State  

SAM ARNOFF, Professor of Biochemistry  
A.B., 1936, Ph.D., 1942, California  

C. LORING ARONSON, Assistant Professor of Engineering Graphics  
B.S., 1958, Iowa State  

LEON J. ARP, Assistant Professor of Engineering Graphics  
B.S., 1960, M.S., 1963, Iowa State  

I. W. ARTHUR, Professor of Economics  
B.S., 1916, M.S., 1927, Iowa State; Ph. D., 1939, Minnesota  

KAY H. ASAY, Associate, Agronomy  
B.S., 1957, M.S., 1959, Wyoming  

RICHARD E. ATKINS, Professor of Agronomy  
B.S., 1941, Kansas State; M.S., 1942, Ph.D., 1948, Iowa State  

GRACE M. AUGUSTINE, Professor Emeritus of Institution Management  
B.S., 1929, A.M., 1930, Ph.D., 1935, Columbia  

MARVIN K. AYCOCK, JR., Associate, Agronomy  
B.S., 1959, M.S., 1963, North Carolina State  

JESS L. AYRES, Research Fellow, Veterinary Pathology  
B.S., 1959, D.V.M., 1961, California  

GEORGE E. AYRES, Instructor of Agricultural Engineering  
B.S., 1964, Cornell  

JOHN C. AYRES, Professor of Dairy and Food Industry; Professor of Animal Science; Professor of Bacteriology  

ROBERT Z. BACHMAN, Associate, Institute for Atomic Research  
B.S., 1951, Iowa State  

ROGER W. BACHMANN, Assistant Professor of Fisheries Biology  
B.S., 1936, Ph.D., 1962, Michigan; M.S., 1958, Idaho  

DONALD M. BAILEY, Associate, Institute for Atomic Research  
B.S., 1954, Illinois State Normal; M.S., 1961, Iowa State  

MERRITT E. BAILEY, JR., Assistant Professor of Technical Journalism; Director of Book Publishing  
B.S., 1949, M.S., 1951, Iowa State  

DURWOOD L. BAKER, Professor of Veterinary Medicine and Surgery and Assistant Dean of the College of Veterinary Medicine  
D.V.M., 1943, Iowa State  

HARLAN K. BAKER, Assistant Professor, Engineering Extension  
B.S., 1963, Iowa State  

HAROLD D. BAKER, Assistant Professor of Statistics, Sciences and Humanities Research Institute  
B.S., 1958, M.S., 1963, Iowa State  

LOUIS N. BAKER, Assistant Professor of Animal Science  
B.S., 1950, New Hampshire; M.S., 1951, Kentucky; Ph.D., 1954, Wisconsin  

ARTHUR L. BAKKE, Professor of Botany  
B.S., 1909, M.S., 1911, Iowa State; Ph.D., 1917, Chicago  

HARPAL S. BAL, Instructor of Veterinary Anatomy  
B.V.Sc., 1953, Punjab (India)  

A. GORDON BALL, Professor of Economics  
B.S., 1949, Toronto (Canada); M.S., 1950, Ph.D. 1954, Iowa State
CHARLES R. BALLANTYNE, Associate Professor of Agronomy, Cooperative Extension Service
B.A., 1930, M.A., 1931, Iowa

STANLEY L. BALLOUN, Professor of Poultry Science
B.S., 1938, Ph.D., 1952, Iowa State

DALE R. BALMER, Associate, Assistant Supervisor, WO-1 TV

THEODORE A. BANCROFT, Professor of Statistics and Head of the Department; Director of the Statistical Laboratory
A.B., 1927, Florida; M.A., 1934, Michigan; Ph.D., 1943, Iowa State

CHARLES V. BANKS, Professor of Chemistry
B.Ed., 1941, Western Illinois; M.S., 1944, Ph.D., 1946, Iowa State

DWIGHT M. BANNISTER, Associate Professor, Assistant Extension Editor, Cooperative Extension Service
B.S., 1928, Northwestern

DONALD W. BARE, Associate, Institute for Atomic Research
A.B., 1936, Yankton

RALPH D. BARNER, Professor of Veterinary Pathology
D.V.M., 1939, M.S., 1940, Ohio State; Ph.D., 1951, Kansas State

RICHARD G. BARNES, Professor of Physics

RONALD E. BARNES, Associate Professor of Education; Associate Dean of Students
B.S., 1952, William and Mary; M.S., 1955, Ed.D., 1958, Colorado

GILBERT D. BARTELL, Assistant Professor of Sociology
B.S., 1954, Illinois; M.A., 1959, Ohio State; Ph.D., 1964, Arizona

THOMAS A. BARTON, Professor of Landscape Architecture and Chairman of the Department
B.S., 1941, M.L.A., 1960, Iowa State

JOHN P. BASSET, Instructor, Technical Institute
B.S., 1962, M.S., 1963, Iowa State

WARD W. BAUER, Professor of Sociology
B.S., 1936, M.S., 1938, Nebraska; Ph.D., 1948, Cornell

C. PHILLIP BAUMEL, Associate Professor of Economics
B.Sc., 1950, M.Sc., 1957, Ohio State; Ph.D., 1961, Iowa State

JOHN A. BATH, Professor of Psychology
A.B., 1932, Nebraska State Teachers at Peru; M.A., 1933, Ph.D., 1942, Nebraska

WILLIAM W. BATHIE, Assistant Professor of Mechanical Engineering
B.S., 1957, Iowa State

E. ROBERT BAUMANN, Professor of Civil Engineering
B.S.E., 1944, Michigan; B.S., 1945, M.S., 1947, Ph.D., 1954, Illinois

GEORGE M. BEAL, Professor of Sociology
B.S., 1943, M.S., 1947, Ph.D., 1953, Iowa State

BERNARD J. BEAUDRY, Associate, Institute for Atomic Research
B.A., 1954, St. John's, M.S., 1959, Iowa State

CRAIG E. BEER, Associate Professor of Agricultural Engineering
B.S., 1950, M.S., 1957, Ph.D., 1962, Iowa State

RUSSELL J. BEERS, Associate Professor of Bacteriology
B.S., 1933, M.S., 1935, Nebraska; Ph.D., 1956, Illinois

THELMA S. BEERS, Associate, Bacteriology
B.A., 1934, M.A., 1936, B.S., 1939, Ph.D., 1940, Minnesota

ROBERT E. BEESON, Instructor of Electrical Engineering
B.S., 1961, M.S., 1964, Iowa State

EDWARD A. BENBROOK, Professor of Veterinary Pathology; Clarence Hartley Co-vault Distinguished Professor in Veterinary Medicine
V.M.D., 1914, Pennsylvania

PHILLIP R. BENDER, Instructor of Mathematics
B.S., 1951, Purdue, M.S., 1959, Marquette

RAYMOND R. BENEKE, Professor of Economics
B.S., 1940, M.S., 1946, Iowa State; Ph.D., 1949, Minnesota

CHARLES L. BENN, Associate, Photographer, Cooperative Extension Service

PAUL C. BENNETT, Professor of Veterinary Pathology
B.S., M.S., 1923, West Virginia; D.V.M., 1931, Ohio State

DWIGHT W. BENSEN, Professor Forestry
B.S., 1937, Ph.D., 1942, Minnesota

DONALD R. BENSON, Associate Professor of English
A.B., 1949, Kansas City; M.A., 1951, Colgate; Ph.D., 1959, Kansas

JAMES E. BENSON, Associate, Institute for Atomic Research
B.S., 1960, Hillsdale; M.S., 1963, Iowa State

WILLIAM R. BENTLEY, Assistant Professor of Forestry
B.S., 1949, Ph.D., 1965, California; M.F., 1961, Michigan

MICHAEL F. BERARD, Instructor of Ceramic Engineering
B.S., 1960, M.S., 1962, Iowa State

HOBART BERESFORD, Professor of Agricultural Engineering
B.S., 1924, A.E., 1941, Iowa State

REX BERESFORD, Professor Emeritus of Animal Science
B.S.A., 1911, Iowa State

HENRY D. BERGMAN, Professor of Veterinary Physiology and Pharmacology; Dean Emeritus of the College of Veterinary Medicine
D.V.M., 1910, D.Sc., 1958, Iowa State
Carole B. Bernard, Instructor of English
B.A. 1962, Southwest Louisiana

Robert W. Bernard, Assistant Professor of Modern Languages
B.A. 1958, St. Thomas; M.A. 1962, Kansas

Elizabeth Beveridge, Professor of Household Equipment
B.S., 1929, Colorado State; M.S. 1934, Iowa State

C. Raymond Bickerstaff, Assistant Professor of Physical Education for Men; Athletic Trainer
B.S.E. 1951, Arkansas, M.E. 1951, Texas

Joseph E. Bierce, Instructor of Speech
B.S., 1962, M.A. 1962, Indiana State

Harry F. Biester, Professor of Veterinary Pathology
V.M.D. 1919, Pennsylvania

Donald L. Biggs, Associate Professor of Geology
B.A. 1949, M.A. 1951, Missouri; Ph.D. 1957, Illinois

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B.S., 1960, Wisconsin State at Eau Claire; M.S., 1962, Wyoming

DENTON WIRKUS, Associate, Institute for Atomic Research
B.S., 1957, Iowa State

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B.S., 1964, Southern Missionary

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B.S., 1957, Iowa State; M.S., 1961, Wisconsin

LEROY WOLINS, Professor of Psychology; Professor of Statistics
B.A., 1951, M.A., 1953, Ph.D., 1956, Ohio State

MARVIN C. WOODFILL, Assistant Professor of Electronics Technology, Technical Institute
B.S., 1959, M.S., 1961, Ph.D., 1964, Iowa State

DONALD G. WOOLLERY, Associate Professor of Agronomy
B.S., 1951, M.S., 1956, Utah State; Ph.D., 1959, Iowa State

EARL O. WRIGHT, Associate Professor of Dairy and Food Industry, Cooperative Extension Service
B.S., 1941, Wisconsin State; M.S., 1953, Wisconsin

FRED M. WRIGHT, Professor of Mathematics
B.A., 1944, Denison; M.S., 1949, Ph.D., 1953, Northwestern

KAREN A. WRIGHT, Instructor, Library
B.S., 1964, Iowa State

RICHARD R. WRIGHT, Instructor of English

WALLACE WRIGHT, Professor Emeritus of Economics
A.B., 1929, Dartmouth; M.A., 1924, Ph.D., 1930, Stanford

JOHN T. WYNNE, Lt Col, USA; Assistant Professor of Military Science
B.S., 1940, Fordham; M.S., 1965, Iowa State

J. PAUL YARBROUGH, Associate, Sociology
B.S., 1960, Georgia

NORRIS W. YATES, Professor of English

MARGARET K. YODER, Associate Professor, District Home Economics Supervisor, Cooperative Extension Service
B.S., 1940, McPherson; M.S., 1946, Iowa State

DONALD F. YOUNG, Professor of Engineering Mechanics
B.S., 1951, M.S., 1952, Ph.D., 1956, Iowa State

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B.S., 1957, Berry; M.S., 1959, Ph.D., 1963, North Carolina State

ROBERT C. YOUNG, Assistant Professor of Physics

JIMMIE R. YOUGLBLOOD, Associate, Institute for Atomic Research
B.S., 1963, Texas A and M

DAINIEL J. ZAFFARANO, Professor of Physics and Chairman of the Department
B.S., 1939, Case, M.S., 1948, Ph.D., 1949, Indiana

PHILIP B. ZARING, Instructor of History
B.A., 1955, Indiana; M.A., 1959, Yale

RICHARD J. ZBARACKI, Assistant Professor of English
B.A., 1953, St. Thomas; M.A., 1954, Northwestern

WILLIAM J. ZIMMERMANN, Associate Professor of Veterinary Parasitology and Pathology
B.S., 1947, Mankato State Teachers; M.S., 1952, Ph.D., 1955, Iowa State

ROY J. ZINGG, Assistant Professor of Electrical Engineering
B.S., 1958, M.S., 1961, Iowa State

BEVERLY Z. ZIV, Instructor of Modern Languages

WILLIAM G. ZMOLK, Professor of Animal Science, Cooperative Extension Service
B.S., 1944, M.S., 1951, Iowa State

MARTIN ZOBER, Professor of Industrial Administration
B.A., 1940, M.Litt., 1943, Ph.D., 1950, Pittsburgh

GEORGE ZYSKING, Associate Professor of Statistics
B.Sc., 1953, McGill (Canada); M.A., 1954, Toronto (Canada); Ph.D., 1958, Iowa State
COOPERATIVE EXTENSION SERVICE FIELD STAFF
Field staff members are listed alphabetically by county

ADAIR COUNTY, Greenfield
James N. Glenn, director
Clara M Schwab, assistant

ADAMS COUNTY, Corning
David R May, director

ALLAMAKEE COUNTY, Waukon
Donald P Arendt, associate
Sharon H Bell, home economist

APPANOOSA COUNTY, Centerville
Harold D. Holder, director
Inga O. Eddy, home economist

AUDUBON COUNTY, Audubon
David C Fenske, director
Beverly S. Anderson, home economist

AUDUBON COUNTY, Waterloo
Paul Barger, director
Elizabeth W. Harrison, home economist

BOONEDALE COUNTY, Vinton
James D Nuss, director
Elizabeth E Benson, assistant
Ronald D Irvin, assistant

BREMER COUNTY, Tripoli
Gene B Vincent, director
Kermit J Hildahl, assistant
Pearl E Pardee, home economist

BUCHEHAN COUNTY, Independence
Jay I. Partridge, director
Gene R McBride, assistant
Janet H Schnepp, home economist

BUENA VISTA COUNTY, Storm Lake
James D Nuss, director
Elizabeth E Benson, assistant
Ronald D Irvin, assistant

CERRO GORDO COUNTY, Mason City
Spencer G Williams, director
Carol J. Stine, home economist

CHEROKEE COUNTY, Cherokee
Forrest J Kohrt, director
Chester C Benson, associate
Theda N Scott, home economist

CHICKASAW COUNTY, New Hampton
Gerald K Anderson, director
Nancy L Meredith, home economist

CLARKE COUNTY, Osceola
William F Short, director
Lillian K Price, home economist

CLAY COUNTY, Spenser
Wayne R. Hansen, director
Glenn S Lyons, associate
Lola A Robinson, home economist

CLAYTON COUNTY, Elkader
Max E. Sauerbray, director
James C Hosch, associate
Evelyn Thiele, home economist

CLINTON COUNTY, DeWitt
Norman J Goodwin, director
Mabel W. Flint, associate
Jimmy W Miller, associate
HeLEN Whittington, home economist

CRAWFORD COUNTY, Denison
Maclyn E Larue, director
Ronald C Sanson, associate

DALLAS COUNTY, Adel
J Dwight Brown, director
Mervyn L Helfert, associate

DAVIS COUNTY, Bloomfield
William D Byers, director
Esther L. Hubbart, home economist

DECATUR COUNTY, Leon
Arvid F Miller, director
Eugene J Carroll, associate

DELAVER COUNTY, Manchester
Robert F. Hall, director
Philip W Gordon, associate
Marilyn J Olson, home economist

DES MOINES COUNTY, Burlington
James C Hodges, director
Dewayne J Schafer, assistant
C Nadine Stillman, assistant

DICKINSON COUNTY, Spirit Lake
Doyle N Gorden, director
Kathleen S Cosgrove, home economist

DUBUQUE COUNTY, Dubuque
Gerald J McGrane, director
L Eugene Fouquette, associate
Esther Mae Franck, assistant

EMMET COUNTY, Estherville
Richard M McMullin, director
Margaret P Pro, assistant
FAYETTE COUNTY, Fayette
Melvin C. Wangsness, director
Harold L. Boulton, associate
Mary E. Lackock, assistant

FLOYD COUNTY, Charles City
Dale M. Stuitt, director
Sondra K. Inman, home economist
Myron L. Kruse, associate

FRANKLIN COUNTY, Hampton
R. Earl Kelsey, director
Carl L. Redder, associate
Aleene Thompson, home economist

FREMONT COUNTY, Sidney
Richard M. McClure, director

GREENE COUNTY, Jefferson
Warren D. Raney, director
Kenneth R. Blair, assistant
Alice J. Walters, home economist

GRUNDY COUNTY, Grundy Center
Everett D. Halstead, director
Genevieve Craven, home economist
Philip P. Hufferd, associate

GUTHRIE COUNTY, Guthrie Center
John J. Ley, director
Sharon K. Krull, assistant

HAMILTON COUNTY, Webster City
C. Lynn Habben, director
Michael A. Fowler, assistant
Mae Belle Godown, home economist
Allan L. James, assistant

HANCOCK COUNTY, Garner
Paul Henderson, director
Gary S. Frahm, associate
Elsie Mae VanVernet, home economist

HARDIN COUNTY, Eldora
James H. Goode, director
Paul D. Clayton, associate
Margaret Ann Shumaker, assistant

HARRISON COUNTY, Logan
Paul W. Watts, director
Gary G. Guge, assistant
Allene Latta, home economist

HENRY COUNTY, Mt. Pleasant
Richard L. Thuma, director
Mary E. Petsche, home economist

HOWARD COUNTY, Cresco
Karl W. Griffith, director
Elaine M. Martens, home economist

HUMBOLDT COUNTY, Humboldt
Norman W. Moklestad, director
Myrtle Hewitt, home economist
Donald J. Wishart, associate

IDA COUNTY, Ida Grove
David L. Hessman, director
Glora Kay Nimocks, assistant

IOWA COUNTY, Marengo
Donald H. Goering, director
Lois Ann Ingels, home economist
Dennis Ladwig, assistant

JACKSON COUNTY, Maquoketa
John E. Henderson, director
Catherine Ruth, home economist

JASPER COUNTY, Newton
Jasper M. Risdal, director
Beulah Gray, home economist

JEFFERSON COUNTY, Fairfield
Stanley R. Stover, director
Mildred VanDerZyl, home economist

JOHNSON COUNTY, Iowa City
Clair E. Hein, director
John W. Patterson, associate
Marilyn S. Thatcher, home economist

JONES COUNTY, Anamosa
Joe F. Legg, director
Varlyn D. Fink, associate
Sharon I. Tapper, assistant

KEOKUK COUNTY, Sigourney
Donald A. Shirk, director
Adelena S. Clark, home economist
David E. Pace, associate

KOSSEUTH COUNTY, Algona
Galen R. DeValois, director
Lois Ann Busch, assistant
Roger P. Hiemstra, assistant

LEE COUNTY, Donnellson
Robert Dowling, director
Granda B. Holleywell, home economist

LINN COUNTY, Cedar Rapids
C. E. Herriott, director
Grace Drenkhahn, home economist
Kenneth D. Muller, associate
Henrietta VanMaanen, home economist

LOUISA COUNTY, Wapello
Gaylord D. Elliott, director
Emogene Y. Brown, home economist

LUCAS COUNTY, Chariton
Joe D. Miller, director
Genevieve R. Altenhofen, home economist

LYON COUNTY, Rock Rapids
Roger A. Baldwin, director
Eleanor L. Ladd, home economist

MADISON COUNTY, Winterset
Russell L. Bredaahl, director

MAHASKA COUNTY, Oskaloosa
Eugene L. Reisseter, director
Sylvia A. Banes, home economist
James D. Johnson, associate

MARION COUNTY, Knoxville
Richard T. Freeman, director
Ruth S. Archibald, home economist
Ronald Dean Sheetz, associate

MARSHALL COUNTY, Marshalltown
Donald G. Harman, director
Greta W. Bowers, home economist

MILLS COUNTY, Malvern
LaVerne C. Obrecht, director
Wilma L. Schultz, home economist
Dale R. Shull, assistant

MITCHELL COUNTY, Osage
Edgar W. Dorow, director
May Johnson, home economist
MONONA COUNTY, Onawa
LARRY D. DUVAL, director
DeVon F. ANDRUS, assistant
LETTIE B. THRIFT, home economist

MONROE COUNTY, Albia
DALE M. UEHLLING, director
MARGARET H. MORDAN, home economist

MONTGOMERY COUNTY, Red Oak
STANLEY L. DUNN, director
SANDRA F. BLAKeway, home economist
GLENN M. FRINK, associate

MUSCATINE COUNTY, Muscatine
EUGENE MathNER, director
GARLAND E. KELLOGG, associate
IRENE W. LARY, home economist

O'BRIEN COUNTY, Primghar
JOHN H. LONGSTREET, director
MARGARET D. PRATT, home economist

OSCEOLA COUNTY, Sibley
RAYMOND DIRKSEN, director
C. DANORA WATERHOUSE, home economist

PAGE COUNTY, Clarinda
JOHN E. RYDEL, director
MARJORIE B. BURCH, home economist
EARL D. MOBLEY, associate

PALO ALTO COUNTY, Emmetsburg
W. JOHN JOHNSON, director
MARGARET D. PRATT, home economist

POLK COUNTY, Des Moines
LYLE R. MACKERY, director
DUANE R. BUEHLER, associate
JOANN K. MCBRIDE, home economist

POCAHONTAS COUNTY, Pocahontas
ALVIN M. ANDERSEN, director
VIRGINIA HARDING, home economist
RONALD L. ORTH, assistant

POLK COUNTY, Des Moines
GROVER H. HAHN, director
BEATRICE J. BROCK, home economist
LORIN W. HANSEN, associate

POTTAWATTAMIE E. COUNTY, Oakland
DOYLE R. WOLVERTON, director
JUDITH K. GEHRMANN, assistant
RAY O. OELKERS, associate

POTTAWATTAMIE W. COUNTY, Council Bluffs
CLIFFORD JOHNSON, director
CAROL ANN E. HAHN, assistant
D. ALLEN SHIRES, associate
RICHARD R. FAGAN, director

POWESHIEK COUNTY, Montezuma
GARY M. PETERSON, director
KATHRYN S. WEMER, home economist

RINGGOLD COUNTY, Mount Ayr
J. NEIL CHICKEN, director
HELEN I. STREEB, home economist

SAC COUNTY, Sac City
K. R. LITTLEFIELD, director
H. ELIZABETH BLOCK, assistant
FLOYD I. SCHNIRRING, assistant

SCOTT COUNTY, Davenport
J. R. UNDERWOOD, director
MABEL W. FLINT, associate

DONALD P. OLSON, associate
LETTIE F. ZUBER, home economist

SHELBY COUNTY, Harlan
DALE C. SIEBACH, director
R. LYNN BENSON, associate
CEDA F. DANIALS, home economist

SIOUX COUNTY, Orange City
Maurice E. ELDRIDGE, director
BEVERLY A. GREEN, home economist

STORY COUNTY, Nevada
JAMES R. CHRISTY, director
OBER J. ANDERSON, associate
SANDRA H. HORTON, home economist

TAMA COUNTY, Tama
G. GRESS ROGERS, director
MINA S. OLIN, home economist
JOHN M. RITTLER, associate

TAYLOR COUNTY, Bedford
HELEN M. MEYERS, home economist

UNION COUNTY, Creston
STEVE A. EVANS, director
DOROTHY E. BARTLES, home economist
JAMES F. KEARNES, associate

WAPELLO COUNTY, Oskaloosa
MELVIN L. POWERS, director
EDNA C. MORRIS, home economist

WAPELLO COUNTY, Ottumwa
HENRY I. STUECHLE, JR., associate
DORCAS L. WHEATLEY, home economist

WARREN COUNTY, Indianola
MORRIS, home economist

WASHINGTON COUNTY, Washington
director
KENNETH C. CUHUL, assistant
SALLY J. SMITH, home economist

WAYNE COUNTY, Corydon
F. WAYNE HART, director

WEBSTER COUNTY, Fort Dodge
JAMES C. ALMQQUIST, director
MERRILL E. ANDERSON, assistant
VERLA B. ULISH, home economist

WINNEBAGO COUNTY, Thompson
RICHARD W. ANDERSON, director
MARY JANE HOLLAND, home economist

WINNESHIEK COUNTY, Decorah
E. J. WEIGLE, director
MARY JANE OSLAND, home economist
JOHN J. RODECAP, associate

WOODBURY COUNTY, Sioux City
ROBERT B. WATSON, director
ESTHER MCKEE, home economist
EDWARD E. NEVON, associate

WORTH COUNTY, Northwood
NEIL E. BULMAN, director
FLORENCE FERDEN, home economist

WRIGHT COUNTY, Clarion
AARON R. BOWMAN, director
ROBERT F. BERNHARDT, associate
GERALDINE S. STEELE, home economist
AREA AND DISTRICT EXTENSION FIELD STAFF

**KYLE R. PETERSON**, Crawford area agronomist, Denison

**VIRGIL K. WEBSTER**, Delaware area agronomist, Manchester

**GARREN O. BENSON**, Henry area agronomist, Mt. Pleasant

**MERLE T. HILLSON**, Linn area agronomist, Cedar Rapids

**JAMES E. HUGHES**, Carroll district extension economist, Carroll

**ERROL D. PETERSEN**, Cass district extension economist, Atlantic

**CHARLES G. MOGGED**, Jefferson district extension economist, Fairfield

**LESLIE G. KRAL**, Linn district extension economist, Cedar Rapids

**W. J. TURNER**, O'Brien district extension economist, Sheldon

**L. J. BODENSTEINER**, Winneshiek district extension economist, Decorah

**HAROLD L. CRAIG**, Davis area extension 4-H leader, Bloomfield

**ROY E. HOUGEN**, Dickinson area extension 4-H leader, Spirit Lake

**MILTON HENDERSON**, Ringgold area extension 4-H leader, Mount Ayr

**ARTHUR H. JOHNSON**, Mahaska extension agent, area development, Oskaloosa

**MARTIN T. POE**, Cerro Gordo extension agent, area development, Mason City

**RONALD C. FAAS**, Union extension agent, area development, Creston

**DONALD M. GEE**, Appanoose area extension agent, farm and home development, Centerville

**MARION F. FITZGERALD**, Cedar extension agent, area livestock, Tipton

**KENNETH ROSS**, O'Brien demonstration farm leader, Primghar
The University

Iowa State University is a broad-based university with an orientation around science and technology.

It was chartered in 1858 by the Iowa General Assembly as a "State Agricultural College and Model Farm", and its first purpose was to help develop the great agricultural potential of the state. A site was selected on the unbroken prairie.

Students were admitted in 1868 after a decade of preparation made difficult by hard times and the Civil War, and a class of 26 was graduated in 1872.

Meanwhile, the United States had fostered on a national scale a new type of education. It was to be of college level, open to all at minimum cost, and would be concerned especially with agriculture and with subjects relating to the industrial growth of the nation. The Morrill Land Grant Act, signed by President Abraham Lincoln, July 2, 1862, provided funds from federal lands for at least one college of this type in every state. Two months later Iowa became the first state to accept the terms of the act and gave the endowment to the recently-established institution at Ames.

The Development of the University

The Land-Grant philosophy proved to be especially adapted to twentieth century demands for large numbers of college graduates and for the introduction of many new disciplines which had previously been unknown in classical education. Following closely the needs of the people and the times, Iowa State developed widely recognized programs in science and technology, with strong support from the social sciences and the humanities.

It pioneered in the establishment of agricultural curricula, was the first state institution to found a veterinary school, and helped move engineering from a small and narrow profession to its present key position in our industrialized society. The basic sciences were emphasized. Co-educational from its beginning, Iowa State took leadership in domestic economy (later to become home economics).

Graduate study was offered almost as soon as classes began and the first graduate degree was conferred in 1877. Experimentation and research also started early, first in agriculture and shortly thereafter in home economics, engineering, science and veterinary medicine.

Iowa State shared the conviction with other Land-Grant institutions that all people should have access to the ideas and knowledge of the campus. By 1870 it was holding educational institutes in various towns in Iowa. In 1903 it set the pattern of county cooperative extension as it is conducted now throughout the United States.

Iowa State's program became that of a university with special teaching responsibilities in science and technology, with an extension education program throughout the state, and with extensive research interests to advance the frontiers of learning.

From 1896 to 1959 it was known as Iowa State College of Agriculture and Mechanic Arts and since 1959 it has been Iowa State University of Science and Technology.

Accreditation and Sessions

The University is fully accredited by the North Central Association of Colleges and Secondary Schools, and is a member of the Association of American Universities.

Instruction is offered throughout the year, divided into four quarters of approximately 12 weeks each. Most undergraduates attend the three quarters from September to June, but increasing numbers are taking advantage of summer attendance.

In 1965 Iowa State had an enrollment of approximately 14,000, and a faculty of approximately 1,500. In its six colleges degree work was offered in more than 115 different fields.
CURRICULA AND PROGRAMS

The University is organized into six colleges. The main academic programs of each are listed below together with the degrees or certificates awarded upon completion. In many cases, certain majors, options or electives allow for increased specialization within the programs. Programs which are administered jointly by two colleges are listed within each college.

COLLEGE OF AGRICULTURE

Leading to the degree Bachelor of Science:
- Agricultural Business
- Agricultural Education
- Agricultural Engineering
- Agricultural Journalism
- Agronomy
- Animal Science
- Dairy Industry
- Dairy Science
- Entomology
- Farm Operation
- Fisheries and Wildlife Biology
- Food Technology
- Forestry
- Horticulture
- Industrial Education
- Landscape Architecture
- Plant Pathology
- Poultry Science
- Rural Sociology

Leading to a Certificate in Technical Agriculture:
- Agricultural Business
- Agronomy
- Animal Science
- Dairy Science
- Farm Operation
- Horticulture
- Industrial Education
- Poultry Science

Leading to a Certificate of Completion:
- Winter Quarter Program in Farm Operation

Non-Collegiate Program:
- Dairy Plant Operation

COLLEGE OF ENGINEERING

Leading to the degree Bachelor of Science:
- Aerospace Engineering
- Agricultural Engineering
- Ceramic Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Engineering Operations
- Engineering Science
- Industrial Engineering
- Mechanical Engineering
- Metallurgy

Leading to the degree Bachelor of Architecture:
- Architecture

Leading to the certificate Associate in Applied Science:
- Chemical Industries Technology
- Construction Technology
- Electronics Technology
- Mechanical Technology
COLLEGE OF HOME ECONOMICS

Leading to the degree Bachelor of Science:
- Applied Art
- Child Development
- Child Development—Elementary Education
- Food and Nutrition
- Home Economics Education
- Home Economics for General Education
- Home Economics Journalism
- Household Equipment
- Institution Management
- Physical Education for Women
- Textiles and Clothing

COLLEGE OF SCIENCES AND HUMANITIES

Leading to the degree Bachelor of Science:
- Bacteriology
- Biochemistry
- Biophysics
- Botany
- Chemistry
- Distributed Studies
- Earth Science
- Economics
- English and Speech
- Genetics
- Government
- History
- Industrial Administration
- Mathematics
- Metallurgy
- Modern Languages
- Naval Science
- Physical Education for Women
- Physical Education for Men
- Psychology
- Sociology
- Statistics
- Technical Journalism
- Zoology

COLLEGE OF VETERINARY MEDICINE

Leading to the degree Doctor of Veterinary Medicine:
- Veterinary Medicine

GRADUATE COLLEGE

The Graduate College confers the degrees Master of Architecture, Master of Education, Master of Engineering, Master of Landscape Architecture, Master of Science and Doctor of Philosophy.

SPECIAL PROGRAMS

- Military training is offered through three separate ROTC programs—the Army, Navy and Air Force. Training is on an elective basis. A student who completes a program of four years may be commissioned as a military officer.

- Inter-Institutional programs offer students the opportunity of completing two years of study in another institution, then completing the last two years at Iowa State without the formality of transferring. Several such programs are offered by the College of Home Economics.

- Dual Degree programs allow students who complete the first three years in certain curricula at Iowa State and who satisfactorily complete the first year in a recognized medical, dental, veterinary medical or law curriculum to be awarded the degree Bachelor of Science from Iowa State.

- The Iowa Lakeside Laboratory at Lake Okoboji offers two terms of five weeks each in June, July and August. A cooperative program in teaching and research, this summer laboratory for the biological sciences is sponsored by Iowa State University, the State College of Iowa and the University of Iowa.

HONORS PROGRAM

Students of high ability will find the University Honors Program provides for them a maximum educational opportunity and will give formal recognition to their special accomplishments and special responsibilities.

Each college has its own Honors Program within the general outline of the Univer-
The University Honors Program: All are highly individualized. They are planned to provide the widest range of opportunity corresponding to the needs, interests, and aptitudes of the individual student. Each student's program is developed with the aid of faculty advisors within the college in which he is enrolled.

A program may permit, among other things:
- Waiving of certain requirements for graduation (except for fixed total number of hours required)
- Waiving of prerequisites (whenever the action appears reasonable) to permit students in Honors Programs to take more advanced courses than ordinarily would be allowed.

Students in any undergraduate curriculum at Iowa State are eligible to participate in the Honors Program. During the third quarter of residence, or at any time thereafter, a student who has a cumulative grade point average of 3.5 or above may apply to the Honors Program Committee of his college for entrance into the Honors Program. A student who has demonstrated exceptionally high ability, but who has not achieved the minimum requirements for entrance into the program, may be admitted if he is recommended by the dean of his college.

Chairman of the University Honors Program Committee is Dr. Don C. Charles, 308 Beardshear Hall.
Research plays a large role at Iowa State. Most faculty engage in research pursuits as well as teaching. Graduate students, and in some cases undergraduates, receive the stimulation which comes from being a part of the never-ending search for new knowledge. The awareness of new developments and new ideas pervades the campus.

A year’s operating budget for all research at the University is approximately $18 million, much of it from contracts or grants involving the federal government and industry.

As part of its total program the University also operates extension services, special laboratories and institutes.

AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION

Agricultural research at Iowa State traces its history to the beginning of the University when the original farm provided an opportunity for experiments with livestock, crops and horticultural material. The Hatch Act, passed by Congress in 1887, gave federal support to agricultural investigations, and the formal beginning of the Agriculture and Home Economics Experiment Station dates from that time. Additional federal, state and private support enabled the Station to reach its present program in both basic and applied research.

In addition to the main station at Ames, experimental work is conducted at a number of outlying farms and in the fields of dozens of farmer cooperators throughout the state. These experimental areas have been selected to represent specific soil types of the state where special problems can be studied on a local basis.

Part of the unusual efficiency of Iowa farmers can be credited to research findings from the Agriculture and Home Economics Experiment Station.

Currently research is being conducted in:

Agricultural Bacteriology
Agricultural Engineering
Agricultural Journalism
Agricultural Statistics
Agronomy
Animal Pathology
Animal Science

Biochemistry
Dairy and Food Industry
Economics
Education
Entomology
Fisheries and
Wildlife Biology

Forestry
Genetics
Home Economics
Horticulture
Plant Pathology
Poultry Science
Sociology

RESIDENT COLLABORATORS

A collaborator is a person working on an active experiment station project whose salary is paid directly by some agency other than Iowa State University and who does not have academic rank.

Agricultural Economics Division, USDA

GLENN HELMERS
PAUL F. ROSENBERY
JERRY SHARPLES
JOHN F. STAHL

Agricultural Research Service, USDA

H. DAVID CURRENCE
STEVE EVERHART
ROGER GRINDELAND
ARNEL HALLAUER
L. W. LARSON

DONALD F. LAW
L. A. LILJEDAHL
W. G. LOVELY
SIMON MICHAELSON
LELAND ROE
R. L. SCHAFFER
J. L. SCHMIDT
GEOE SCOTT
JAMES H. SEARS
JAMES L. STEELE
JOHN M. TROEGER
Organized in 1904 to conduct investigations on engineering problems and to promote industrial development of the state, the Iowa Engineering Experiment Station is the research arm of the College of Engineering.

Research is supported by state appropriations, and industrial and government research grants and contracts. Major research facilities include an aerodynamic shock tube, x-ray and infra-red spectrophotometers, a high-speed digital computer, an electrical network analyzer, a 10 kw nuclear reactor, an electron microscope, a nationally
recognized Soils Research Laboratory and Bituminous Research Laboratory and various engineering shops.

The Station undertakes research in the fields of architectural, agricultural, aerospace, ceramic, chemical, civil, electrical, industrial, mechanical and nuclear engineering, and in the areas of:

- aerodynamics
- agricultural by-products
- biomedical engineering
- ceramics
- computers
- electronics
- energy conversion
- extraction
- filtration
- fluids
- highways
- ion exchange
- materials
- metallurgy
- nucleonics
- operations analysis
- process development
- sanitation
- semi-conductors
- similitude
- soils
- structures
- valuation
- wave propagation

The major research personnel of the station are active also in teaching, and a large part of the research activities is related directly to graduate instruction and training. Research projects generally are initiated and supervised by the staff.

SCIENTES AND HUMANITIES RESEARCH INSTITUTE  
CHALMER J. ROY, Ph.D., Director

The College of Sciences and Humanities sponsors and administers research programs through the Sciences and Humanities Research Institute. The primary objective is to encourage basic research which can provide knowledge to aid in the solution of industrial, social and agricultural problems in Iowa. The Institute works closely with other campus research agencies.

Research is conducted in the fields of:
- bacteriology
- biochemistry
- biophysics
- botany
- chemistry
- earth science
- economics
- English
- government
- history
- industrial administration
- mathematics
- philosophy
- physics
- psychology
- sociology
- statistics
- zoology

COMPUTATION CENTER  
C G MAPLE, D Sc, Director
R M STEWART, Ph D, Assoc. Director
C C MOSIER, B S, Assistant Director

The Computation Center was organized in 1962 to provide an all-university computing service and a centralized facility for research and education in the computer sciences.

University staff members and students having problems suited for digital computation can use the computing service as well as a consulting and programming service. The Center maintains a variety of computing facilities ranging from unit record equipment through large scale digital computers. Peripheral equipment includes an analogue-to-digital conversion system, and a digital plotter.

The Center offers short non-credit courses in computer programming and provides liaison for academic departments offering formal courses in computer sciences. Research encompasses numerical mathematics, programming research and digital computer systems.

STATISTICAL LABORATORY  
T A BANCROFT, Ph D, Director

The Statistical Laboratory is a research and service institute which conducts research in statistical theory and methodology and promotes and fosters the use of sound statistical methods in University research. Established in 1933, it was the first statistical center of its kind in the United States.
Students receive practical experience working with a variety of computing facilities in the Computation Center.

The Laboratory cooperates closely with research workers in all colleges of the University Staff and facilities are maintained for statistical consulting aid, numerical analysis and programming, sample survey operations, and statistical design and analysis of surveys and experiments. Similar consulting aid, research cooperation and services are extended to off-campus groups, other colleges and universities and civic groups, when such activities are of mutual benefit or otherwise in the public interest.

INSTITUTE FOR ATOMIC RESEARCH

FRANK H. SPEDDING, Ph.D., LL.D., D.Sc., Director
HARLEY A. WILHELM, Ph.D., Associate Director
MORTON SMUTZ, Ph.D., Deputy Director
ADOLF F. VOIGT, Ph.D., Assistant Director

During World War II, a small group of scientists and co-workers at Iowa State played a very important role in the atomic energy program. Through their efforts, a process was developed and demonstrated for making high purity uranium metal. Before turning the process over to industry, over 2,000,000 pounds of uranium metal were produced on campus in a temporary building. Shortly after World War II, Major General Leslie R. Groves presented the Ames project employees with the Army-Navy “E” ward for excellence in industrial promotion of a vital war material.

In order that the program of the University in this field might be carried forward in peace time, the Iowa State University Institute for Atomic Research was authorized by the Iowa State Board of Regents on November 1, 1945.

The objective of the Institute is to develop the peace time uses of atomic energy and the by-products from it. Specifically, its purposes are:

To build up and maintain a strong group of scientists working in the fundamental phases of physics and chemistry as they apply to nuclear processes and to develop the aspects of physics, chemistry, metallurgy, engineering and biology, which are naturally associated with these fields.

To have available on the campus a group of experts in these newer developments so other members of the faculty can consult them concerning the application of these new tools to their own problems.

To encourage cooperation and coordination in this type of research work on the campus on a voluntary basis. Particular emphasis is placed on borderline fields between the several sciences where expert advice is needed from several different fields.

To carry out research whereby graduate students may obtain the specialized knowledge and skills which they will need in order to do independent research in these fields. The formal course work is given and degrees awarded through the several departments and colleges.
A student assists a staff member in the examination of a client’s dog in the small animal section of the Veterinary Clinic.

The Ames Laboratory nuclear reactor has recently joined the Iowa scene.

Fuel elements are loaded into the Ames Laboratory research reactor.

A student assists a staff member in the examination of a client’s dog in the small animal section of the Veterinary Clinic.
Due to the outstanding record of achievement made by the Iowa State project during the war years, the Atomic Energy Commission decided to continue this program of research in the nuclear and associated fields at Iowa State University in the post-war period. Accordingly, it established on the campus one of its major research centers known as the Ames Laboratory of the Atomic Energy Commission. This Laboratory specializes in the basic and pioneering types of researches necessary to the development of the fields associated with atomic energy.

The University has leased to the Atomic Energy Commission areas on campus for the Metallurgy, Research, and Metals Development Buildings and the Ames Laboratory Research Reactor. Because virtually all of the work done is of a fundamental and basic nature, which is not classified, results of the research normally are published in the scientific journals. The Laboratory also provides research opportunities for several hundred graduate students and part-time work for a number of advanced undergraduate students.

VETERINARY MEDICAL RESEARCH INSTITUTE

Operated as a part of the College of Veterinary Medicine, the Veterinary Medical Research Institute carries on cooperative research with other departments of the University, particularly Bacteriology, Animal Science, Poultry Science, Zoology and Food and Nutrition. Its quarters include laboratories and isolation facilities for experimental animals south of campus. Some research is also conducted in campus laboratories.

Emphasis is given diseases of greatest consequence to the livestock industry of Iowa, and frequent conferences are held with veterinarians in general practice in order to identify these problems.

IOWA VETERINARY MEDICAL DIAGNOSTIC LABORATORY

Primary purpose of the Iowa Veterinary Medical Diagnostic Laboratory is to provide technical service to veterinarians and others within the state in the diagnosis of animal diseases. The laboratory annually receives thousands of specimens from all parts of Iowa for examination. It cooperates closely with the state and federal disease control programs and public health agencies. In addition, it serves as a teaching laboratory for both undergraduate and graduate students in the College of Veterinary Medicine.

VETERINARY MEDICAL CLINICS

Veterinary clinics at Iowa State include medical, surgical, obstetrical and radiological clinics for large and small animals. The department also operates an ambulatory clinic.
service which makes calls to farms in the general area of Ames. Junior and senior students are required to spend several hours each day in the clinics working under the supervision of the clinic staff and assisting in the diagnosis, care and treatment of sick and injured animals. Close liaison is maintained with the other teaching departments of the College of Veterinary Medicine such as Anatomy, Physiology, Hygiene, Pathology and the Diagnostic Laboratory which also make a contribution to the clinic training program.

COORDINATING EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS

The University extends its services to all people in Iowa through the Cooperative Extension Service in Agriculture and Home Economics. Local groups work with University personnel in identifying subjects for educational programs.

Among the programs offered are agricultural production, conservation of national resources, efficient marketing and distribution of farm-raised products, family living, 4-H club work, youth development, community improvement and resource development.

A central staff, headquartered on the campus, and a field staff with headquarters in every county in the state work with nearly 50,000 local volunteer leaders in carrying out various Extension activities.

The University was charged with its present responsibilities in Extension by action of the state legislature in 1906. In 1914 Congress passed the Smith-Lever Act which provided for Cooperative Extension work in the Land-Grant College system. The United States Department of Agriculture, the University, county governments and local organized groups are cooperators in this enterprise. Financial support comes from state, federal, and county appropriations.

An extension specialist in home management discusses money management on "Today's Homemaker."
Firemen are educated through a controlled burning demonstration sponsored by the Engineering Extension Service.

ENGINEERING EXTENSION SERVICE

Established at Iowa State in 1913 by the Iowa General Assembly, Engineering Extension is supported by fees from participants, by state appropriations and by certain federal funds.

"Refresher" or service courses, which do not qualify for college credit, are conducted by Engineering Extension throughout the state, or on campus. Level of instruction varies from vocational or "practical" to collegiate post-graduate.

Specific programs include:
- An Engineering Management Institute to assist industry in developing engineering and management personnel;
- Fire extension training for volunteer and paid departments, industrial brigades and for fire department officers, instructors or inspectors;
- An industrial safety correspondence course;
- Junior Engineering Technical Societies which provide insight into engineering and applied science for students in high schools.

GEORGE R TOWN, D.Eng., Director
R F. PATTERSON, JR., B.S., Associate Director
The University

CENTER FOR
AGRICULTURAL AND
ECONOMIC DEVELOPMENT

EARL O. HEADY, Ph.D., Executive Director

The Center was created in July 1957 to deal with problems stemming from the changing resource makeup of agriculture resulting from growth in the national economy and the technological revolution in farming. The transformation of agriculture under rapid economic growth affects not only farm people and rural communities, but people and institutions throughout society.

Thus the Center tries to help both rural and urban people understand—and shape—the necessary social and economic adjustments in our growing domestic economy. It also concerns itself with the role of U.S. agriculture in aiding underdeveloped nations of the world achieve economic growth and political stability.

In seeking to attain these objectives the Center engages in these major lines of endeavor:

Original research as well as the synthesis and interpretation of existing knowledge to explain adjustment and development problems facing agriculture—and also the alternative policies that can be applied to solve these problems.

Direct educational work with audiences especially selected because of their sensitivity to public decision making. The goal here is to give people an understanding so they can make intelligent, informed decisions on the problems and public policy alternatives open in meeting those problems.

Help to the Land-Grant universities to modify their organizational structures and programs in order to assist people to cope with the rapidly-changing needs of the times.

The Center holds fact-finding seminars, organizes conferences and workshops, publishes reports, and pursues other lines of activity to achieve its objectives. It is supported in part by a grant from the W.K. Kellogg Foundation.

CENTER FOR
INDUSTRIAL RESEARCH AND
SERVICE (CIRAS)

WALDO W. WEGNER, B.S., Director

CIRAS was established in 1963 to provide a facility on campus to which Iowa industry can bring its problems for counsel and assistance. Through the Center, technical and engineering assistance of Iowa State University and other talents of a wide variety in the state are made available to Iowa industry in these ways:

1. Coordination of industrial needs with technical capabilities and the broad range of specialized industrial talents throughout Iowa.

2. Assistance with special problems facing industry in Iowa by full time staff employed by CIRAS.

3. Publication of information from research and field contacts by CIRAS relating to industrial climate and growth in Iowa.

Counseling and information can be provided directly to industry by CIRAS staff, or through assistance of other ISU staff. Referrals are made to other state agencies, private professional organizations, or other colleges in Iowa.

CIRAS does not duplicate or overlap activities now undertaken by established groups in the state. It coordinates and supplements activities of other organizations and performs functions which cannot easily be undertaken by academically oriented university departments. The Center works to provide an integrated research and service function oriented toward industrial needs. It provides a coordinated approach to the usual industrial problems containing implications which reach from the area of basic research to the organization, management, and implementation of the results of technical and theoretical discoveries.
Admission and Registration

ARTHUR M. GOWAN, Ph.D., Director of Admissions and Records
WAYNE A. DEVAUL, B.S., Associate Director of Admissions and Records
FRED C. SCHLUNZ, M.S., Registrar
JOHN W. PACE, M.A., Assistant to the Director of Records
DON F. GUSTOFSON, B.S., Assistant to the Director of Admissions
KARSTEN SMEDEAL, B.S., Assistant to the Director of Admissions
JOHN V. STJOBLOM, M.A., Assistant to the Registrar

Application for admission to Iowa State University may be made by writing to the Director of Admissions, 104 Beardshear Hall, Iowa State University, Ames, Iowa. The applicant should state his educational background and indicate the area in which he plans to study. The Director of Admissions will then forward application blanks and detailed information concerning the admissions process.

The Admissions Office, 104 Beardshear Hall, is open Monday through Friday from 8 a.m. to 11:50 a.m. and from 1 p.m. to 5 p.m. In general, University offices are closed on Saturday. Prospective students are encouraged to visit the Admissions Office in person to discuss with counselors any problems or questions that may arise in connection with admissions. Personal visits are not required, however, and in most cases admission can be completed by mail.

Students planning to enter as freshmen should make application early in their senior year of high school. Inquiries about admission are welcomed at any time.

Candidates for admission generally are informed of the action taken on their applications within a few days after all necessary forms are in the hands of the Director of Admissions.

ADMISSION REQUIREMENTS

In general, requirements for admission as a freshman to Iowa State are that the student be in the upper half of his secondary school graduating class, that he take the American College Testing Program (ACT) tests, and that he present the necessary credits to meet the requirements of the curriculum he has selected.

Since there are many variations in the admissions process for freshman and transfer students, a detailed set of regulations has been drawn up by the State Board of Regents as follows:

General Requirements

A. ADMISSION OF FRESHMAN STUDENTS

A student desiring admission must meet the requirements in this section and also any special requirements for the college or curriculum of his choice. See also Specific Requirements.

He must submit a formal application for admission and must have the secondary school provide a certificate of high school credits, including a complete statement of the applicant's high school record, rank in class, scores on standardized tests, and certification of high school graduation. The applicant must also submit any other evidence, such as a certificate of health, that may be required.

1. A graduate of an approved Iowa high school who has the proper subject-matter background, who is in the upper one-half for his graduating class, who meets specific curricular requirements will generally be admitted upon certification of graduation, if he applies for admission.

2. A graduate of an approved Iowa high school who has the proper subject-matter background, who is in the upper one-half for his graduating class, who meets specific curricular requirements will generally be admitted upon certification of graduation, if he applies for admission.

3. A graduate of a non-approved high school must submit all data as required above and in addition must take examinations which will demonstrate his general competence to do successful college work. Evidence of specific competence for admission to a given curriculum will also be required.

4. An applicant who is not a high school graduate must submit all data required...
B. Admissions of Undergraduate Students by Transfer from Other Colleges

1. Students from accredited colleges and universities. Transcripts of record are given full value if coming from colleges or universities accredited by the North Central Association of Secondary Schools and other organizations. For schools not regionally accredited the recommendations contained in the current issue of the Report of Credit Given by Colleges and Universities published by the American Association of Collegiate Registrars and Admissions Officers will be followed.a. Each applicant shall submit an official transcript bearing the original seal and signature of the official in charge of records from each college or university which the student has attended previously. The student will also submit any other records or letters which the University may require to support the application for admission.b. A transfer applicant shall be expected to have maintained a "C" average (2.00 based on an "A" grade being 4 points) for all college work previously attempted and not be under suspension from the last college attended. Students who are not residents of Iowa may be expected to have maintained a 2.25 grade index.c. A student who is below the above standard may be permitted to take entrance examinations. If the applicant successfully completes the examinations he may be admitted on probation.d. In general transfer applicants under academic suspension from the last college attended will not be considered for admission during the period of suspension or if for an indefinite period. Any college months have passed since the last date of attendance When eligible for consideration the applicant will be considered as in "C" above.e. A transfer applicant under disciplinary suspension will not be considered for admission until a clearance and a statement of the reason for suspension is filed from the previous college. When it becomes proper to consider an application from a student under suspension, Iowa State University must take into account the fact of the previous suspension in consideration of the application. An applicant granted admission under these circumstances will always be on probation and his admission subject to cancellation.f. Applicants for admission by transfer who do not meet the standards may be denied.

2. Students from non-accredited colleges. The University may refuse to recognize credit from a non-accredited college or may admit the applicant on a provisional basis and provide a means for the validation of some or all of the credit. The validation period shall not be less than one semester and will ordinarily be a full academic year. The University will specify to the student the terms of the validation process and the conditions for provision admission. Each student from a non-accredited college will be considered on his merits and his admission or rejection is at the discretion of the admissions officer.

C. Application Deadlines

Applicants for admission must submit the required applications for admission and the necessary official transcripts and other required documents to the admissions officer of the appropriate college at least 10 days prior to the beginning of orientation for the session for which the student is applying. Applications for admission from students who are required to take entrance examinations will not be considered unless the examinations are completed at least five days before the beginning of orientation. This regulation may be waived by the admissions officer only for adequate reasons.

This regulation does not apply to the College of Veterinary Medicine, Veterinary Medicine Admission Requirements. All new undergraduate students must complete the tests provided through the American College Testing Program (ACT) before the beginning of orientation for the session in which the student first registers.

D. Classification of Residents and non-Residents for Admission and Fee Purposes

1. General

Students shall be classified as Resident or Non-resident for admission, fee, and tuition purposes by the Registrar. The decision shall be based upon information furnished by the student and all other relevant information. The Registrar is authorized to require such written documents as affidavits, verifications, or other evidence as are deemed necessary to establish the domicile of a student, including proof of emancipation, adoption, award of custody, or appointment of a guardian.

The burden of establishing that a student is exempt from paying the non-resident fee is upon the student.

For purposes of resident and non-resident classifications, the word "parents" as herein used shall include legal guardians or other persons legally in loco parentis in all cases where lawful custody of any applicant for admission has been awarded to persons other than actual parents.

2. Residence for Tuition Purposes

Regulation regarding residence for admission, fee, and tuition payments are generally divided into two categories—those that apply to students who are minors and those that apply to students who are over 21 years of age. The requirements in these categories are different. Domicile
within the state means adoption of the state as a fixed permanent home and involves personal presence within the state. The two categories are discussed in more detail below.

3. Students Who Are Minors

The residence of a minor shall follow that of the parents at all times, except in extremely rare cases where emancipation can be proved beyond question. The residence of the father during his life and, after his death, the residence of the mother, is the residence of the unmarried or unemancipated minor; but if the father and the mother have separate places of residence, the minor takes the residence of the parent with whom he lives or to whom he has been assigned by court order. The parents of a minor applying for admission will be considered residents of Iowa only if they have had domicile within the state for six months immediately prior to the date of the minor's enrollment at Iowa State University. A minor admitted before his parents have moved to Iowa or before they have been here six months, may be reclassified as a resident at the next registration after his parents have had a domicile here six months.

A minor whose parents move their residence from Iowa to a location outside of Iowa shall be considered to be a non-resident after six months from the date of the parents' removal from the state. In the event that the fact of non-resident emancipation is established, the emancipated minor assumes all of the responsibilities and duties of a resident for tuition purposes by maintaining his residence within the state for 12 consecutive months while not in school, the same as in the case of any other non-resident adult.

4. Students Over 21 Years of Age

A resident student 21 years of age or over is permitted to reside in the state and be considered a resident of the state at the time he reached his majority and who has not acquired a domicile in another state, or (2) who, while an adult, has established a bona fide residence within the state of Iowa by residing in the state for at least 12 consecutive months immediately preceding registration. Bona fide residence in Iowa means that the student is not in the state primarily to attend a college; that he is in the state for purposes other than to attempt to qualify for resident status. Any non-resident student who reaches the age of 21 years while a student at any school or college does not of itself establish residence in this state for admission or tuition payment purposes.

5. General Facts

The residence of a wife is that of her husband. A non-resident female student may attain residence through marriage, and correspondingly, a resident female student may lose residence by marrying a non-resident. Proof of marriage shall be furnished to the Registrar at the time change of status is requested. Persons who are moved into the state as the result of military or civil orders from the armed forces, or the minor children of such persons, are entitled to residence status after residing in Iowa for six months. However, if the initial registration of the minor children precedes the arrival of the parents, non-resident tuition will be charged in all cases until the next registration after the conditions set forth above are met.

Dependent persons whose legal residence is permanently established in Iowa, who have been classified as residents for tuition purposes may continue to be classified as residents so long as such residence is maintained, even though circumstances may require extended absence of some months. Proof is required that persons who claim an Iowa residence while living in another state or country will provide proof of a continuous Iowa domicile such as (1) evidence that the claimant has acquired a domicile in another state, (2) they have maintained a continuous voting record in Iowa, and (3) they have filed regular Iowa income tax returns during their absence from the state.

Ownership of property in Iowa, or the payment of Iowa taxes, does not in itself establish residence. A student from another state who has enrolled for a full program, or substantially a full program, in a degree or educational institution will be presumed to be in Iowa primarily for educational purposes, and will be considered not to have established residence in Iowa. Continued residence in Iowa during the academic periods or during periods of interruption to the course of study does not of itself overcome the presumption.

All students not classified as resident students shall be classified as non-residents for admission, fee and tuition purposes. A student who willfully gives incorrect or misleading information to evade payment of the non-resident fees and tuition shall be subject to serious disciplinary action and must also pay the non-resident fee for each session attended. An alien who has entered the United States on an immigration visa and who has established a bona fide residence in Iowa by living in the state for at least 12 consecutive months immediately preceding registration may be eligible for resident classification provided he is in the state for purposes other than to attempt to qualify for resident status as a student.

Men in military service (except career servicemen) who listed Iowa as their residence prior to entering service and who, immediately upon return to Iowa to establish their residence or enter college, will be classified as residents unless their parents moved from the state while the individual was still a minor.

Change of classification from non-resident to resident will not be made retroactive beyond the semester or session in which application for resident classification is made.

6. Review Committee

The decision of the Registrar on the residence of a student for admission, fee and tuition purposes may be appealed to a Review Committee. The findings of the Review Committee shall be final.

Specific Requirements

The following requirements are in addition to those given in Section 1.

1. Undergraduate Students

A minimum of one unit of algebra is required for admission to all curricula. A non-high school graduate, in addition
to meeting standards in Section I must be at least 17 years of age and have an unqualified recommendation from his high school principal. Requirements for admission to the several colleges are given below.

College of Agriculture—A minimum of one and one-half units of algebra is required of students entering any four-year curriculum. In addition, the curricula in Agriculture Journalism, Forestry, Industrial Education, and Landscape Architecture require one unit of geometry. Students who have not completed all of the required mathematics courses may take geometry or third-semester algebra at Iowa State University. The requirements for admission to Agricultural Engineering are the same as for the College of Engineering.

College of Engineering—One unit of geometry and one and one-half units of algebra are required. Students who have not completed all of these courses may take geometry or third-semester algebra at Iowa State University. The requirements for the College of Engineering are the same as for the College of Agriculture.

College of Home Economics—Two units of mathematics are required. One of the units must be algebra. The other unit may be algebra, geometry, and/or trigonometry in any combination. Students who have not completed all of the required mathematics may take geometry or third-semester algebra at Iowa State University.

College of Sciences and Humanities—For the curricula in Sciences and Humanities, one and one-half units of algebra and one unit of geometry are required. Students who have not completed all of these courses may take geometry and third-semester algebra at Iowa State University. For the curriculum in Physical Education for Men one unit of algebra is required.

College of Veterinary Medicine—See Veterinary Medicine, Admission Requirements.

2. Graduate Students See Graduate College, Admission Requirements.

3. Technical Institute One unit of geometry and one and one-half units of algebra are required. Students who have not completed all of these courses may take geometry or third-semester algebra at Iowa State University. Unconditional admission to the Technical Institute may be granted to students who are not in the upper one-half of their graduating class.

HEALTH EXAMINATION

A health examination is part of the admission process for all students. Each new student is sent a form to be filled out by his physician and returned to the Student Health Service. If the form is not received at the Health Service prior to registration of the student, he may receive a physical examination from a University physician. Professional fees are charged for this service.

University physicians study reports of the physical examinations in placing students in proper physical education classes, and in qualifying them for military training, when necessary.

New students are requested to furnish the results of a tuberculin test and/or chest x-ray made within the preceding year. If none is available, these may be obtained at the University Health Service.

It is advisable to have remediable defects in vision corrected and to have necessary dental work accomplished before entrance in the University. Vaccinations for smallpox and poliomyelitis, as well as tetanus toxoid inoculations, are also advised.

SUMMER ORIENTATION

To welcome students and parents to Iowa State, and to accomplish more thoroughly some of the orientation process which ordinarily marks the beginning of the fall quarter for new students, the University holds a summer orientation program.

The program is conducted individually by the College of Agriculture, the College of Engineering, the College of Home Economics, the College of Sciences and Humanities and the College of Veterinary Medicine and varies somewhat among colleges.

In general, students are asked to select a convenient time from among a number of two-day periods which are scheduled between June 1 and July 15. They are requested to come to the campus during the period which they select for the orientation program.

Parents are urged to accompany students whenever this is possible.

Students and parents are housed in campus residence halls for nominal fees, or may choose to stay at hotels and motels in Ames. Meals may be purchased at University facilities or in Ames restaurants.

During the orientation period, both students and parents are briefed by faculty members on matters of curriculum, study, and university life in general. Considerable time
is spent on answering individual questions. Visits are made to residence halls, classrooms and laboratories to inspect facilities. Tests are administered to students so they may be placed in class sections according to their abilities and aptitudes. Each student has a personal conference with an academic adviser to outline his program of study.

Attendance at the summer orientation program is not required but is strongly advised. A large portion of the incoming students and their parents usually do attend.

FALL ORIENTATION

All new students are required to attend orientation days which precede the opening of the fall quarter. This period includes tests for those who have not attended the summer orientation program, plus registration and the many activities necessary to insure that each new student is properly enrolled and ready to begin his career at Iowa State.

REGISTRATION

Registration and the payment of assessed fees are required of all who attend classes. Registration is not complete until fees are paid, including board and room fees for those living in residence halls. The fee payment period for a quarter extends through the second day of classes, and a late fee is attached for payments made after that date.

The instructor in each class receives from the Office of Student Records a class list showing all students properly registered for his class. This list serves as his authority to admit the students to class. Additional students should be admitted only upon presentation of an official add slip. Students are permitted to audit non-laboratory classes. This means they may attend the class as a visitor but may not participate in discussions or make claims upon the time of the instructor. Approval to audit must be obtained from the dean, and the payment of regular fees is required.

CLASSIFICATION

Students are not admitted to any class nor are they dropped from any class except by permission of their dean. Students may not classify at conflicting hours without the approval of the departments concerned. Any student may be required to drop work which is not being accomplished in a satisfactory manner.

A change from one college to another within the University requires the permission of the dean of the college to which the student wishes to transfer. A change from one curriculum to another in the same college requires the approval of the dean of the college as well as the head of the curriculum to which the student wishes to transfer.
Fees and Expenses

All fees and expenses listed in this catalog are effective as of Sept 1, 1965. They are subject to change at any time thereafter without notice.

A registration fee is charged all students of the University. A full undergraduate registration fee covers laboratory fees, hospital service, use of the library, membership in the Union, and a number of student activities. For graduate students and students on light classification, the activity fee is optional. Students who are not residents of Iowa pay an additional tuition fee each quarter. This is assessed in accordance with regulations of the State Board of Regents, found in this catalog under Admissions.

ESTIMATE OF EXPENSES

An undergraduate enrolling at Iowa State and living in a residence hall will find the following basic expenses will cover one academic year (three academic quarters):

<table>
<thead>
<tr>
<th></th>
<th>Iowa Resident</th>
<th>Sept. 1, 1965</th>
<th>Sept. 1, 1966</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration fee</td>
<td>$345</td>
<td>$345</td>
<td>$345</td>
</tr>
<tr>
<td>Tuition</td>
<td></td>
<td>$495</td>
<td>$585</td>
</tr>
<tr>
<td>Board and room</td>
<td>$735</td>
<td>$735</td>
<td>$735</td>
</tr>
<tr>
<td>Books, supplies and equipment (estimated)</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,180</strong></td>
<td><strong>$1,675</strong></td>
<td><strong>$1,765</strong></td>
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</table>

The above figures make no allowance for clothing, transportation, most social and recreational expenses, laundry or a variety of incidental expenses. These vary widely with the individual student, but should be considered carefully as part of the total cost of attending the University.

Further information regarding board and room expenses is found in this catalog under Student Housing.

FEE SCHEDULE

<table>
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<tr>
<th>Light Classification (assessed on a minimum of three hours)</th>
<th>Iowa Resident Undergraduate</th>
<th>Sept. 1, 1965</th>
<th>Iowa Resident Graduate</th>
<th>Sept. 1, 1965</th>
<th>Nonresident Undergraduate</th>
<th>Sept. 1, 1965</th>
<th>Nonresident Graduate</th>
<th>Sept. 1, 1965</th>
</tr>
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<tr>
<td>12 weeks</td>
<td>$115</td>
<td>$125</td>
<td>$280</td>
<td>$310</td>
<td>$240</td>
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<tr>
<td>10 weeks</td>
<td>98</td>
<td>107</td>
<td>228</td>
<td>253</td>
<td>196</td>
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<td>9 weeks</td>
<td>87</td>
<td>95</td>
<td>202</td>
<td>223</td>
<td>173</td>
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<td>8 weeks</td>
<td>76</td>
<td>83</td>
<td>177</td>
<td>196</td>
<td>152</td>
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<td></td>
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<tr>
<td>6 weeks</td>
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<td>64</td>
<td>140</td>
<td>155</td>
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<td>3 weeks</td>
<td>42</td>
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<td>96</td>
<td>107</td>
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<td>75</td>
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<td>Light Classification (assessed on a minimum of three hours)</td>
<td>3 hours</td>
<td>$42</td>
<td>$52</td>
<td>$99</td>
<td>$78</td>
<td>$26</td>
<td>$29</td>
<td></td>
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<tr>
<td>4 hours</td>
<td>56</td>
<td>66</td>
<td>132</td>
<td>148</td>
<td>116</td>
<td></td>
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<tr>
<td>5 hours</td>
<td>70</td>
<td>80</td>
<td>165</td>
<td>185</td>
<td>145</td>
<td></td>
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<tr>
<td>6 hours</td>
<td>84</td>
<td>94</td>
<td>198</td>
<td>222</td>
<td>174</td>
<td></td>
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<tr>
<td>7 hours</td>
<td>98</td>
<td>108</td>
<td>231</td>
<td>259</td>
<td>203</td>
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<tr>
<td>8 hours</td>
<td>112</td>
<td>122</td>
<td>264</td>
<td>296</td>
<td>232</td>
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</tr>
</tbody>
</table>

Audit—Same as light classification

Off-campus—Same as light classification

In absentia—Same as light classification

Interim Fee

| 1 hour | $17 | $26 | $29 |
| 2 hours | 34 | 52 | 58 |
### Fees and Expenses

<table>
<thead>
<tr>
<th></th>
<th>Resident Undergraduate</th>
<th>Resident Graduate</th>
<th>Non-resident Undergraduate</th>
<th>Non-resident Graduate</th>
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<tr>
<td>Lakeside Laboratory</td>
<td>$70</td>
<td>$70</td>
<td>$70</td>
<td>$70</td>
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<td>Driver Education</td>
<td>$20</td>
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<td>Special Women's</td>
<td>$10</td>
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<td>Education</td>
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<tr>
<td>Change of</td>
<td>$1</td>
<td>$1</td>
<td>$1</td>
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</tr>
<tr>
<td>Classification</td>
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</tbody>
</table>

**Private Music Instruction**

<table>
<thead>
<tr>
<th></th>
<th>University students, per quarter</th>
<th>Non-University students, per quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 lessons per quarter 1 credit ($25-$30)</td>
<td>$30</td>
<td>$33</td>
</tr>
<tr>
<td>20 lessons per quarter 2 credits</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>Practice Room (1 hour per day)</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Electric Organ practice</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Pipe Organ practice</td>
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<td>15</td>
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</table>

**HOME MANAGEMENT HOUSE FEE**

Students who have reservations for Home Management House (475) pay $46 room rent before they preclassify for this course. Married women who do not stay overnight in the houses pay $23.

Students who cancel reservations after preclassification for winter, spring or summer
quarter or after Aug 1 for fall quarter, forfeit one-half of their room rent fee. All students pay a fee of $47 for board and incidentals upon moving into the house. Bedding, linens and towels are furnished in the home management houses.

SPECIAL STUDENTS AND NON-COLLEGIATE STUDENTS

Special students and non-collegiate students pay the same fees as undergraduates.

REGISTRATION FEE FOR STUDENTS WITH FEE REDUCTIONS

For students with fee reductions, the registration fee for each of the fall, winter and spring quarters is $52. For either term of the summer quarter, the fee is $26. This fee covers laboratory fees, hospital service, use of the library and membership in the Memorial Union. An activity fee is optional.

APPLICATION FEE

A fee of $10 must accompany the application for admission and is non-refundable except in the case of residents of Iowa who are denied admission. This fee will not apply to special students or workshop applicants.

ADVANCE FEE PAYMENT

Nonresident undergraduates and special students are required to make an advance partial fee payment of $50 before final admission is made. This $50 payment is applied at registration time toward the fees for the first quarter. The payment is not refunded if the student does not register.

LATE REGISTRATION

A fee of $5 for the first day and $1 per day thereafter is charged to those who do not complete registration during the regular registration period. Maximum charge for late registration is $10.

ACTIVITY FEE

Students whose payments do not include the activity fee may pay $9 per quarter and receive admission to concerts, lectures and debates and subscription to several student publications. An additional charge is made for admission to football and basketball games.

SENIOR FEE

To cover the cost of special senior activities, all students classified as seniors in the spring quarter pay a fee of $1 at that registration.

REFUNDS

Refunds are made on the unused portions of fees for registrations, room and board under the following policy:

Registration fee and room rental—Ten percent is deducted for each week or part of a week that the student is enrolled, but no refund is granted if the student is in the University beyond the fifth week of the quarter. In the summer session, 20 percent is deducted for each week or part of a week, with no refund after the third week.

Board charges—Ten percent is deducted for each week or portion of a week that the student is enrolled in the University.

Each quarter begins on the registration day immediately preceding the opening of classes and continues through the day previous to graduation day.
Financial Aid

A large number of Iowa State students depend in part upon their own savings, current earnings, loans or scholarships for support in their university educational program. A combination of two or more of these resources often is used.

Opportunities for on-campus employment are described in the Student Services section of this catalog. Financial aid in various forms available to students in Military Science, Air Science and Naval Science is outlined in the sections which deal with each branch of the Armed Services. (See Index.)

The award of a scholarship or the issuing of a loan is based on a careful review of the background and the needs of each individual applicant.

Detailed information concerning applications may be obtained from the Loans and Scholarships Office, 9 Beardshear Hall.

STUDENT LOAN FUNDS

Long term loans are available from the National Defense Education Act Student Loan Fund, established in 1958 by the federal government. Students in need of financial help are encouraged to apply in the quarter previous to the time they will need the help. Freshman students may apply during the first quarter they are in the University. The amount loaned is determined by need, availability of funds and evaluation of scholastic ability.

Loans must be used for educational purposes, such as room, board, tuition and books. Single students owning or possessing automobiles are requested not to seek assistance through this fund.

A number of other loan funds may be used by students for emergency or long term loans at modest charges.

STUDENT AID FUNDS

Student aid funds, which are limited in size and number, require no interest of the borrower. These funds include the Electrical Engineering and Equipment Company Fund, Frances Coover Aid Fund, Mary Huncke Student Loan Fund, and the Ralph W Atkinson Aid Fund.

SCHOLARSHIPS

To be considered for a scholarship, a freshman student must have ranked in the upper 25 percent of his high school graduating class, and must have achieved a composite score of 27 or more on the American College Test.

Applications from those who will be freshmen should be made when they apply for admission. Transfer students are considered on the same basis as university freshmen. Applications are accepted until March 1 for scholarships effective in the fall quarter unless otherwise specified. High school students should consult their principals or counselors for information about possible local scholarships as well as National Merit Scholarships, National Science Talent Search Scholarships and others. High school officials also can provide information about aids available to war orphans, physically handicapped students and others.

GENERAL UNIVERSITY SCHOLARSHIPs AND AWARDS

General University awards are made to prospective students who rank near the top in their high school studies and in the American College Test scores. These awards are issued without regard to financial need. Students who feel they can qualify for these awards should make application on a regular scholarship application blank.
All University Scholarships

Application for a Freshman General Scholarship will give a student consideration for the following freshman scholarships: General, Alumni Achievement, Class, Freshman Lane Wells, General Motors, and any new scholarships that might not be listed. Unless otherwise stated, apply to Scholarship Committee, 9 Beardshear Hall.

C.G. Adams Scholarship for a member of Delta Upsilon social fraternity. No application necessary.

Alumni Achievement Fund Scholarships for freshmen and undergraduates. See headnote.

Athletic Grants-in-Aid for graduating high school seniors. Established by the Big Eight Conference Schools. Apply to Department of Athletics.

George W. Catt Memorial Scholarships for seniors. No application necessary.

Class Scholarships for freshmen and undergraduates. Established by the classes of 1906, 1907, 1908 and 1911. See headnote.

Delta Delta Delta Scholarship for an undergraduate woman. Apply to Delta Delta Delta Sorority, 302 Ash Avenue, after arrival at Iowa State University.

Epsilon Chapter of Tau Kappa Epsilon Fraternity Scholarship for a member of that fraternity. No application necessary.

General Motors (College Plan) Scholarships for freshmen. See headnote.

General University Scholarships for freshmen and undergraduates. Apply to local counselor or General Scholarship Committee, 9 Beardshear Hall.

Interfraternity Council Scholarship for a freshman. Apply to Interfraternity Council after arrival at Iowa State University.

Iowa State Club of Chicago Scholarship for a student who will graduate from a high school in the West Suburban and Suburban League of Chicago. Apply to high school principals of respective schools.

Lane-Wells Scholarships for freshmen. See headnote.

Lane-Wells Scholarships for seniors. No application necessary.

La Verne Noyes Scholarships for freshmen and undergraduates who are blood descendants of men who served in World War I. Apply first quarter in the University, 9 Beardshear Hall.

Veishea Scholarships for Iowa freshmen. Application blanks are sent to high schools. Applications may be made after student completes seventh semester of high school. Applications are due by March 31. Questions should be directed to Career Day Director, Veishea Central Committee, Memorial Union.

Walnut Grove Products Company Scholarship for a junior, based on an essay on a chosen subject. No application necessary.

Ward Scholarships for Ward System freshmen and sophomores. No application necessary.

Women's Residence Association Scholarships for undergraduates living in residence halls. Apply to WRA Scholarship Council.

Madge Young Memorial Scholarship for a Men's Residence Association junior or senior with a 2.25 grade point or above. Apply to MRA president.

Scholarships Listed Under Two or More Colleges

These scholarships are available to students of more than one college.

Hazel Beck Andre Journalism Scholarship for a junior in journalism in the College of Agriculture or Home Economics. Apply to Technical Journalism Department.

James W. Bell Company, Inc Scholarship for a Science or Engineering freshman. No application necessary.
JAMES W. BELL "CHRISTMAS" SCHOLARSHIP for a Science or Engineering freshman. No application necessary.

JOURNALISM TUITION SCHOLARSHIPS for freshmen majoring in journalism. Apply to Technical Journalism Department.

W. E. HOLMES SCHOLARSHIP for a freshman enrolling as a journalism major. Apply to Technical Journalism Department

RUTH WATKINS NEWTON SCHOLARSHIP for a freshman enrolling as a journalism major. Apply to Technical Journalism Department.

R.C.A. SCHOLARSHIP for a senior in electrical engineering or physics. No application necessary.

SEARS-ROEBUCK 4-H FOUNDATION POULTRY SCHOLARSHIP for a freshman from Iowa in the College of Agriculture or Home Economics. Based on 4-H record, including a laying flock project. Apply to Agricultural Awards and Scholarships Committee, 121 Curtiss Hall.

TEXACO SCHOLARSHIPS for junior and senior men in a curriculum which qualifies them for a career in the petroleum industry. No application necessary.

**Agricultural Scholarships**

Applications for freshman scholarships must be submitted by March 15. Applications for sophomore, junior and senior scholarships are due either October 15, December 15 or April 15 each year. Students should contact their advisor or the Awards and Scholarship Committee, 121 Curtiss Hall, for further information about these scholarships.

AGRICULTURAL MARKETING MANAGEMENT SCHOLARSHIPS for agricultural business undergraduates in the marketing management option. Sponsored by the Farmers Elevator Service Company, the Farmers Grain Dealers Association of Iowa, the Quaker Oats Company and the Western Grain and Feed Association.

ALCOA FOUNDATION AGRICULTURAL SCHOLARSHIPS for residents of Iowa in their freshman year.

BEEF CATTLE IMPROVEMENT SCHOLARSHIP for a student who has completed courses in animal breeding, beef production and a special problem on beef cattle improvement.

BORDEN AGRICULTURAL AWARD for the student with the highest grade average among students completing two or more dairy courses prior to senior year. No application necessary.

C. H. CHASE HONORARY SCHOLARSHIP for a sophomore in agricultural business with an interest in the retailing of farm equipment. Sponsored by the Iowa Retail Farm Equipment Association.

CHICAGO AND NORTH WESTERN RAILWAY 4-H SCHOLARSHIPS for male agricultural economics or forestry juniors, seniors or graduate students 4-H background and essay necessary. Apply to state 4-H office by September 15.

CHICAGO FARMERS’ CLUB SCHOLARSHIP for a senior.

CONSUMERS COOPERATIVE ASSOCIATION SCHOLARSHIPS for juniors and seniors who are male residents of Iowa and whose parents belong to an agricultural cooperative.

COOPERATIVE EDUCATION SCHOLARSHIPS for a freshman interested in cooperative management who are residents of Cedar, Clinton, Jackson, Louisa, Muscatine or Scott counties. During summers the students must work at one of the sponsoring cooperatives in the six county area.

DANFORTH AWARD FOR COLLEGE SENIORS. Made at the end of the junior year and includes a four week program at Camp Miniwanca and at the Ralston Purina facilities in St. Louis, Mo. No application necessary.

DANFORTH LEADERSHIP TRAINING SCHOLARSHIP for a freshman. This includes a program at Camp Miniwanca Leadership Training Camp. No application necessary.
J N "Ding" Darling Foundation Scholarships for fisheries and wildlife biology students who have an interest in the promotion and communications field.

Delicious Apple Tree Scholarship for a horticulture freshman. Sponsored by the Iowa Horticulture Society. No application necessary.

Electric Cooperative Pioneer Scholarship for a freshman in agricultural journalism.

F. S. Estel Scholarship for a junior or senior in dairy industry or dairy science. Sponsored by the National Dairy Cattle Congress in Waterloo.

Farmers National Farm Management Scholarship for an agricultural business, agricultural education, agronomy, animal science, dairy science or farm operation junior who has an interest in professional farm management.

Federal Land Bank of Omaha and Federal Land Bank Associations in Iowa Scholarships for male freshmen from an Iowa farm.

Federated Garden Clubs of Iowa, Inc. Scholarships for horticulture and landscape architecture undergraduates. No application necessary.

B J Firkins Memorial Scholarship for an agronomy sophomore. Sponsored by the friends of the late Prof. B J Firkins. No application necessary.

Goke Scholarships for Agriculture undergraduates. In honor of Mrs Portia Goke.

George Gund Animal Science Awards for animal science seniors. No application necessary.

E S Haber Scholarship for a horticulture or landscape architecture undergraduate majoring in nursery management or planning a career in the landscape nursery business. Sponsored by the Iowa Nurserymen's Association. No application necessary.

Henry Field Seed and Nursery Company Scholarship for a student majoring in the four and one-half year nursery management training program. No application necessary.

Industrial Education Scholarships for industrial education students. Sponsored by the industrial education alumni.

International Milling Company Scholarship for an animal, dairy and poultry science or agricultural business senior.

Iowa Cheese Manufacturers Association Scholarship for dairy industry freshmen.

Iowa Crop Improvement Association Scholarship for an agronomy junior or senior. No application necessary.

Iowa Hoo-Hoo Club Forestry Scholarship for a forestry sophomore. No application necessary.

Iowa Limestone Scholarship for an agronomy junior or senior. Sponsored by the Iowa Limestone Producers Association. No application necessary.

Iowa Master Farmer's Club Scholarships for agricultural journalism freshmen.

Iowa Pest Control Operators Association Scholarship for an entomology undergraduate. No application necessary.

Iverson Honorary Dairy Industry Scholarships for dairy industry undergraduates. Sponsored by alumni and friends in honor of Prof.: C. A. Iverson. No application necessary.

Izaak Walton League of America and Auxiliary Scholarships for fisheries and wildlife biology students. Sponsored by several Izaak Walton League chapters in Iowa. No application necessary.

Knights of Ak-Sar-Ben Scholarships for freshmen from Iowa counties which had exhibitors at the Ak-Sar-Ben livestock show the previous year.

Eli Lilly Advanced Curriculum Scholarships for sophomores who have earned a 3.0 cumulative average and plan to follow the advanced curriculum.
Midwest Agricultural Chemicals Association Marketing Scholarship for a junior or senior student whose home is in Iowa, Illinois, Kansas, Missouri, or Nebraska.

Moorman Manufacturing Company Scholarships for freshmen and sophomores.

National Plant Food Institute Scholarship for an agronomy sophomore who has been especially active in the Agronomy Club. No application necessary.

Nopco Chemical Company Scholarships for sophomores, juniors and seniors in animal or dairy science.

Charles Pfizer Extension Scholarship for a junior interested in extension work.

Poultry Industry Scholarships for poultry science freshmen. Sponsored by the members of the poultry industry of Iowa.

Production Credit Associations in Iowa Scholarships for male freshmen from Iowa farms.

Ralston Purina Company Senior Scholarship for agricultural business, animal, dairy or poultry science, agricultural journalism, agronomy, farm operation or agricultural education senior. No application necessary.

Rice Estate Advanced Curriculum Scholarships for juniors and seniors taking the advanced curriculum.

Rice Estate International Service Scholarships for juniors or seniors taking the Preparation for International Service in Agriculture program.

Louis Rich Foods, Inc. Scholarship for undergraduates who have a strong interest in the turkey industry.

Ralph Rothacker Scholarship for a landscape architecture junior or senior. Sponsored by friends in honor of the late Prof. R. R. Rothacker.

Sears-Roebuck Foundation Scholarships for freshmen who live on Iowa farms.

Sears-Roebuck Foundation Sophomore Scholarship for the sophomore who earned the highest grade average among the previous year's freshman recipients. No application necessary.

Smith-Douglass Company, Inc. Scholarship for a male freshman in agronomy.

Spokesman Press Scholarship for an undergraduate or graduate in agricultural journalism.

Paul P. Stewart Memorial Scholarship for a sophomore, junior or senior student in dairy science, sponsored by dairymen and friends of the late Paul P. Stewart.

Louis Ware IMC Pregraduate Scholarship for a senior planning graduate study. Sponsored by the International Minerals and Chemical Corporation.

J. R. Watkins Company 4-H Scholarship for an Iowa freshman with a strong 4-H background.

Chuck Worcester Intern Scholarship for a junior to work one summer as a farm editor and one school year as a campus correspondent.

Engineering Scholarships

Applications for all College of Engineering scholarships, awards and aid funds must be made in triplicate by February 1. Unless otherwise stated below, all scholarship applications should be addressed to the Scholarships and Awards Committee, College of Engineering, 104 Marston Hall. Application blanks are available in the various departmental offices. In this section only, a reference to an undergraduate refers to a sophomore, junior or senior.

Alcoa Engineering Achievement Scholarship for an Engineering senior.

Alcoa Engineering Scholarships for undergraduates in Engineering.

American Institute of Industrial Engineers Scholarship for an industrial engineering senior.
Archer-Daniels-Midland Company Scholarship for a chemical engineering senior.

Babcock and Wilcox Scholarships for undergraduates in Engineering and the Technical Institute.

Black and Veatch Scholarships for Engineering freshmen.

E. W. Bliss Scholarship for an Engineering freshman. Apply to E. W. Bliss Company, Canton, Ohio.

Boeing Scholarships for electrical, mechanical, aerospace, civil engineering and industrial administration juniors or seniors.

Amos E. Buetell Memorial Award for a senior in mechanical or electrical engineering.

Cedar Rapids Engineers' Club Scholarships for Engineering freshmen. Apply to Cedar Rapids Engineers' Club, Cedar Rapids.

Continental Oil Company Scholarship for a chemical engineering undergraduate.

Claud Coykendall Memorial Scholarship for a civil engineering senior.

Leo A. Daly Scholarship for an architecture or architectural engineering undergraduate.

Dr. J. B. Davidson Scholarship for an agricultural engineering undergraduate and/or graduate student.

Douglas Aircraft Company Scholarship for an aerospace, mechanical or electrical engineering senior.

Engineers' Club of Des Moines Scholarship for an Engineering freshman who is a graduate of a Des Moines high school. Apply to Engineers' Club of Des Moines.

Engineers' Club of Sioux City Scholarship for an Engineering freshman who is a graduate of a Sioux City high school. Apply to Engineers' Club of Sioux City.

Fisher Foundation Scholarships for chemical, electrical, mechanical or nuclear engineering undergraduates.

Almon H. Fuller Scholarship for a civil engineering senior.

Gibbs-Cook Scholarship for an Engineering junior or senior with interest in the construction industry.

Goodyear Scholarship for a chemical engineering junior or senior.

Frank W. Griffith Educational Award for an architecture student.

Henning H. Henningson Memorial Scholarship for an Engineering freshman from a rural community.

Iowa Limestone Producers Association Award for a civil engineering senior.

Karl Keffer Scholarship for an architecture undergraduate.

Koppers Company, Inc. Award for outstanding architecture design.

Link-Belt Speeder Corporation Scholarship for a mechanical engineering undergraduate.

Fred F Loy Memorial Award for a civil engineering junior or senior.

Master Builders of Iowa Scholarship for an architectural engineering or civil engineering junior or senior.

The Maytag Scholarship in Engineering for a mechanical or industrial engineering senior.

Keith B Mfrrell "Christmas" Scholarship for a civil engineering junior or senior.

Minnesota Mining and Manufacturing Company Scholarships for Engineering undergraduates.

Missouri Valley Machinery Company Scholarships for Engineering undergraduates.
Missouri Valley Steel Company Scholarship for a civil, mechanical or architectural engineering freshman.

Nebraska Lath & Plaster Scholarships for architecture seniors.

Carl F. Nelson Scholarship for an undergraduate in Engineering.

Herman W. Nelson Memorial Scholarship for a mechanical, electrical or industrial engineering senior.

Northwest Chapter, Iowa Engineering Society Scholarship for an Engineering freshman. Apply to Scholarship Committee, Northwest Chapter Iowa Engineering Society.

Paxton-Vierling Steel Company Scholarship for a civil, mechanical or architectural engineering freshman.

Pennsylvania Glass Sand Corporation Scholarship for a ceramic engineering senior. No application necessary.

Rath Packing Company Scholarship for a mechanical engineering undergraduate.

Square D Scholarships for electrical, mechanical or industrial engineering juniors and seniors.

Standard Oil of California Scholarships for a chemical engineering and a mechanical engineering undergraduate.

Trane Company Scholarships for mechanical or industrial engineering seniors.

Union Carbide Engineering Scholarship for a mechanical or chemical engineering freshman.

Universal Oil Products Company Scholarships for a chemical engineering senior and two juniors.

Western Electric Fund Scholarship for an Engineering undergraduate.

Home Economics Scholarships

Unless otherwise stated below, send applications to the Home Economics Scholarships and Awards Committee, 122 MacKay Hall.

Grace M. Augustine Scholarship for a graduate student in institution management. Inquire at Institution Management Department, 11E MacKay Hall.

Bishop-Stoddard Cafeteria Scholarship for Men for a student majoring in institution management. Inquire at Institution Management Department, 11E MacKay Hall.

Borden Home Economics Scholarship for a Home Economics senior with the highest grade point average among eligible senior students (two or more courses in food and nutrition). No application.

Helen Alice Burling Scholarship for a sophomore, junior or senior student in Home Economics.

Lillian Storms Coover Memorial Scholarship for a graduate student in nutrition or dietetics. Inquire at Food and Nutrition Department, 107 MacKay Hall.

County Extension Home Economists Association Scholarship for an Iowa resident who is a freshman with a 4-H record. Apply to your County Extension home economist or to Home Economics Extension Service, 108 Curtiss Hall.

Frances H. Crawford Scholarship for a person who intends to work in school food service or is now engaged in school food service work and wishes to prepare further for responsibilities of school food service administration. Inquire at Institution Management Department, 11E MacKay Hall.

Danforth Award for Home Economics College Seniors for a junior student.
DANFORTH LEADERSHIP TRAINING SCHOLARSHIP for a Home Economics freshman. No application necessary

DELTA PHI DELTA SCHOLARSHIP for a junior in applied art. Inquire at Applied Art Department, 216A MacKay Hall.

JULIE DIEKMANN APPLIED ART SENIOR AWARD for a senior woman in applied art. No application necessary

FRESHMAN HOME ECONOMICS CLUB SCHOLARSHIP for a freshman.

VERA FOREMAN FRILEY SCHOLARSHIP for a Home Economics senior.

GERBER LILLIAN STORMS COOVER SCHOLARSHIP for a sophomore, junior or senior student in food and nutrition.

IOWA HOME ECONOMICS ASSOCIATION SCHOLARSHIP for a freshman with 4-H or FHA record and a graduate of an accredited Iowa high school. Apply to Scholarship Committee, Iowa Home Economics Association.

CATHERINE MACKAY SCHOLARSHIP for a Home Economics freshman.

MARTHA MOFFITT SCHOLARSHIP for an undergraduate student in food and nutrition. Inquire at Food and Nutrition Department, 107 MacKay Hall.

P. MABEL NELSON SCHOLARSHIP for a sophomore, junior or senior student in food and nutrition who is interested in pursuing graduate study in food science or nutrition.

ESTHER COMPTON OGLAND MEMORIAL SCHOLARSHIP for an Iowa resident who is a senior in home economics education.

OMICRON Nu AWARD for a Home Economics senior who is a member of Omicron Nu. Apply to Omicron Nu, 122 MacKay Hall.

FLORENCE PEN SCHOLARSHIP for an undergraduate student in food and nutrition. Inquire at Food and Nutrition Department, 107 MacKay Hall.

CHARLES PFIZER EXTENSION SCHOLARSHIP for a junior interested in extension work with 4-H record and one or more extension courses. Apply to State 4-H Club Office, 303 Curtiss Hall.

PHI UPSILONOMICRON SCHOLARSHIP for a sophomore or junior student in Home Economics.

SEARS-ROEBUCK FOUNDATION SCHOLARSHIPS for freshmen Home Economics students with 4-H or FHA records.

SEARS-ROEBUCK 4-H POULTRY SCHOLARSHIP for a freshman in Home Economics who has taken part in a 4-H laying flock project.

JULIA McCOLLough SMITH AWARD for a Home Economics senior with highest average grade point during at least seven consecutive quarters preceding the senior year. No application necessary.

STOUFFER RESTAURANT CORPORATION SCHOLARSHIP for a sophomore, junior or senior student in Home Economics.

TALL CORN CHAPTER OF CLUB MANAGERS ASSOCIATION OF AMERICA SCHOLARSHIP for an Iowa resident who is a sophomore, junior or senior in institution management. Inquire at Institution Management Department, 11E MacKay Hall.

VEISHEA CHERRY PIE SCHOLARSHIP for an undergraduate or graduate student in institution management. Established by Institution Management Club and Institution Management Department. Inquire at Institution Management Department, 11E MacKay Hall.

FLORENCE WALLS SCHOLARSHIPS for sophomores and juniors.

J R WATKINS 4-H SCHOLARSHIP for a Home Economics freshman with a record of major accomplishments in 4-H Club work.

WOMEN'S ATHLETIC ASSOCIATION SCHOLARSHIP for a senior majoring in physical education for women. Inquire at Department of Physical Education for Women, 201 Women's Gym.
Sciences and Humanities Scholarships

Unless otherwise indicated, apply to the Scholarships Committee, 9 Beardshear Hall. If no application is necessary, this is so stated.

Gertrude Herr Adamson Scholarship in Mathematics for an undergraduate student who has displayed ingenuity in mathematics. No application necessary.

Archer-Daniels-Midland Company Scholarship for a senior in chemistry. Apply to Chemistry Department.

Chemistry Department Awards for freshmen, sophomores, juniors and seniors in chemistry who display outstanding scholarship. No application necessary.

Collins Radio Company Award in Physics for the senior who demonstrates highest competence in physics. No application necessary.

Dow Chemical Company Scholarship for a freshman in chemistry. Apply to Chemistry Department at end of first semester of high school senior year.

Earl May Seed Company Scholarship for a junior in botany. No application necessary.

George Freeman Memorial Scholarship for a junior, senior or graduate student in general or rural sociology.

Dio Lewis Holl Award to an outstanding senior who completes his work in the current academic year in the curriculum in mathematics. No application necessary.

Iowa Science Talent Search Scholarship for a high school senior who is a participant in the National Talent Search of Science Clubs of America. Apply to J. D. Woods, Drake University, Des Moines.

Thomas H. McBride Scholarships in Natural Sciences to undergraduates for expenses at Iowa Lakeside Laboratory. Apply to Director, Iowa Lakeside Laboratory, Zoology Department, University of Iowa, Iowa City.

Minnesota Mining and Manufacturing Prize in Physics for a sophomore who shows outstanding promise for a career in physics. No application necessary.

Pi Mu Epsilon Award to a junior who has completed sophomore calculus and holds the highest scholastic average in freshman and sophomore mathematics and in general scholarship. No application necessary.

Purchasing Agents Scholarship for a junior or senior in the general area of purchasing. No application necessary.

RCA.-N.B.C. Television Scholarship for a telecommunicative arts major. Apply to Professor in Charge, Telecommunicative Arts, 21 Exhibit Hall.

Reader’s Digest Scholarships to help cover the cost of projects undertaken by undergraduates or graduates in journalism. Apply to Technical Journalism Department.

Standard Oil Company of California Scholarship for an undergraduate major in mathematics. No application necessary.

Clark Marcus Varnum Prize in Physics for a freshman who shows promise in physics. No application necessary.

Veterinary Medicine Scholarships

All veterinary medicine award and scholarship recipients are selected. Therefore, no applications are necessary.

Borden Veterinary Medicine Scholarship for a senior with the highest grade point average of students preceding senior year.

G. G. Graham Scholarship for a graduating senior in clinical medicine.

Iowa State University Veterinary Medical Alumni Association Scholarships for sophomores and juniors.

Riser Small Animal Award for a senior in small animal medicine and surgery.

Charles Steele Memorial Award for a veterinary medicine sophomore.

Burton C. Thomson Scholarship for a freshman.
Student Regulations,
BACHELOR'S DEGREE REQUIREMENTS

CLASS ATTENDANCE

Students are expected to attend class periods as scheduled. Excuse from any class period is a matter between the student and his instructor.

SATISFACTORY ACADEMIC PROGRESS

Minimum satisfactory scholastic achievement is represented by a 2.00 quality-point average each quarter of enrollment. Although failure to achieve this average is not cause for immediate dismissal, a student whose work is not satisfactory over a period of time is placed on temporary enrollment or may be dismissed in accordance with the regulations prescribed by the University Academic Standards Committee and the academic standards committee of the college in which he is enrolled.

GRADING SYSTEM

The University grades are reported as:
A superior
B very good
C satisfactory
D passing but unsatisfactory
F failure
I incomplete
X dropped

For graduate students the lowest passing mark is C.
The mark P may be used for undergraduate “required” courses and may also be given to graduate students to indicate satisfactory progress in research, special topics or “required” courses.

For each credit earned, quality points are given according to the mark attained:

- A 4 points
- B 3 points
- C 2 points
- D 1 point
- F 0 points

Grade reports are prepared each quarter and are supplied to students upon their request. Grade reports are not routinely sent to parents but are made available upon their request.

ADVANCED PLACEMENT

Iowa State is not at present a part of Advanced Placement Program sponsored by the Educational Testing Service. However, it is possible for a student to advance as far as his background will permit. A student may take an examination for credit in any course taught in the University provided he can show to the satisfaction of the department head concerned, and of his dean, that he has made the necessary preparation. This may have been through high school courses or independent study. If the student meets the standard of the department in the course in which he is being examined, the credit will become a part of his University record. A grade of P is recorded and does not become a part of the student's cumulative average.

WITHDRAWAL

A student who withdraws from the University during any quarter for which he is enrolled should report to his dean. Those who withdraw receive refunds according to University policy outlined under Fees and Expenses.

TRANSCRIPT OF RECORD

One transcript of a student's academic record is provided without charge, upon request, to each student. Each additional single copy beyond the first is $1. In multiple orders, following the first copy for which no charge is made, the first additional copy charge is $1, and additional copies are 25 cents each.

GRADUATION REQUIREMENTS FOR A BACHELOR'S DEGREE

An average of at least 2 quality points per credit in all courses taken is required for graduation.

In unusual circumstances, the academic standards committees of the respective colleges may review and give further consideration to the records of students who, except for grade point average, have satisfactorily completed all graduation requirements. If the appropriate college academic standards committee considers that the educational and professional needs of such a student have been satisfactorily met, or can be satisfactorily met by imposing further conditions, then the committee may recommend to the dean of the college that the student be graduated or that a supplemental program be accepted in place of the fully unqualified grade point average. The college academic standards committee chairman reports such exceptional actions to the University Academic Standards Committee.

High scholarship is recognized at graduation. Students who have a cumulative quality-point-average of 3.50 or above are eligible to graduate with distinction. The quality-point-average upon which graduation with distinction is determined includes all work undertaken at Iowa State prior to the opening of the quarter in which the student receives his degree.

The last 45 quarter credits needed to complete the requirements for a bachelor's degree must be taken in residence. However, 9 of this last 45 quarter credits may be taken out of residence if in elective courses.

A student may receive two bachelor's degrees if he has completed at least 243 college credits and if heads of both curricula recommend him for each degree.
ENGLISH REQUIREMENT

The University grants degrees only to those persons who have demonstrated, through an examination, that they can express themselves clearly and correctly in the English language. All seniors pass this examination before graduation. The examination consists of a 500-word written exposition which is judged on spelling, punctuation, grammar, clarity of expression and the organization and development of the subject.

All students take instruction in English composition throughout the freshman year, and nearly all take one course in speech later. They may continue to receive help and advice in English through the Writing Clinic and the Speech Clinic, both of which are supervised by members of the Department of English and Speech.

LIBRARY REQUIREMENT

Independent study and investigation through the use of books and libraries enable students to grow intellectually and professionally in college and afterward. For this reason, all students receive instruction in the use of the University Library, including practice in how to locate the published literature of their respective fields of study.

STUDENT CONDUCT

It is expected that all Iowa State students are on campus for serious educational pursuits and that they will conduct themselves so as to preserve an appropriate atmosphere of learning. It is also expected that all students who enroll at Iowa State are willing to assume the responsibilities of citizenship in the campus community. Association in such a community is purely voluntary, and any student may withdraw from it at any time that he considers the obligations of membership disproportionate to the benefits. While enrolled, students are subject to University authority which includes the prerogative of dismissing those whose conduct is unsuited to the aims of an institution of higher learning.

The President has delegated to the Committee on Student Conduct the authority to establish policy and to deal directly with discipline cases.

AUTOMOBILES

Students are permitted to own and operate automobiles. However, an automobile is in no way necessary for an Iowa State student, and the University believes students under 21 years of age will find it to their best interests not to operate an automobile in Ames. Those who drive must abide by the rather extensive regulations necessary because of vehicle congestion on campus. Fines are levied for infractions of the regulations.
The University maintains residence halls for approximately 2,000 single women and 3,300 single men. University apartments are available for approximately 1,000 married students. Chapter houses are maintained near the campus by 33 fraternities and 12 sororities and house about 2,100 students. Other members of the student body live in private rooms or apartments in Ames or nearby communities. A sizable group commutes from Des Moines and from other cities and towns in central Iowa.

Inquiry concerning rooms in University facilities should be addressed to the Director of Residence, Friley Hall. Applications are accepted beginning Sept. 1 for the following fall quarter.

A deposit of $25 is required at the time a reservation is completed for a room in a residence hall or an apartment operated by the University. The deposit is returned
Linden Hall, one of the newest women's residences, faces on dormitory court.

The Men's Residence Association includes Friley Hall, left, Helser Hall, below, and the Tower complex south of the campus.
when the student releases the room or apartment at the end of a quarter or if he withdraws from the University because of circumstances beyond his control, provided he notifies the University in terms of his contract and provided he has no outstanding bills to the University.

The Residence Halls

Residence halls at Iowa State have complete facilities for comfortable living. All have spacious lounges. Most have recreation rooms. A house mother resides in each residence hall.

Friley Hall contains a snack bar, radio station, exercise room and hobby rooms. In its two large dining rooms the residents of Friley, Helser and Westgate Halls are served cafeteria style.

The Towers Hall also provides food service for 1,200 men cafeteria style.

Birch, Linden, Oak and Welch Halls have dining rooms which serve all of the women’s residence halls. Meals are served cafeteria style.

Most rooms in residence halls are planned for double occupancy.

Charges for residence halls (except the Graduate Hall) include both room and board. All charges are subject to change without notice, but the rate for the academic year established Sept. 1, 1965, is $735. Room rates in the Graduate Hall for the academic year are $315 for double occupancy and $420 for single occupancy. Rooms are rented on the basis of the entire academic year. Students should not request rooms
in the residence halls if they do not plan to occupy them for a full academic year. Most fraternities ask pledges to live at the chapter house during a portion of the year. Therefore, students who plan to pledge fraternities should not seek rooms in the residence halls.

All undergraduate women (except those 21 or over) are required to live in residence halls or sororities unless special exception is made by the Director of Residence.

Rooms in residence halls are furnished with single beds and mattresses, chests of drawers, study tables and straight chairs. Students furnish their own bedding, including mattress pad, pillow and bed linen, as well as towels and throw rugs.

Married Student Housing

The University accommodations for married students are in recently built University apartments and in World War II barracks-type apartments. Most apartments have two bedrooms. Rentals for students on Sept. 1, 1965, ranged from $32 to $80 per month. Change in this rate may be made at any time.

Approximately one-half of the married students at Iowa State live in University apartments. The remainder find accommodations in rented houses or apartments and trailer courts in the city of Ames and nearby communities.

Off-Campus Housing for Single Students

Single men may obtain housing in private quarters off campus. Arrangements are made directly with the owners, and accommodations vary in price and desirability. The contract is usually for one quarter.

It is best if the new student comes to Ames well in advance of the quarter in which he enrolls, and personally makes arrangements for an off-campus room.

Off-campus room rates Sept 1, 1965, generally were $8 per week for each occupant where a room accommodates two and $10 per week where the room is occupied by one student. Students usually furnish their own linens.

Meals may be obtained in restaurants near the campus or in the Memorial Union on an individual meal basis for about $20 per week.

A list of approved rooms for students may be obtained from the Director of Residence. The Department of Residence has prepared a standard set of requirements for householders furnishing rooms to students and reserves the right to restrict student housing to those rooms which meet University requirements.

Hawthorn Court is a complex of two-bedroom apartments for married students.
Buchanan Hall houses graduate men and women.

The Towers Hall is the newest men's residence located south of the campus.

University Village provides two-bedroom apartments for staff and married students.
Student Services

THE UNIVERSITY LIBRARY  Robert W. Orr, M.S., Director

The University Library contains approximately 565,000 carefully selected volumes, chiefly in the basic and applied fields of the physical and biological sciences.

A very complete selection of periodicals is available in such fields as botany, chemistry, entomology, mathematics, physiology, physics, and veterinary medicine. Other subject fields are also well represented by periodical collections. The Library currently receives more than 9,500 periodicals and other serial publications in many languages.

All books and periodicals are shelved on open stacks in the main Library Building.

Graduate students and upperclassmen majoring in chemistry and physics have access to the Physical Sciences Reading Room located on the second floor of the building between the Physics and Chemistry buildings. An Engineering Reading Room containing certain specialized engineering books and periodicals is located in Marston Hall.

Both formal and informal instruction in the use of books and libraries are offered to undergraduate and graduate students. Special services such as the procurement of interlibrary loans and the supplying of microfilm and Xerox copies are also available.

A second addition to the library is presently being planned in order to accommodate the increasing number of students.

THE OFFICE OF THE DEAN OF STUDENTS

Millard R. Kratochvil, A.M., Dean of Students
Ronald E. Barnes, Ed.D., Associate Dean of Students
Paul R. McQuilkin, M.B.A., Assistant Dean of Students
Vida S. Benson, B.S., Social Director
Eugene L. Clubine, B.S., Foreign Student Adviser

Functioning in the broad area of student life not specifically related to academic courses of study, the Office of the Dean of Students concerns itself with the self-development and individual welfare of each Iowa State student. It serves as a general counseling agency and clearing house of information for all students and student groups. Sometimes it works with individuals and at other times with student organizations and activities. Specifically, staff members in this office work with student leaders, fraternities, sororities and members of the Ward System; counsel foreign students; supervise social and activity programs; handle disciplinary matters; and coordinate the religious activities of campus groups and the various churches in Ames.

STUDENT COUNSELING SERVICE  Martin F. Fritz, Ph.D., Director

Functioning as a part of the Office of the Dean of Students, the Student Counseling Service provides, without charge, testing and consulting service for regularly enrolled students. This includes educational, vocational and personal counseling. Students may come on their own initiative or they may be referred by academic advisers or other staff.
members. Emotional and personal problems are given consideration in cooperation with the Student Health Service. A limited amount of pre-college testing and counseling is also available to high school students, seniors or graduates at a nominal cost to the individual.

**STUDENT EMPLOYMENT SERVICE**

To assist students in securing part-time employment, the University maintains a student employment service as part of the Personnel Office, 1 Beardshear Hall. Most part-time employment of students on campus is found in the residence halls dining service, the University Library, Memorial Union, campus offices and laboratories. Inquiries concerning employment in the residence halls dining service should be directed to 1212 Friley Hall. Students interested in employment with the Memorial Union should contact the Union directly. Odd jobs at yard work and housework may be found, as well as jobs with businesses in town.

The University cannot guarantee employment, but a considerable number of students each year find jobs through the Employment Service.

New students are advised against employment their first quarter at Iowa State. After initial adjustment to University routine, they can better determine how many hours they can spare for outside work.

Those students who plan to earn a large portion of their expenses are advised to carry a reduced schedule of academic work.

**STUDENT HEALTH SERVICE**

The University maintains a well-equipped hospital and dispensary for the care of students. Routine medical advice and treatment are given through the dispensary without charge. Medicines and services such as X-ray, are provided at cost. Hospital service is at a nominal rate except that full fees for special nurses or consulting physicians are paid by the student. Special diets for such conditions as diabetes and ulcers are served at a diet table at the hospital.

The University physicians are authorized to exclude from the residence halls and classrooms any persons afflicted with a contagious disease and, if necessary, those coming in contact with such disease.

**STUDENT HOSPITALIZATION INSURANCE**

Student hospitalization, accident and sickness insurance is available on a voluntary basis and at a favorable rate to all students who are enrolled at the University for a minimum of 9 credits per quarter.

**PLACEMENT OFFICES**

The University maintains offices in five different areas where employers and prospective employees are brought together. These areas are: Agriculture, Engineering and Sciences, Home Economics, Teaching, and Veterinary Medicine.

Each of these offices assists students who are about to graduate and who seek information about career openings in their field. The offices also work with alumni who are changing positions. In some instances, undergraduates are assisted in finding summer employment.
Student Life

RELIGIOUS LIFE

Iowa State is a state-supported, nonsectarian institution, but it recognizes the importance of spiritual life and cooperates with the many off-campus groups which fulfill the religious needs of the community.

As part of the Religion in Life emphasis, a series of lectures is presented throughout the school year on topics which are aimed at challenging students to a deeper exploration of their religious beliefs. These lectures are given by nationally recognized speakers and are presented as all-university convocations. In addition, these speakers are available for informal residence discussions and personal consultation. These and other religious activities are planned and coordinated by the Student Religious Council.

Most of the larger denominations have churches within easy walking distance of the campus. A number of these have built attractive student centers in connection with the churches and conduct extensive student programs under direction of professionally trained persons.

Church-going is a continuing tradition at Iowa State, and student religious groups are among the strongest of campus organizations.

The Young Men's Christian Association and the Young Women's Christian Association have active campus projects. The two "Y's" share Alumni Hall, a large building near the center of campus.

LECTURES

The University Lecture Series brings to the campus during the academic year a number of speakers eminent in national and international affairs, the sciences and the arts. In addition to their formal lectures, a number of these speakers meet with students informally for discussions. Through these lectures and discussions the students are given a well-rounded presentation on subjects and areas affecting their culture, educational and economic philosophy and scientific development. The University Lecture Series, from time to time, also sponsors or co-sponsors dramatic, dance and musical events.

FOCUS

During the first few weeks of March each year the University features a fine arts festival called Focus. This program brings to the campus arts and crafts exhibits, musical, dance and dramatic events and lecturers prominent in their respective areas of the arts, as well as in the areas of national and international affairs.

DEBATE

The Iowa State Debaters participate in many kinds of speech experience. In addition to intercollegiate debate, they sponsor extemporaneous speaking, radio and television discussions and public speeches before business and professional organizations. Each year the Debaters attend approximately 15 intercollegiate debate and speech tournaments. They also conduct a yearly speech tournament for high schools of the Midwest. The university is a member of the Missouri Valley Forensic League, and has a chapter of Delta Sigma Rho-Tau Kappa Alpha, national forensics honorary society.

MUSIC ACTIVITIES

An opportunity to enjoy music, as both a listener and a performer, is provided all Iowa State students. The Department of Music offers private lessons in both vocal and instrumental music as well as courses in music appreciation and history, harmony,
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conducting and music education. Large student performing organizations include four choruses, five bands, and a symphony orchestra. Smaller student ensembles include a chamber orchestra, a stage band, and chamber singers. Campus concerts, student operas, musical shows, concert tours to Iowa cities and a Christmas Festival of Music are among the musical events offered yearly.

Two concert series bring professional performers of high caliber to the campus and the city of Ames. Choral groups, orchestras, opera, ballet and solo artists are presented. In addition, a series of concerts and recitals is given each year by members of the music faculty. These include programs by artist members of the Amati Trio, a piano trio in residence at the University.

Radio and television shows periodically feature student and faculty performers. Sigma Alpha Iota and Phi Mu Alpha, professional music fraternities for women and men, are represented on campus.

DRAMATICS

Iowa State Theatre includes the Iowa State Players who present well-known plays and the Laboratory Theatre which seeks unusual and lesser-known plays for specific laboratory purposes. From six to eight plays per year are presented.

In co-sponsorship with the Visual Instruction Service, the Theatre presents a series of 15 films which include unusual American films that are part of the history of films and the unusual and best of the foreign films.

Another Theatre-sponsored program is Theatre 324 in which students direct the plays. Professional productions are brought to campus by the Theatre in cooperation with the Lecture Committee.

ATHLETICS

Iowa State is a member of the Big Eight Conference which includes the University of Nebraska, University of Colorado, University of Kansas, Kansas State University, University of Oklahoma, Oklahoma State University and the University of Missouri.
The Kingston Trio entertained at a concert during the spring University open house, Veihea.

Iowa State Players and the Laboratory Theatre sponsor two plays during each academic quarter.
Beyer Hall has been the scene of the NCAA swimming championships. These recreational facilities are continually in use for intramural sports and free play.
Teams are fielded by Iowa State in football, basketball, baseball, wrestling, swimming, track, cross country, golf, tennis and gymnastics.

One of the most extensive intramural programs in the nation allows undergraduates to compete among themselves as representatives of residence groups. Men compete in touch football, basketball, softball, volleyball, bowling, swimming, track, table tennis, wrestling, pocket billiards, golf and tennis. Women compete in volleyball, basketball, softball, badminton, tennis, table tennis, golf, bowling and swimming. Students may play the 18-hole Veenker Memorial Golf Course, which is part of the campus recreation area, at a nominal greens fee. Twenty-nine tennis courts are available.

SPECIAL RECOGNITIONS

The "Deans' List," issued at the close of each quarter, recognizes undergraduate students who have been enrolled for 15 or more hours during the quarter and have earned a quality-point average of 3.5 or higher.

Undergraduate students who have an average of 3.5 or above for all work taken in the University are graduated "with distinction."

Many special awards, established by professional groups, alumni and others interested in the University, are presented annually in recognition of academic attainment and noteworthy achievements in others areas of campus life. Information about awards offered in the various colleges is available through the offices of the respective deans.

HONOR AND PROFESSIONAL ORGANIZATIONS

Ten honor societies, which elect membership primarily on attainment in scholarship or research, are recognized by the University:

- Alpha Kappa Delta
- Alpha Lambda Delta
- Alpha Zeta
- Gamma Sigma Delta
- Omicron Nu
- Phi Eta Sigma
- Phi Kappa Phi
- Phi Zeta
- Sigma Xi
- Tau Beta Pi

Sociology
Freshmen (women)
Agriculture and Veterinary Medicine (men)
Agriculture and Veterinary Medicine
Home Economics (women)
Freshmen (men)
All-university
Veterinary Medicine (men)
Scientific research
Engineering (men)

Professional societies that choose their membership from students having special departmental affiliations and meeting scholastic and character requirements are officially recognized in most curricula of the University. There are also departmental clubs and organizations that meet special interests.

In addition, activities honoraries focus their requirements on the basis of interest, participation or special attainment in all-university activities. Cardinal Key and Mortar Board are the highest activity honoraries for men and women respectively. Both select members on leadership, service to Iowa State, scholarship, and character.

Seven other activities honoraries recognize students in various special areas.

PUBLICATIONS

Student publications cover all facets of student life. They include:

The Bomb                     student yearbook
The Iowa State Daily         campus newspaper
The Ames Forester            for forestry students and alumni
The Iowa Agriculturist       published by students of the
                              College of Agriculture
FRATERNITIES AND SORORITIES

All social fraternities and sororities are under supervision of the Dean of Students. His staff works through Interfraternity Council and Panhellenic Council to provide opportunities for self development of students in these residence groups.

The 34 social fraternities with chapters at Iowa State provide living accommodations for approximately 1,800 men. The cost of living in a fraternity house varies from $80 to $100 per month, with an average cost of $91. This amount includes board, room, social dues and other chapter expenses. Initiation fees range from $32 to $84 per member with an average cost of $60. The higher fees generally include the cost of the fraternity pin. First-year men students may live in a fraternity house.

The 12 national social sororities provide living accommodations for approximately 600 women. The monthly house bill for each member of these chapters ranges from $82 to $101.50, with an average cost of approximately $90. This amount includes room, board, social and national dues, other chapter expenses, and in some cases the building fund payment. Initiation fees vary from $40 to $137. The higher figure may include the cost of the active's pin or "badge," building fund payment and lifetime membership.

Freshman sorority pledges, enrolling fall quarter, are required to live in residence halls for one year and may move to their chapter houses at the beginning of their sophomore year. Upperclass women, who pledge during Formal Fall Rush or during the school year, may move into their chapter houses only by complying with the provisions of their residence hall contracts.

To be eligible for pledging either a fraternity or a sorority and for participating in sorority rush, a freshman entering Iowa State University without previous college credit must either rank in the upper one-half of his high school class on graduation or rank in the upper one-half of his high school class when admitted to Iowa State University.

MEN'S RESIDENCE ASSOCIATION

Students living in men's residence halls are members of the Men's Residence Association. The association includes 54 "houses" which are set up as units within the men's residence halls. Each unit of 40 to 80 men elects its own officers, has its own program of social activities and competes in intramural athletics. The Men's Residence Association includes all such groups and has its own officers, a social program, and a radio station which serves all the residence halls.

WOMEN'S RESIDENCE ASSOCIATION

Women living in residence halls are members of the Women's Residence Association. Since women's residence halls are smaller than those of the men, the women organize their groups according to halls for social activity, intramural sports and similar activities.
Sorority sisters greet each member returning to the house at the start of the school year.

Radio Station KISU is owned and operated by the Men's Residence Association serving the students in the men's and women's residence halls.
THE WARD SYSTEM

The Ward System is an organization of men and women living outside residence halls, fraternities and sororities. A local branch of the National Independent Student Association, its purpose is to serve the interests of all students living off campus and to offer them an opportunity to participate in social activities, intramural sports and various campus activities. Its representatives serve on the Government of the Student Body. Both within the campus organization and through the National Independent Student Organization, Ward System provides the opportunity for its members to develop their own leadership capabilities.

The residential area of Ames is divided into four districts, or wards, for men, and one ward which serves all off-campus women. Each ward elects its own officers and works with the Executive Council, which serves as a central guidance body.

Membership in the Ward System is $4 for the academic year.

MEMORIAL UNION

The Memorial Union is the center of much informal education on campus. It is a meeting place and headquarters for most of the larger student organizations. Dances, banquets, lectures, concerts, shows, exhibits and other large campus gatherings are accommodated in its meeting halls and ballrooms. Recreational facilities include bowling alleys, table tennis, billiards, television and a music listening room, as well as quiet lounges and a browsing library. A small chapel occupies one corner of the building. A cafeteria, a restaurant and a snack bar cater to guests of the University as well as students and faculty. Overnight guest rooms are occupied by campus visitors.

Launched by alumni as a memorial to the service of sons and daughters of the University in World War I, Memorial Union has now become a memorial to all Iowa State men and women who have served in the armed forces of our country.

Acquisition cost of the building was nearly $3½ million. The Memorial Union is owned and operated by students and alumni of Iowa State and is financed from dues and from fees received from services.
The Alumni Association of Iowa State University was organized in 1878 to promote the highest interests of the institution and to increase friendship and understanding among students and alumni. It now serves nearly 50,000 living alumni of record. The office of the Association is off the main lobby of Memorial Union. Active local clubs of the general association are found in most of the principal cities of the United States and in various counties of Iowa. The Alumnus, official periodical of the Association, appears bimonthly under supervision of the Director of Alumni Affairs.

ALUMNI ACHIEVEMENT FUND

The Alumni Achievement Fund is an annual giving program sponsored by the Alumni Association for alumni, former students and friends of the University and many industries interested in Iowa State. Its purpose is to provide alumni and friends with an opportunity to assist in extending the usefulness and prestige of the University and to help the University meet needs which would not be satisfied ordinarily through regular appropriations. The Fund is administered by a board of eight trustees who appoint the personnel necessary to conduct its business. Offices for the Alumni Achievement Fund are in Room 242, Memorial Union.

THE IOWA STATE UNIVERSITY FOUNDATION

The Iowa State University Foundation was formed in 1958 to assist the University in projects which are vital to its growth and development, but which cannot or should not be financed from legislative appropriations. The Foundation is able to accept large gifts and grants from individuals or organizations and to assure continuity of management of such funds. Its board of 59 governors, mostly alumni, represents all areas of the nation.

The Iowa State Center is the future setting for many cultural and educational activities.
Students graduating from the College of Agriculture are provided with a broad education including the physical, biological and social sciences, and humanities. Only enough specialization is provided to help the graduate become established in his chosen profession. Greater specialization is provided at the graduate college level.

Graduates generally enter one of three broad areas (1) research and education (2) agricultural production or (3) business and industry. Several curricula provide options so that the specialization developed in the curriculum is designed for entry in one of these three areas.

Agriculture includes a broad range of career opportunities and hundreds of different kinds of jobs. The following list provides some notion of the wide range of opportunities:

Farming and related enterprises such as nursery production, raising fruits and vegetables, managing greenhouse crops, and growing timber or woodlands.

Research in agriculture, either in government agencies, universities, industry or private research organizations.

Education, including high school and college teaching, the Cooperative Extension Service, farm organizations, foundations, industry and government agencies.

Industry, such as food processing, forest products, feed and fertilizer, farm machinery, fat and oils, pesticides and herbicides.

Business associated with agriculture—farm management, credit, insurance, marketing food products, and providing necessary supplies or service to farmers.

Special services, including landscape planning, turfgrass management, establishment of parks and playgrounds.

Communications as represented by agricultural magazines and journals, farm radio and television programs, motion pictures, exhibits, advertising and public relations.

Forestry, soil and water conservation, fish and wildlife management, and recreation programs which often require agricultural knowledge.

In addition to studies required for professional competence, the College of Agriculture provides in each of its curricula the opportunity to pursue studies which add to personal growth, help the individual to understand the environment in which he lives and aid him in communicating clearly. Requirements in any four-year curriculum are at least as extensive as those shown below.

Each student in the College of Agriculture works closely with an academic adviser who is associated with the curriculum in which the student is majoring. The adviser helps the student prepare his schedule of courses each quarter, assists in making personal adjustment to university life and counsels on vocational choices. A special effort is made in the College of Agriculture to adjust the student’s schedule of course work in accordance with his capabilities.
Subject Group

I. English and Speech

Credits Required

12

II. Mathematics or Mathematics and Statistics

8

III. Physical Sciences

(Biochemistry, Biophysics, Chemistry, Earth Science excluding courses in Geography, and Physics). Up to 5 credits in Mathematics above Mathematics 101 may be substituted for Physical Sciences.

16

IV. Biological Sciences (Bacteriology, Biochemistry, Biophysics, Botany, Genetics, Zoology)

10

V. Social Sciences and Humanities

(Economics, Government, Psychology, Sociology)

12

(Art, History, Literature, Music, Philosophy)

6

Most undergraduate study in the College of Agriculture covers a period of four years and leads to the Degree of Bachelor of Science, but several curricula also have a two-year program which leads to a Certificate in Technical Agriculture. Shorter programs are also available. Graduate study in agriculture is conducted through the Graduate College. Details are found in the Graduate College section of this catalog.
## AGRICULTURE CURRICULA

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<tr>
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<tr>
<td>Production and Technology</td>
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<tr>
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<tr>
<td>Pre-Veterinary Medicine</td>
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<td>Dairy Industry</td>
<td>Dairy and Food Industry</td>
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<td>Business</td>
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<tr>
<td>Zoology and Entomology</td>
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<td>B.S., 2 yr. Certificate in Technical Agriculture</td>
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<td>Fisheries and Wildlife Biology</td>
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<td>Urban Planning</td>
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<td>Plant Pathology</td>
<td>Botany and Plant Pathology</td>
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<td>Poultry Science</td>
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<td>Production</td>
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<td>B.S.</td>
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</table>
Curriculum in Agricultural Business

With options in Agricultural Economics, Farm Management, Marketing Management, Public Service and Administration.

Administered by the Department of Economics and Sociology.

Leading to the degree Bachelor of Science. Total credits required, 200 plus six quarters of physical education.

A student preparing for the study of law may complete three years of specified study under the agricultural business curriculum followed by one year in a recognized law college, after which the degree Bachelor of Science in Agriculture will be awarded by Iowa State University.

See also Technical Agriculture for two-year program.

The following options within the Agricultural Business curriculum provide training in agriculture, in the natural and social sciences and in the particular economic field in which the student primarily is interested. Each option provides for electives to permit the student to select technical courses needed for his own employment objective.

**Agricultural Economics Option**

For students interested in positions as professional agricultural economists either in government agencies or in business and for students interested in post-graduate study in any of the above three specializations.

**Farm Management Option**

For students interested in professional farm management, farm credit, banking, appraisal, extension, insurance, farming, economic aspects of soil conservation planning and other advisory services to farmers.

**Marketing Management Option**

For students interested in entering the various agricultural marketing, processing, distributive and farm supply businesses which serve agriculture. Students interested in farm machinery and equipment merchandising and service will be allowed to substitute specified courses in agricultural engineering. Students in the Marketing Management Option ordinarily will be encouraged to complete supervised training in the employ of an agricultural business.

**Public Service and Administration Option**

For students interested in positions with various governmental agencies at the federal, state or county levels and also in farm organizations or foreign agricultural services which require a basic knowledge of the business side of agriculture.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
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### Freshman Year

<table>
<thead>
<tr>
<th>Ag Economics</th>
<th>Econ 121</th>
<th>Prin of Livestock Production</th>
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</thead>
<tbody>
<tr>
<td>Prin of Comp</td>
<td>Eng 101</td>
<td>An S 114</td>
</tr>
<tr>
<td>Gen Chem</td>
<td>Chem 101</td>
<td>Prin of Comp</td>
</tr>
<tr>
<td>Alg and Trig.</td>
<td>Math 101</td>
<td>Gen Chem.</td>
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<td>Technical Lecture</td>
<td>Econ 110</td>
<td>Psych 101</td>
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</table>

* See *Mathematics* for description of beginning courses. Courses selected should be consistent with preparation.

### Sophomore Year

<table>
<thead>
<tr>
<th>Prin of Econ</th>
<th>Econ 241</th>
<th>Prin of Stat</th>
<th>Stat 201</th>
<th>Fund of Soil Sci</th>
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</thead>
<tbody>
<tr>
<td>Amer Govt</td>
<td>Govt 215</td>
<td>Prin of Econ 242</td>
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<td>Prin of Stat 201</td>
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| Agron 114A | Econ 242 | Agron 154A | Elem Org Chem 231 |
| 4          | 3        | 4          | 5               |

<p>| Bot 101 | Intro to Soc 134 |
| 3       | Soc 200         |
|         | 3-4             |</p>
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<thead>
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<th>WINTER QUARTER</th>
<th>Credits</th>
<th>SPRING QUARTER</th>
<th>Credits</th>
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<tbody>
<tr>
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<td>Prices and Resource</td>
<td>3</td>
<td>Prices and Resource</td>
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<tr>
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<td>Alloc Econ 307</td>
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<td>Alloc Econ 308</td>
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<td>Farm Mgt. and Organization</td>
<td>4</td>
<td>General Bacteriology</td>
<td>5</td>
<td>Ag Marketing</td>
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<tr>
<td>Econ 330</td>
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<td>Bact 304</td>
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<td>Econ 335</td>
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<tr>
<td>Intro Gen</td>
<td>3</td>
<td>Fund of Nutrition</td>
<td>4</td>
<td>Applied Animal Nutrition</td>
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<td>An S 318</td>
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<td>An S 319</td>
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<td>Junior Year</td>
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<td></td>
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<td>Senior Year</td>
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<td>See Options</td>
<td>See Options</td>
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<tr>
<td>Intro to Ag Policy</td>
<td>3</td>
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<tr>
<td>Econ 447</td>
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<tr>
<td>Each student is required to include in his freshman and sophomore years six credits of physical education. Students electing to take ROTC may apply ROTC credit toward elective requirements.</td>
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<tr>
<td>In addition to the courses listed above the student must complete the courses in one of the options below.</td>
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### Agricultural Economics Option

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<tr>
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<tr>
<td>Analytic Geometry and Calculus I</td>
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<tr>
<td>Math 110</td>
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<tr>
<td>Land Economics</td>
<td>3</td>
</tr>
<tr>
<td>Econ 334</td>
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<tr>
<td>Business and Professional Speaking</td>
<td>3</td>
</tr>
<tr>
<td>Sp 312</td>
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<tr>
<td>Soil Fertility</td>
<td>4</td>
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<tr>
<td>Agron 354</td>
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<tr>
<td>Economic History of the United States</td>
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<td>Hist 335</td>
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<tr>
<td>Business Law I</td>
<td>3</td>
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<tr>
<td>1 Ad 365C</td>
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<tr>
<td>Accounting I</td>
<td>4</td>
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<tr>
<td>1 Ad 384</td>
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<tr>
<td>Public Finance and Fiscal Policies</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 405</td>
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<tr>
<td>National Income and Employment</td>
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<tr>
<td>Agricultural Finance</td>
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<tr>
<td>Econ 435</td>
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<tr>
<td>Appraisal of Farm Real Estate</td>
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<td>Econ 440</td>
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<td>Writing of Scientific Papers</td>
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<td>Government and Agriculture</td>
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<td>Statistical Methods for Research Work</td>
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### Farm Management Option

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<td>General Physics</td>
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<td>Physics 111</td>
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<tr>
<td>Principles of Zoology</td>
<td>4</td>
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<tr>
<td>Zool 101</td>
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<tr>
<td>Crop Growth and Culture</td>
<td>4</td>
</tr>
<tr>
<td>Agron 315</td>
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<tr>
<td>Soil Fertility</td>
<td>4</td>
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<tr>
<td>Agron 354</td>
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<tr>
<td>Soil and Water Management</td>
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<tr>
<td>AE 306</td>
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<tr>
<td>Animal Breeding I</td>
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<tr>
<td>An S 350</td>
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<tr>
<td>Farm Machinery and Power Management</td>
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<tr>
<td>AE 334</td>
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<td>Psychology of Sales and Advertising</td>
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<td>Psych 250</td>
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<td>Labor Economics and Labor Relations</td>
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<td>Accounting II</td>
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<td>1 Ad 386</td>
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<tr>
<td>Econ 409</td>
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<td>Agricultural Marketing Analysis</td>
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<td>Econ 436</td>
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Management Theory and Practice  3  
Econ 444  
International Economics  3  
Econ 455  
Principles of Transportation  3  
T Ad 460  
Industrial Risks  3  
T Ad 490  
Humanities*  6  
Electives  43 or 44  

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<td>Publicity and Public Relations</td>
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<tr>
<td>Crop Growth and Culture</td>
<td>4</td>
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<tr>
<td>Agron 315</td>
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<td>Soil Fertility</td>
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<tr>
<td>Advertising</td>
<td>3</td>
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<td>T JI 325</td>
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<td>Sociology of Rural Life</td>
<td>3</td>
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<td>Soc 386</td>
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<td>Accounting 1</td>
<td>I Ad 384</td>
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<td>or</td>
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</table>

Curriculum in Agricultural Education

With Options in Teaching and Business

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

Two calendar years of farm experience after the age of 14 are required of those who wish to qualify for teaching vocational agriculture.

The curriculum in Agricultural Education is designed to prepare persons for careers as vocational agriculture instructors, agricultural extension workers or as educational personnel in related agricultural businesses and industries.

**TEACHING OPTION**

**FALL QUARTER**  
Credits  
Prin of Composition  3  
Engl 101  
Prin of Horticulture  3  
Hort 114A  
Algebra and Trig  1B  
Math 101B  
Drafting for Agricultural Students  3  
I Ed 154  
Prin of Crop Production  4  
Agron 114A  

**WINTER QUARTER**  
Credits  
Prin of Composition  3  
Engl 102  
Metal Construction and Maintenance  3  
A E 254  
Elements of Livestock Production  3  
An S 114  
General Botany  5  
Bot 101  
Algebra and Trig  1B  3  
Math 101C  

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: Ed. 110, Ag. 104 and six quarters of physical education. Students electing to take ROTC may apply ROTC credit toward elective requirements.

**SPRING QUARTER**  
Credits  
Prin of Composition  3  
Engl 103  
Ag Const. Materials and Processes  3  
A E 255  
Principles of Zoology  4  
Zool 101  
Psychology I  3  
General Psychology  
Foundations of American Education  3  
Ed. 204  

**Sophomore Year**

Prin of Economics  3  
Econ 241  
General Chemistry  4  
Chem 101  
Weed Identification and Control  4  
Bot 215  
Publicity and Public Relations  4  
T JI 225  
Library Instruction  1  
Lib 116  

Prin of Economics  3  
Econ 242  
General Chemistry  4  
Chem 102  
Fundamentals of Soil Science  4  
Agron 154A  
Prin of Statistics  3  
Stat 201A  
Developmental Psych  3  
Psych 230  

Elem Organic Chem  5  
Chem 231  
American Government  3  
Govt 215  
Crop Growth and Culture  4  
Agron. 315  
Survey of Agri Educ  1  
Ag Ed 211A  
Farm Machinery and Power Management  4  
A E 334  

Junior and Senior Years

<table>
<thead>
<tr>
<th>Technical Agriculture</th>
<th>Science</th>
<th>Professional</th>
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<tr>
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<td>Credits</td>
<td>Credits</td>
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<td>A E 415</td>
<td>Electives in Phys.</td>
<td>Psych. 333</td>
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<td>Chem or Earth Sci.</td>
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<td>Genetics 301</td>
<td>Ag.Ed. 321</td>
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<td>Speech and Humanities</td>
<td>Ag Ed. 423</td>
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<td>Speech 311</td>
<td>Ed 426</td>
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<td>An S. 319</td>
<td>Electives in Art, History,</td>
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<td>Electives in An.S</td>
<td>Literature, Music and</td>
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<td>Po.S. 365</td>
<td>Philosophy</td>
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<td>Econ 330</td>
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<td>Electives in Econ, Ag</td>
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</table>

The junior and senior years will cover a minimum of 97 credits and will be planned to carry forward and expand the field of the student’s major study. A foundational or advanced systematic sequence of science or social studies may be chosen for the student’s minor, non-agricultural teaching field. Early in the junior year, a complete program will be worked out by the student in conference with his adviser. The subjects making up the junior-senior years ordinarily should be 300 or 400 level courses.

Business Option

This option is available to those students who do not wish to meet the requirements for a teaching certificate but are preparing for agricultural education positions with business and industry. Students in this program may elect 17 credits in the following courses in place of Ag. Ed. 423, Ag. Ed. 424 and Ag. Ed. 425:

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing Business Operations</td>
</tr>
<tr>
<td>Industrial Marketing 1</td>
</tr>
<tr>
<td>I Ad. 340</td>
</tr>
<tr>
<td>Business Correspondence</td>
</tr>
<tr>
<td>Business Law 1</td>
</tr>
<tr>
<td>I Ad. 365C</td>
</tr>
<tr>
<td>Accounting 1</td>
</tr>
<tr>
<td>I Ad. 384</td>
</tr>
<tr>
<td>Psychology of Sales and Advertising</td>
</tr>
<tr>
<td>Business and Professional Speaking</td>
</tr>
<tr>
<td>Sp. 312</td>
</tr>
<tr>
<td>Persuasion</td>
</tr>
<tr>
<td>Sp. 334</td>
</tr>
<tr>
<td>Advertising</td>
</tr>
<tr>
<td>T.JL. 325</td>
</tr>
</tbody>
</table>

Curriculum in Agricultural Engineering

Administered jointly by the College of Agriculture and the College of Engineering. See Engineering, Curricula.

Curriculum in Agricultural Journalism

Administered by the Department of Technical Journalism. Leading to the degree Bachelor of Science. Total credits required, 200 plus six quarters of physical education.

Group Requirements

As a prerequisite to graduation, to insure breadth of educational experience, and to provide professional competence in the field of journalism or as foundation for graduate work, each student must complete, at some time during the four years, credits in the basic areas of learning as specified below.

1. Written and spoken English: 18 credits required.
   Group I must include Engl. 101, 102, 103, Sp. 311.
2. Mathematics, or mathematics and statistics: 10 credits
   Math. 101.
3 Chemistry, physics; earth science 16 credits
   Chem 101, 102
4 Biological sciences 11 credits
   Bot 101, Gen 400, Zool 101 (or Zool 155)
5 Animal and plant sciences 20 credits **
   Agron 154A, An S 216 ***
6 Social sciences and humanities 30 credits
   Gov 215, Econ 241, 242, Hist 324
7 Modern Language 9 credits
8 Journalism 34 credits.
   101, 221, 222, 223, 325, 341, 430
9 Area of concentration in Agriculture 15 credits
**Students are encouraged, though not required, to enroll in Stat. 201 or Stat. 201A.
***Students must enroll in a minimum of six hours in each of the animal and plant science areas.
****Students seeking a subject matter concentration in the animal sciences are encouraged to include Chemistry 231 in the physical science group and An. S. 318 (in preference to An S. 216) in the animal and plant sciences group.

GENERAL REQUIREMENTS
1 Other required courses 7 credits
   Six quarters in physical education, 6 credits
   Lab 116, 1 credit
   Ag 110 required
2 Electives 36 credits
3 Freshman year
   During this year the student should complete 9 credits in Written English (Group 1) and at least 5 credits in Mathematics (Group 2), 101 in Group 8 and at least 30 hours in Groups 3, 4, 5 or 6 with more than one group represented
4 Sophomore year
   In the sophomore year students are expected to complete at least TJL 221 and 222 from Group 8 and additional courses may be selected from any of the other groups listed above
5 Junior and senior years
   Requirements—Completion of whatever group requirements remain after the freshman and sophomore years
   Completion of the journalism major and a minor in agriculture
   Elective courses.
   All candidates for degrees in agricultural journalism must have completed at least three months in professional mass communications work
   Students electing to take ROTC may apply ROTC credits to elective requirement

Curriculum in Agronomy

With options in Science, Business and Industry or Production and Technology
Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.
See also Technical Agriculture for two-year program.

The Agronomy curriculum provides training in agriculture with emphasis on crop science, soil science and agricultural climatology. Supporting work is provided in the other natural sciences as well as in the social sciences and humanities. Students are offered the opportunity of selecting one of the following three options within the agronomy curriculum.

SCIENCE OPTION
Students in this option are trained for positions that place emphasis on a thorough knowledge of the basic sciences in addition to training in agronomy. Such training will qualify graduates for positions as soil or crop scientists and as technical specialists with chemical and other industries and with government agencies. Completion of this option prepares students for graduate study in Crop Science, Soil Science or Agricultural Climatology. Graduate work leads to positions in education and research with colleges, universities, industries and government agencies.

BUSINESS AND INDUSTRY OPTION
Students in this option are trained for business positions requiring a thorough knowledge of agronomy and some training in business procedure and operation. There will be opportunities for graduates in positions involving public relations and consulting services as well as promotion, sales and supervisory work in fertilizer, seed, farm chemical and other industries related to agronomy.

PRODUCTION AND TECHNOLOGY OPTION
Students in this option are trained for positions requiring a thorough knowledge of agronomy as well as a broad knowledge of agriculture. Graduates are employed as farm operators
and managers and qualify for positions in soil conservation, crop production, seed production and technology, and in agronomic extension and other advisory services. Graduates also may qualify for more specialized positions such as those in turfgrass management, soil survey and land appraisal.

### Core Requirements

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>Freshman Year</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prin of Crop Prod</td>
<td>Intro to Geology</td>
<td>Fund of Soil Science</td>
</tr>
<tr>
<td>Agron 114A</td>
<td>Geol 100</td>
<td>4</td>
</tr>
<tr>
<td>Prin of Comp</td>
<td>Gen Chemistry</td>
<td>Agron 154A</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Chem 102</td>
<td>4</td>
</tr>
<tr>
<td>Algebra &amp; Trig 1B</td>
<td>Algebra &amp; Trig 1C</td>
<td>Intro to Plant Science</td>
</tr>
<tr>
<td>*Math 101B</td>
<td>Math 101C</td>
<td>3</td>
</tr>
<tr>
<td>Gen Chemistry</td>
<td>Prin of Comp.</td>
<td>Gen Psych</td>
</tr>
<tr>
<td>*Chem 101 or 101A</td>
<td>Engl 102</td>
<td>4</td>
</tr>
<tr>
<td>Elective</td>
<td>Elective</td>
<td>Psych 101</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include the following: Agron. 110, Ag. 104 (must be completed before beginning of senior year) and six quarters (totaling six credits) of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

* See Mathematics and Chemistry for descriptions of beginning courses. Course selected should be consistent with preparation.

### Core Group Requirements

As a prerequisite to graduation, to provide breadth of educational experience, and to gain competence in Agronomy, each student must complete credits in the areas of learning specified below. The exact number of credits in each area depends on option selected as well as choice of electives. The courses listed must be included.

1. Agricultural Sciences: 41 to 58 credits
2. Biological Sciences: 27 to 35 credits
   - Bot 210, 310, 407, Gen 301, Bact 304 or 200 and 300, Zool 101 or 102
3. Written and Spoken English: 15 to 20 credits
   - Engl 101, 102, 103, Lib 116, Sp 311, T J 225
4. Mathematics and Statistics: 9 to 24 credits
   - Math 101 or 101B and 101C, Stat 201A or 201
5. Physical Sciences: 20 to 34 credits
   - Chem 101, 102, Geol 100, Phys 111
6. Social Sciences and Humanities: 24 to 37 credits
   - Econ 241, 242, Gov't 215, Hist 324, Psych 101, Soc 134 or 200
7. Electives: 30 to 39 credits

### Option Requirements

In addition to the required courses listed above, a student will be required to take the following courses in his selected option:

<table>
<thead>
<tr>
<th>Science</th>
<th>Business &amp; Industry</th>
<th>Production &amp; Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>B &amp; B 301 or An S 318</td>
<td>Agron 444</td>
<td>4</td>
</tr>
<tr>
<td>Chem 103</td>
<td>An S 318 or Agron 444</td>
<td>4</td>
</tr>
<tr>
<td>Chem 211</td>
<td>B &amp; B 301</td>
<td>Agron 464</td>
</tr>
<tr>
<td>Chem 334</td>
<td>Bot 216</td>
<td>An S 318</td>
</tr>
<tr>
<td>Chem 335</td>
<td>Chem 231</td>
<td>An S 319</td>
</tr>
<tr>
<td>Math 102</td>
<td>Econ 435</td>
<td>Bot 216</td>
</tr>
<tr>
<td>Math 110</td>
<td>Engl 404</td>
<td>Chem 231</td>
</tr>
<tr>
<td>Math 211</td>
<td>I Ad 365C</td>
<td>Zool 374</td>
</tr>
<tr>
<td>Phys 112*</td>
<td>I Ad 384</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Psych 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sp 312</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zool 374</td>
<td></td>
</tr>
</tbody>
</table>

* 221, 222 may be substituted for 111, 112.

### Specialized Training

Students who wish to receive more training in certain areas are advised to elect the courses listed below in the respective areas of interest. Those courses listed under Fertilizer Technology and Seed Production normally will supplement the Business and Industry Option.
Courses listed under Turfgrass Management, Soil Conservation Technology, Land Appraisal, and Extension Education normally will supplement the Production and Technology Option. Students interested in graduate study preparation will follow the Science Option and select appropriate courses in their major area of interest.

**Fertilizer Technology and Distribution:**
Agron 313, 453, 464; Econ. 292, 305, 306, 430, 447; 1E 351, Sp 317

**Seed Production, Processing and Distribution:**
Agron 313, Bot 306, 338, 404, 436, Hort 214; Zool 324 or 374

**Turfgrass Management:**
Omit from basic curriculum of Production and Technology Option: Agron 415, 464; An S 114, 318, 319
Add to basic curriculum: Agron 313, 314, 453, Bot 306, 424, Hort 154, 214, 244, 305, 316, 490

**International Service in Agriculture:**
See International Service Program, Agron 406, 415, 483, 514

**Soil Conservation and Land Appraisal:**
Agron 565, 575, Econ 330, 334, 430, 440, 510, For 220

**Extension Education:**
Agron 453, 464, Econ 292; Ed 204; Engl. 205, 404, Sp. 312, 332

**Graduate Study Preparation**

**Crop Science**
Bot 306, 404; Gen. 305; Math 212; Chem. 336; Zool. 374

**Soil Science.**
Agron 577, Chem 321, 322, 323, 336, Geol 355, Math 212; Phys 113 or 223.

**Agricultural Climatology:**
Agron. 406; Geophys. 305; Math 212

**Curriculum in Animal Science**
With options in Production, Science, and Industry.

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of Physical Education.

See also Technical Agriculture for two-year program.

**Production Option**
Students in this option receive detailed training in areas to provide an adequate background for general farming and livestock production, county extension work, livestock marketing and buying, and farm or ranch management. In addition to these specific areas, students have opportunities to enter many areas in industries related to livestock production, marketing, and merchandising.

**Science Option**
This option provides training in Animal Science and additional detailed study in the basic sciences. Such training provides a background appropriate for research positions with commercial firms involved in the production of meat and other foods. Similar opportunities exist in the feed and pharmaceutical industries as well as with private and institutional research agencies. This option also serves as a pregraduate program for students interested in studying for advanced degrees required in university teaching, research, and extension.

**Industry Option**
An option for students interested in entering the many areas of industry related to animal or general agriculture. In addition to work in Animal Science, students receive training in business organization, management, marketing, sales, and promotion. Major areas of employment are with the meat and feed industries, finance agencies, and food processors and distributors.

**Pre-Veterinary Medicine**
Students interested in preparing for admission to the College of Veterinary Medicine may do so by fulfilling the requirements for admission stated on page 197. Pre-Veterinary students in Animal Science are requested to take Animal Science 114 and 115.
### Core Requirements

#### FALL QUARTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Lecture</td>
<td>An S 110 R</td>
</tr>
<tr>
<td>Elements of Livestock Production</td>
<td>An S 114</td>
</tr>
<tr>
<td>Prin. of Composition</td>
<td>Engl 101</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>Chem 102</td>
</tr>
<tr>
<td>Math 101B</td>
<td>3</td>
</tr>
<tr>
<td>Meat and Meat Processing</td>
<td>An S 270</td>
</tr>
<tr>
<td>Library Instruction</td>
<td>Lib 116</td>
</tr>
<tr>
<td>Fund of Soil Science</td>
<td>Agron 154A</td>
</tr>
</tbody>
</table>

#### WINTER QUARTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prin. of Crop Production</td>
<td>Agron 114A</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>Chem 102</td>
</tr>
<tr>
<td>Prin. of Composition</td>
<td>Engl 102</td>
</tr>
<tr>
<td>Algebra and Trig IB</td>
<td>Math 101B</td>
</tr>
</tbody>
</table>

#### SPRING QUARTER

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prin. of Composition</td>
<td>Engl 103</td>
</tr>
<tr>
<td>Algebra and Trig. IC</td>
<td>Math 101C</td>
</tr>
<tr>
<td>Prin. of Zoology</td>
<td>Zool 101</td>
</tr>
</tbody>
</table>

### Elective Requirements

- Students must select three areas:
  - General Botany
  - General Physics
  - Meat and Meat processing

#### Freshman Year

- Livestock Selection and Meat Evaluation | An S 305 | 3 |
- Fund of Nutrition | An S 318 | 4 |
- General Physics | Physics 111 | 4 |
- Dairv Cattle Performance | An S 235 | 3 |
- Principles of Economics | Econ 242 | 3 |
- Physiology of Domestic Animals | V Phys 264 | 3 |
- American Govt | Govt 215 | 3 |
- Animal Breeding | An S 350 | 4 |
- Speech | Sp 311 | 3 |
- Beef Cattle Production and Mktg | An S 427* | 3 |
- Livestock Sanitation | V Hyg 427 | 3 |
- Animal Breeding II | An S 450 | 3 |

*Any three of these four required for Graduation.*

In addition to the above, a student will be required to take the following courses in his selected option:

#### Production Option

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy Dom Animals</td>
<td>V Anat 217</td>
</tr>
<tr>
<td>Animal Reproduction</td>
<td>An S 431</td>
</tr>
<tr>
<td>Crop Growth and Culture</td>
<td>Agron 315</td>
</tr>
<tr>
<td>Soil Fertility</td>
<td>Agron 354</td>
</tr>
<tr>
<td>Elementary Organic Chemistry</td>
<td>Chem 231</td>
</tr>
<tr>
<td>Farm Mgmt and Organ Econ</td>
<td>Econ 330</td>
</tr>
<tr>
<td>Farm Acct and Bus Anal Econ</td>
<td>Econ 329</td>
</tr>
<tr>
<td>Poultry Feeding and Mgmt</td>
<td>Po S 365</td>
</tr>
<tr>
<td>Social Studies and Humanities*</td>
<td>15</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>200</td>
</tr>
</tbody>
</table>

#### Science Option

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Reproduction</td>
<td>An S 431</td>
</tr>
<tr>
<td>Systematic Inorganic Chemistry</td>
<td>Chem 103</td>
</tr>
<tr>
<td>Quantitative Analysis</td>
<td>Chem 211</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>Chem 334</td>
</tr>
<tr>
<td>Analytic Geometry and Calculus I</td>
<td>Math 102</td>
</tr>
<tr>
<td>The Animal Kingdom</td>
<td>Zool 102</td>
</tr>
<tr>
<td>Comparative Anatomy</td>
<td>Zool. 224</td>
</tr>
<tr>
<td>Social Studies and Humanities*</td>
<td>15</td>
</tr>
<tr>
<td>Electives</td>
<td>21</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>200</td>
</tr>
</tbody>
</table>

#### Industry Option

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary Organic Chemistry</td>
<td>Chem 231</td>
</tr>
<tr>
<td>Prin. of Economics</td>
<td>Econ 243</td>
</tr>
<tr>
<td>Business Law I</td>
<td>I Ad 365</td>
</tr>
<tr>
<td>Business Law II</td>
<td>I Ad 366</td>
</tr>
<tr>
<td>General Psychology</td>
<td>Psych 101</td>
</tr>
<tr>
<td>Psychology of Sales and Advertising</td>
<td>Psych 250</td>
</tr>
<tr>
<td>Introduction to Sociology</td>
<td>Soc 134</td>
</tr>
<tr>
<td>Business and Professional Speech</td>
<td>Sp 312</td>
</tr>
<tr>
<td>Anatomy Dom Animals</td>
<td>V. Anat 217</td>
</tr>
<tr>
<td>Social Studies and Humanities*</td>
<td>9</td>
</tr>
<tr>
<td>Electives</td>
<td>35</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>200</td>
</tr>
</tbody>
</table>

*Social Sciences and Humanities must be selected from the following areas:
- Economics, Sociology, Government, Psychology—9 hours
- Art, History, Literature, Music, Philosophy—6 hours
Curriculum in Dairy Science

With options in Production, Science and Business.
Administered by the Department of Animal Science.
Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.
See also Technical Agriculture for two-year program.

Students interested in preparing for admission to the College of Veterinary Medicine may do so by fulfilling the requirements for admission stated in this catalog. (See index, Veterinary Medicine). Pre-Veterinary students in Dairy Science are requested to take Animal Science 114 and D.F.I. 114.

Production Option

Dairy farming, as owners or managers, will be the goal of many students in this option. Graduates from this option can qualify for county extension work, as breed fieldmen, for work with dairy companies or various farm service organizations. Those who wish to work as herdsmen, artificial breeding technicians and DHIA supervisors would select this option.

Science Option

Students in this option will be prepared for research and development work with feed companies, artificial breeding associations and organizations allied to dairy production. This option serves as a pre-graduate program for those who wish to prepare for college teaching, research or extension specialist work.

Business Option

Students in this option are trained for positions requiring a thorough knowledge of dairy science and some training for business and industry. There will be opportunities for graduates as buyers, sellers and fieldmen in dairy and related areas. In addition there will be opportunities in management, public relations and promotion in which knowledge of dairy science is the primary educational qualification.

Core Requirements

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>Credits</th>
<th>WINTER QUARTER</th>
<th>Credits</th>
<th>SPRING QUARTER</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Lecture</strong>&lt;br&gt; An.S. 110</td>
<td>R</td>
<td>General Chemistry&lt;br&gt; Chem 102</td>
<td>4</td>
<td>Principles of Crop Production&lt;br&gt; Agron. 114</td>
<td>4</td>
</tr>
<tr>
<td><strong>Elements of Livestock Production</strong>&lt;br&gt; An.S. 114</td>
<td>5</td>
<td>Prin. of Composition&lt;br&gt; Engl 102</td>
<td>3</td>
<td>Prin. of Composition&lt;br&gt; Engl. 103</td>
<td>3</td>
</tr>
<tr>
<td><strong>General Chemistry</strong>&lt;br&gt; Chem. 101</td>
<td>4</td>
<td>Algebra and Trig. 1B&lt;br&gt; Math. 101B</td>
<td>3</td>
<td>Algebra and Trig. 1C&lt;br&gt; Math 101C</td>
<td>3</td>
</tr>
<tr>
<td><strong>Elements of Dairy and Food Industries</strong>&lt;br&gt; D.F.I. 114</td>
<td>4</td>
<td>Prin. of Zoology&lt;br&gt; Zool 101</td>
<td>4</td>
<td>General Botany&lt;br&gt; Bot 101</td>
<td>3</td>
</tr>
<tr>
<td><strong>Prin. of Composition</strong>&lt;br&gt; Engl. 101</td>
<td>3</td>
<td></td>
<td></td>
<td>Concepts in Plant Science&lt;br&gt; Bot 105</td>
<td>1</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his Freshman and Sophomore years six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
<th>Junior Year</th>
<th>Credits</th>
<th>Junior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Govt.&lt;br&gt; Govt. 215</td>
<td>3</td>
<td>Introduction to Genetics&lt;br&gt; Gen. 301</td>
<td>3</td>
<td>Animal Reproduction&lt;br&gt; An.S. 431</td>
<td>3</td>
</tr>
<tr>
<td>General Physics&lt;br&gt; Phys 111</td>
<td>4</td>
<td></td>
<td></td>
<td>Animal Breeding I&lt;br&gt; An.S. 350</td>
<td>4</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his Freshman and Sophomore years six quarters of physical education.
In addition to the courses listed previously, a student is required to take the following courses according to his selected option:

**Production Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop Growth &amp; Culture</td>
<td>4</td>
</tr>
<tr>
<td>Agron 315 (Jr F)</td>
<td></td>
</tr>
<tr>
<td>Meats</td>
<td></td>
</tr>
<tr>
<td>An S 270 (Jr F)</td>
<td>3</td>
</tr>
<tr>
<td>Livestock Selection</td>
<td></td>
</tr>
<tr>
<td>Livestock Selection &amp; Meat Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>An S 305 (Jr F)</td>
<td></td>
</tr>
<tr>
<td>Elem Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>Chem 231 (So F)</td>
<td>5</td>
</tr>
<tr>
<td>Farm Mgmt &amp; Organ</td>
<td></td>
</tr>
<tr>
<td>Econ 330 (Jr S)</td>
<td>4</td>
</tr>
<tr>
<td>Anatomy Dom Animals</td>
<td></td>
</tr>
<tr>
<td>V Anat 217 (So F)</td>
<td>3</td>
</tr>
<tr>
<td>Soil Fertility</td>
<td></td>
</tr>
<tr>
<td>Agron 354</td>
<td>4</td>
</tr>
<tr>
<td>Social Sciences and Humanities*</td>
<td>15</td>
</tr>
<tr>
<td>Electives</td>
<td>38</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>200</td>
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</tbody>
</table>

**Science Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Systematic Inorganic Chemistry</td>
<td></td>
</tr>
<tr>
<td>Chem 103 (Fr S)</td>
<td>4</td>
</tr>
<tr>
<td>Quantitative Analysis</td>
<td></td>
</tr>
<tr>
<td>Chem 211 (So S)</td>
<td>5</td>
</tr>
<tr>
<td>Organic Chemistry</td>
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</tr>
<tr>
<td>Chem 334 (So F)</td>
<td>4</td>
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<tr>
<td>Organic Chemistry</td>
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</tr>
<tr>
<td>Chem 335 (So W)</td>
<td>4</td>
</tr>
<tr>
<td>Algebra &amp; Trig II</td>
<td></td>
</tr>
<tr>
<td>Math 102 (So F)</td>
<td>5</td>
</tr>
<tr>
<td>Analytic Geometry &amp; Calculus I</td>
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</tr>
<tr>
<td>Math 110 (Jr F)</td>
<td>5</td>
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<tr>
<td>The Animal Kingdom</td>
<td></td>
</tr>
<tr>
<td>Zool 102 (So W)</td>
<td>4</td>
</tr>
<tr>
<td>Comparative Anatomy</td>
<td></td>
</tr>
<tr>
<td>Zool 224 (So F)</td>
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<tr>
<td>Social Sciences and Humanities*</td>
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<tr>
<td>Electives</td>
<td>29</td>
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<td><strong>TOTAL</strong></td>
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**Business Option**

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Elementary Organic Chemistry</td>
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</tr>
<tr>
<td>Chem 231 (So F)</td>
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<tr>
<td>Prin of Economics</td>
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</tr>
<tr>
<td>Econ 243</td>
<td>3</td>
</tr>
<tr>
<td>Farm Management &amp; Org</td>
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<tr>
<td>Econ 330 (Jr S)</td>
<td>4</td>
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<td>Econ 355 (Jr F)</td>
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<td>Business Law</td>
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<tr>
<td>I Ad 365 (Jr W)</td>
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<tr>
<td>Business &amp; Professional Speaking</td>
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<tr>
<td>Sp 312 (Jr W)</td>
<td>3</td>
</tr>
<tr>
<td>Anatomy Dom Animals</td>
<td></td>
</tr>
<tr>
<td>V Anat 217 (So F)</td>
<td>3</td>
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<td>Social Sciences and Humanities*</td>
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<tr>
<td><strong>TOTAL</strong></td>
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</table>

* Social Sciences and Humanities must be selected from the following areas:
  Economics, Sociology, Government, Psychology—9 hours
  Art, History, Literature, Music, Philosophy—6 hours

**Curriculum in Dairy Industry**

With options in Technology, Science and Business.
Administered by the Department of Dairy and Food Industry.
Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td></td>
</tr>
<tr>
<td>Chem 101</td>
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</tr>
<tr>
<td>Algebra and Trig I</td>
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<td>Math 101</td>
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<tr>
<td>Elements of Dairy and Food Industries</td>
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<tr>
<td>D F I 114</td>
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<tr>
<td>Prin of Composition</td>
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<tr>
<td>Engl 101</td>
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<td><strong>TOTAL</strong></td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Freshman Year</td>
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<td>General Chemistry</td>
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<td>Prin of Composition</td>
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</tr>
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<td>Engl 102</td>
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<td><strong>TOTAL</strong></td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Sophomore Year</td>
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<td>Library Instruction</td>
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<td>Lib 116</td>
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<td>American Government</td>
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<td>Govt 215</td>
<td>3</td>
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<tr>
<td>General Physics</td>
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</tr>
<tr>
<td>Phys 111</td>
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<td><strong>TOTAL</strong></td>
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<thead>
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<td>Freshman Year</td>
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<td>Dairy Mechanics</td>
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<td>A E 157</td>
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<tr>
<td>Drafting for Ag Students</td>
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<td>I Ed 154</td>
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<tr>
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<td>Math 102</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Sophomore Year</td>
<td></td>
</tr>
<tr>
<td>Prin of Economics</td>
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</tr>
<tr>
<td>Econ 243</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>200</td>
</tr>
</tbody>
</table>
In addition to the courses listed, 6 months of practical experience, D.F.I. 110, Ag. 104 and 6 quarters of physical education are required for graduation.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

Students interested in combining the essential courses of the Dairy Industry curriculum with a curriculum in Chemistry or Mechanical Engineering or Chemical Engineering may, through counselors representing both departments, arrange special 5-year programs leading to degrees in both subjects.

According to his selected option, the student is required to take the following courses. The recommended year and quarter to schedule these courses are indicated.
Curriculum in Entomology

Administered by the Department of Zoology and Entomology.

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

See also Technical Agriculture for two-year program.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>Credits</th>
<th>WINTER QUARTER</th>
<th>Credits</th>
<th>SPRING QUARTER</th>
<th>Credits</th>
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<tbody>
<tr>
<td>General Chemistry</td>
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<td>General Chemistry</td>
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<td>Systematic Inorganic Chemistry Analysis</td>
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<td>Chem 102</td>
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<td>Chem 103</td>
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<td>Prin of Composition</td>
<td>3</td>
<td>Prin of Composition</td>
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</tr>
<tr>
<td>Engl 101</td>
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<td>Engl 102</td>
<td></td>
<td>Engl 103</td>
<td></td>
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<tr>
<td>Alegebra and Trig I</td>
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<td>Alegebra and Trig II</td>
<td>5</td>
<td>An Geom and Calc I</td>
<td>1</td>
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<td>Math 101</td>
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<td>Math 102</td>
<td></td>
<td>Math 110</td>
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</tr>
<tr>
<td>P E</td>
<td></td>
<td>P E</td>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Technical Lecture</td>
<td>R</td>
<td>Principles of Zool</td>
<td>4</td>
<td>Prin. of Statistics</td>
<td>5</td>
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<td>Zool. 100</td>
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<td>Stat 201</td>
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<tr>
<td>The Animal Kingdom</td>
<td>4</td>
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<td></td>
<td>P E</td>
<td></td>
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<tr>
<td>Zool. 102</td>
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<td></td>
<td>Gen. Ent.</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Zool. 274</td>
<td>4</td>
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</table>

* Any student may, and especially those preparing for graduate study should, replace Chem. 231 with Chem. 334 and 335.

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Credits</th>
<th>Credits</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Prin of Crop Prod.</td>
<td>4</td>
<td>Fund. of Soil Science</td>
<td>4</td>
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<tr>
<td>Agron. 114A</td>
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<td>Agron. 154A</td>
<td></td>
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<tr>
<td>General Botany</td>
<td>3</td>
<td>The Plant Kingdom</td>
<td>3</td>
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<tr>
<td>Bot 101</td>
<td></td>
<td>Bot 202</td>
<td></td>
</tr>
<tr>
<td>Concepts of Plant Science</td>
<td>1</td>
<td>Prin of Economics</td>
<td>3</td>
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<tr>
<td>Bot 105</td>
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<td>Econ 242</td>
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<td>*Elem. Organic Chemistry</td>
<td>5</td>
<td>P E</td>
<td></td>
</tr>
<tr>
<td>Chem 231</td>
<td></td>
<td>Animal Evolution</td>
<td>3</td>
</tr>
<tr>
<td>Prin of Economics</td>
<td>3</td>
<td>Zool 303</td>
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<tr>
<td>Econ 241</td>
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<td>Prin. of Applied Ent</td>
<td>4</td>
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<tr>
<td>Library Instruction</td>
<td>1</td>
<td>Zool 370</td>
<td></td>
</tr>
<tr>
<td>Lib 116</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P E</td>
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</table>

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
<th>Credits</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Intro to Literature</td>
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<td>General Bacteriology</td>
<td>5</td>
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<tr>
<td>Engl 201</td>
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<td>Bact. 304</td>
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<tr>
<td>Gen Phys.</td>
<td>5</td>
<td>Introductory Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Phys. 111</td>
<td></td>
<td>Gen 301</td>
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<tr>
<td>Animal Ecology</td>
<td>4</td>
<td>General Physics</td>
<td>5</td>
</tr>
<tr>
<td>Zool 402</td>
<td></td>
<td>Phys 112</td>
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<td>Electives</td>
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<table>
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<tr>
<th>Senior Year</th>
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<th>Credits</th>
<th>Credits</th>
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<tr>
<td>Electives</td>
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<td>Business Correspondence</td>
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<td></td>
<td></td>
<td>Engl 404</td>
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<tr>
<td></td>
<td></td>
<td>Electives</td>
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</table>

Ag. 104, six months of work experience, is required before graduation.

A minimum of 12 credits must be elected from the following groups of courses: Engl. 256, 354, 363, 364; Hist. 211, 212, 213, 311, 312, 313, 324; Phil. 260, 370; I.A. 365.

Other suggested electives: Ag. Ed. 466; Agron. 424; An. S. 114; B. and B 301, 311; Bot. 216, 404; Chem. 211; Gen. 305; Hist. 440, 441, 442; Hort. 214; Math. 211, 212, 213; Phys. 113; Psych. 101; T.Jl. 225; Zool. 311, 424, 572, 576, 577, 578.

Students electing ROTC may apply ROTC credits toward elective requirement.

Curriculum in Farm Operation

Administered by the College of Agriculture.

The curriculum in Farm Operation is intended for those students who are looking forward to general farming as their life work. It is, therefore, designed to develop those understandings, abilities, and attitudes which are essential to (a) efficient farm operation and management, (b) effective participation as a citizen and leader in a rural community, and (c) personal satisfaction and happiness in rural living.

The Farm Operation curriculum includes a collegiate winter-quarter program, a two-year
program leading to a certificate and a four-year program leading to Bachelor of Science degree in Farm Operation.

**WINTER QUARTER PROGRAM**

A winter quarter collegiate program is available to the student who plans to spend only one quarter in the University. All courses required in this program will apply toward a Bachelor of Science degree in the event that the student decides to remain in or return to the University. The student who decides to continue may follow the regular Farm Operation curriculum, described in this section, or transfer to another curriculum.

**TWO-YEAR PROGRAM**

Students who complete satisfactorily at least 96 credits in a prescribed program and who find it impractical to continue will receive a Certificate in Technical Agriculture. The two-year program will include those courses specified below.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>Prin. of Composition</td>
<td>Prin. of Composition</td>
<td>Prin. of Composition</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Engl 102</td>
<td>Engl 103</td>
</tr>
<tr>
<td>Prin. of Crop Production</td>
<td>Elem. of Farm Mgt</td>
<td>Rural Inst &amp; Org</td>
</tr>
<tr>
<td>Agron 114A</td>
<td>Econ 130</td>
<td>Soc 200</td>
</tr>
<tr>
<td>Elem. of Livestock Prod</td>
<td>*Ag Math</td>
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</tr>
<tr>
<td>An S 114</td>
<td>Math 100</td>
<td></td>
</tr>
<tr>
<td>Library Instruction</td>
<td>General Botany</td>
<td></td>
</tr>
<tr>
<td>Lib 116</td>
<td>Bot 101</td>
<td></td>
</tr>
</tbody>
</table>

In addition to the courses listed above the student will be required to include the following:
2. Sixteen credits of free electives.
3. Six quarters of physical education.
4. *All of the above courses will apply toward a B.S. in Farm Operation except Agron. 212, Math. 100.

**THE FOUR-YEAR CURRICULUM IN FARM OPERATION**

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>Elem. of Livestock Prod</td>
<td>Prin. of Crop Prod</td>
<td>Zoology</td>
</tr>
<tr>
<td>An S 114</td>
<td>Agron 114A</td>
<td>Zool 101</td>
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<tr>
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<td>General Chemistry</td>
<td>Algebra and Trig IC</td>
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<tr>
<td>Chem 101</td>
<td>Chem 102</td>
<td>Math 101C</td>
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<td>Prin. of Composition</td>
<td>Prin. of Composition</td>
</tr>
<tr>
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<td>Engl 102</td>
<td>Engl 103</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Math 101B</td>
<td></td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: Ag. 104, 110, and six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.
### 132/Colleges and Curricula

#### FALL QUARTER Credits
- **Elem Organic Chem Chem 231** 5
- **Prin of Economics Econ 241** 3
- **Anat of Dom Animals Vet Anatomy 217** 3
- **Library Instruction Lib 116** 1

#### WINTER QUARTER Credits
- **Phys of Dom Animals Vet Phys 264** 3
- **Prin of Economics Econ 242** 3
- **General Botany Bot 101** 3
- **Fund of Soil Science Agron 154A** 4

#### SPRING QUARTER Credits
- **Farm Mgt & Org Econ 330** 4
- **Fundamentals of Speech Sp 33** 3
- **Farm Records & Bus Analysis Econ 329 or 3**
- **Accounting I 1 Ad 384** 4

---

#### FALL QUARTER Credits
- **Fund of Nutrition An S 318** 4
- **Prin of Statistics Stat 201A** 3
- **General Physics Phys 111** 4

#### WINTER QUARTER Credits
- **Applied Animal Nutrition An S 319** 3
- **Soil Fertility Agron 354** 4
- **Intro Genetics Gen 301** 3
- **American Government Gov 215** 3

#### SPRING QUARTER Credits
- **Crop Growth & Culture Agron 315** 4
- **Animal Breeding Prin An S 350** 4
- **Appraisal of Farm Real Est Econ 440** 3

---

### Credits
- **Sophomore Year**
  - **Bot 202** 3
  - **Engl 102** 3
  - **Math 102** 5
  - **Zool 141** 3
  - **P E 1**

### Senior Year
- **Bact 304A** 5
- **Rural Inst & Org Soc 200** 4

---

In addition to the courses listed the student will be required to include the following:
1. Six credit hours elected from art, history, literature, music, and philosophy.
2. Six credit hours elected from Agron. 415, 464, 473; An.S. 425, 427, 434; PoS. 365, 404.
4. Three to four credit hours from Biochem. 301, Bot. 310.
5. Fifty-two free electives.

---

### Curriculum in Fisheries and Wildlife Biology

Administered by the Department of Zoology and Entomology. Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education

#### FALL QUARTER Credits
- **General Botany Bot 101** 3
- **Prin of Composition Engl 101** 3
- **Math 101** 5
- **Zool 102** 4
- **Technical Lecture Zool 100** 1
- **P E 1**

#### WINTER QUARTER Credits
- **The Plant Kingdom Bot 202** 3
- **Prin of Composition Engl 102** 3
- **Math 102** 5
- **Zool 141** 3
- **P E 1**

#### SPRING QUARTER Credits
- **Plant Taxonomy Bot 306** 4
- **Prin of Composition Engl 103** 3
- **An Geom & Calc I Math 110 or**
- **Zool 140** 4
- **P E 1**

---

**Sophomore Year**
- **Agricultural Meteorology Agron 206** 3
- **Chemistry Chem 102** 4
- **Prin of Economics Econ 241** 3
- **General Botany Bot 310** 4
- **Gen Plant Ecology Bot 424** 3
- **Intro Genetics Gen 301** 3

---

**Junior Year**
- **Intro Genetics Gen 301** 3
- **Fund of Speech Sp 311** 3
FALL QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>General Physics</td>
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<tr>
<td>Phys 111</td>
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<tr>
<td>Mammalogy</td>
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WINTER QUARTER

<table>
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<th>Credits</th>
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</thead>
<tbody>
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<td>General Physics</td>
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<td>Phys 112</td>
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<td>Zool 370</td>
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<tr>
<td>Prin. of Physiology</td>
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<tr>
<td>Zool 355</td>
<td></td>
</tr>
</tbody>
</table>

SPRING QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing of Scient Papers</td>
<td></td>
</tr>
<tr>
<td>Engl 414</td>
<td></td>
</tr>
<tr>
<td>or Publicity and Public Relations</td>
<td></td>
</tr>
<tr>
<td>T Jl 225</td>
<td>3</td>
</tr>
<tr>
<td>Ichthyol &amp; Herpetol</td>
<td>5</td>
</tr>
<tr>
<td>Zool. 464</td>
<td></td>
</tr>
</tbody>
</table>

*Any student may, and especially those preparing for graduate study should, omit Chem. 231 and take Chem. 103, 334, 335.

Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Forest Conservation</td>
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</tr>
<tr>
<td>For 400</td>
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<tr>
<td>Vertebrate Embryology</td>
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</tr>
<tr>
<td>Zool 234</td>
<td>5</td>
</tr>
<tr>
<td>Animal Ecology</td>
<td></td>
</tr>
<tr>
<td>Zool 402</td>
<td>4</td>
</tr>
<tr>
<td>Fisheries Management</td>
<td></td>
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<tr>
<td>Zool 465</td>
<td>5</td>
</tr>
</tbody>
</table>

Ag.104, six months of work experience, is required before graduation.
A minimum of 9 credits must be elected from the following courses: Engl. 201, 256, 354, 363, 364; Hist. 211, 212, 213, 311, 312, 313, 324; Phil. 260, 370.
Other suggested electives: Bot. 203, 564; C.E. 315; For. 101, 302, 491; Govt. 471, 478; Psych. 101; Phys. 113; Zool. 303.
Students electing ROTC may apply ROTC credits toward elective requirement.

Curriculum in Food Technology

With options in science and business.
Administered by the Department of Dairy and Food Industry.
Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

FALL QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 101</td>
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</tr>
<tr>
<td>Elements of Dairy and Food Industries</td>
<td>4</td>
</tr>
<tr>
<td>D F I 114</td>
<td></td>
</tr>
<tr>
<td>Prin. of Composition</td>
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</tr>
<tr>
<td>Engl 101</td>
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<tr>
<td>Algebra and Trig. I</td>
<td></td>
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<tr>
<td>Math 101</td>
<td>5</td>
</tr>
<tr>
<td>Quantitative Analysis</td>
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</tr>
<tr>
<td>Chem 211</td>
<td>5</td>
</tr>
<tr>
<td>Propaganda Analysis</td>
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<tr>
<td>Engl 205</td>
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<tr>
<td>Fund. of Speech</td>
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<tr>
<td>Sp 311</td>
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<td>Library Instruction</td>
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<tr>
<td>Lib 116</td>
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<tr>
<td>Meats</td>
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<tr>
<td>An S 270</td>
<td>3</td>
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<tr>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>Phys 111</td>
<td>4</td>
</tr>
<tr>
<td>Market and Process Poultry Products</td>
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<tr>
<td>Po S. 401</td>
<td>4</td>
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<tr>
<td>Food Processing Equip.</td>
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<td>D F I 491</td>
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WINTER QUARTER

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>Freshman Year</td>
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<tr>
<td>General Chemistry</td>
<td>4</td>
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<tr>
<td>Chem 102</td>
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<tr>
<td>Prin. of Composition</td>
<td>3</td>
</tr>
<tr>
<td>Engl 102</td>
<td></td>
</tr>
<tr>
<td>Algebra and Trig. II</td>
<td>5</td>
</tr>
<tr>
<td>Math 102</td>
<td></td>
</tr>
<tr>
<td>Prin. of Zoology</td>
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<tr>
<td>Zool 101</td>
<td>4</td>
</tr>
<tr>
<td>Introductory Genetics</td>
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<tr>
<td>Gen 301</td>
<td>3</td>
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<tr>
<td>General Bacteriology</td>
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<td>Bact 304</td>
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<td>General Physics</td>
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</tr>
<tr>
<td>Phys. 112</td>
<td>4</td>
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<tr>
<td>Sophomore Year</td>
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</tr>
<tr>
<td>Systematic Inorganic Chemistry</td>
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</tr>
<tr>
<td>Chem 103</td>
<td>4</td>
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<td>Prin. of Composition</td>
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<tr>
<td>Engl. 103</td>
<td>3</td>
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<tr>
<td>Anal. Geom and Calculus I</td>
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<td>Math 110</td>
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<tr>
<td>General Botany</td>
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<td>Bot 101</td>
<td>3</td>
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<tr>
<td>Vegetable Crops</td>
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<td>Hort 164</td>
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<td>American Government</td>
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<tr>
<td>Govt 215</td>
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<td>Junior Year</td>
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<td>Food Process Equip.</td>
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<td>D F I 492</td>
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<tr>
<td>Food Chemistry</td>
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<tr>
<td>D F I 349</td>
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<tr>
<td>Food Processing Equip.</td>
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<tr>
<td>D F I. 493</td>
<td>4</td>
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</tbody>
</table>
Curriculum in Forestry

With options in Forest Management and Forest Products.

Leading to the degree Bachelor of Science. Total credits required, 212, plus six quarters of physical education.

Five-year majors offered in Forest Management, Forestry Economics, Farm Forestry, Forest Range Management, Forest Products and Wood Technology.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
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**Science Option**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Organic Chemistry</td>
<td>4</td>
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<tr>
<td>Chem 334 (Jr F)</td>
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<tr>
<td>Organic Chemistry</td>
<td>4</td>
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<tr>
<td>Chem 335 (Jr W)</td>
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<tr>
<td>Organic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 336 (Jr S)</td>
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<tr>
<td>Biophysical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Chem 483 (Sr F)</td>
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<tr>
<td>Biochemistry</td>
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<tr>
<td>B and B 301 (So S)</td>
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<tr>
<td>Laboratory in Biochemistry</td>
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<tr>
<td>B and B 311 (So S)</td>
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<tr>
<td>Analytic Geometry and Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>Math 211 (Jr F)</td>
<td></td>
</tr>
<tr>
<td>Analytic Geometry and Calculus III</td>
<td>5</td>
</tr>
<tr>
<td>Math 212 (Jr W)</td>
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<tr>
<td>Analytic Geometry and Calculus IV</td>
<td>3</td>
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<tr>
<td>Math 213 (Sr S)</td>
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<td>Humanities</td>
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<td>Electives</td>
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Total 200

**Business Option**

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<tbody>
<tr>
<td>Elementary Organic Chemistry</td>
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<tr>
<td>Chem 231 (Jr F)</td>
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<tr>
<td>Introduction of Sociology</td>
<td>3</td>
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<tr>
<td>Soc 134 (So S)</td>
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<tr>
<td>General Psychology I</td>
<td>3</td>
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<td>Psych 101 (So W)</td>
<td></td>
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<tr>
<td>General Psychology II</td>
<td>3</td>
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<tr>
<td>Psych 201 (So S)</td>
<td></td>
</tr>
<tr>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 241 (Jr F)</td>
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<tr>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Econ 242 (Jr W)</td>
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<tr>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Econ 243 (Jr S)</td>
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<tr>
<td>Industrial Marketing I</td>
<td>3</td>
</tr>
<tr>
<td>I Ad 340 (So S)</td>
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</tr>
<tr>
<td>Accounting I</td>
<td>3</td>
</tr>
<tr>
<td>I Ad 384 (Sr F)</td>
<td></td>
</tr>
<tr>
<td>Accounting II</td>
<td>3</td>
</tr>
<tr>
<td>I Ad 385 (Sr W)</td>
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</tr>
<tr>
<td>Intermediate Accounting</td>
<td>3</td>
</tr>
<tr>
<td>I Ad 386 (Sr S)</td>
<td></td>
</tr>
<tr>
<td>Social Sciences</td>
<td>9</td>
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<td>Humanities</td>
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</tr>
<tr>
<td>Electives</td>
<td>32</td>
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</tbody>
</table>

Total 200

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: Fore. 110, and six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

Students interested in additional courses in the basic sciences in preparation for advanced technical work in Forest Management or Wood Science and Technology should see their adviser and the sections in the catalog dealing with pre-graduate training and electives suggested for specialized training.

*See Mathematics for descriptions of beginning courses. Course selected should be consistent with preparation.
Summer Camp (Required)
The summer camp is conducted for eight weeks during the summer between the freshman and sophomore years and is prerequisite to admission to the junior year. The following courses are offered at the freshman summer camp: Forest Biology, For 214, Cr 3, Wood Utilization, For 234, Cr 3, Forest Mensuration and Mapping, For 244, Cr 4, Forest Operations, For 250, Cr 2.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>Prin. of Economics</td>
<td>Prin. of Economics</td>
<td>Fund of Speech</td>
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<tr>
<td>Econ. 241</td>
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<td>3</td>
</tr>
<tr>
<td>Elem. Organic Chemistry</td>
<td>Forest Mensuration</td>
<td>Prin. of Zoology</td>
</tr>
<tr>
<td>Chem. 231</td>
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<td>4</td>
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<tr>
<td>General Physics</td>
<td>General Physics</td>
<td>Phys. 112</td>
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<td>Phys. 111</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Library Instruction</td>
<td>Logging and Milling</td>
<td>American Government</td>
</tr>
<tr>
<td>Lib. 116</td>
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<tr>
<td>Elem. Plant Physiology</td>
<td>Wood Technology I</td>
<td>Plant Taxonomy</td>
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<tr>
<td>Bot. 310</td>
<td>4</td>
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</tbody>
</table>

Junior Year

<table>
<thead>
<tr>
<th>Dendrology</th>
<th>Silvics</th>
<th>Silviculture</th>
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</thead>
<tbody>
<tr>
<td>Bot. 356</td>
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<td>4</td>
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<tr>
<td></td>
<td></td>
<td>For. 301</td>
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<tr>
<td></td>
<td></td>
<td>For. 302*</td>
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<td></td>
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</table>

*Students in the Forest Products Option may elect to take For. 302 for 3 credits.

Senior Year

<table>
<thead>
<tr>
<th>Prin. of Forestry Economics I</th>
<th>Prin. of Forestry Economics II</th>
<th>Forest Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>For. 470</td>
<td>For. 471</td>
<td>For. 402</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Timber Products</td>
<td>Forest Management</td>
<td></td>
</tr>
<tr>
<td>For. 486</td>
<td>For. 497</td>
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<tr>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>Forest Soils</td>
<td>Publicity and Public Relations</td>
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</tr>
<tr>
<td>Forest Range Management</td>
<td>T.J. 225</td>
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</tr>
<tr>
<td>For. 491 (Jr. W.)</td>
<td>For. 425 (Jr. S.)</td>
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<tr>
<td>3</td>
<td>Writing of Scientific Papers</td>
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<tr>
<td>Forest Protection</td>
<td>Engl. 414</td>
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<tr>
<td>For. 390 (Jr. S.)</td>
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<tr>
<td>Forest Entomology</td>
<td>Seminar</td>
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<tr>
<td>Zool 377 (Jr. F.)</td>
<td>For. 411</td>
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</table>

In addition to the above core curriculum, the student is required to take the following courses in his selected option.

**Forest Management Option**

<table>
<thead>
<tr>
<th>Surveying</th>
<th>Credits</th>
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<tbody>
<tr>
<td>C.E. 210 (Jr. F)</td>
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<tr>
<td>Introductory Genetics</td>
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<tr>
<td>Gen. 301 (Jr. F)</td>
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<tr>
<td>Forest Entomology</td>
<td>4</td>
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<tr>
<td>Zool 377 (Jr. F)</td>
<td>5</td>
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<tr>
<td>Forest Range Management</td>
<td>3</td>
</tr>
<tr>
<td>For. 491 (Jr. W.)</td>
<td>3</td>
</tr>
<tr>
<td>Forest Protection</td>
<td>3</td>
</tr>
<tr>
<td>For. 380 (Jr. S.)</td>
<td>4</td>
</tr>
<tr>
<td>Forest Photogrammetry</td>
<td>4</td>
</tr>
<tr>
<td>For. 445 (Sr. F)</td>
<td>4</td>
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<tr>
<td>Forest Influences</td>
<td>3</td>
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<tr>
<td>For. 407 (Sr. F)</td>
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<tr>
<td>Forest Pathology</td>
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<tr>
<td>For. 416 (Sr. S)</td>
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<tr>
<td>Forest Management</td>
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</tr>
<tr>
<td>For. 498 (Sr. S)</td>
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<tr>
<td>Humanities</td>
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<tr>
<td>Practical Work</td>
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<td>Ag. 104</td>
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**Forest Products Option**

<table>
<thead>
<tr>
<th>Wood Technology II</th>
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<tr>
<td>For. 389 (Jr. F)</td>
<td>3</td>
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<tr>
<td>Mechanical Behavior of Wood</td>
<td>4</td>
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<tr>
<td>For. 488 (Jr. W)</td>
<td>4</td>
</tr>
<tr>
<td>Wood Deterioration</td>
<td>4</td>
</tr>
<tr>
<td>Bot. 417 (Jr. W)</td>
<td>4</td>
</tr>
<tr>
<td>Physical Properties and Seasoning of Wood</td>
<td>3</td>
</tr>
<tr>
<td>For. 423 (Jr. S.)</td>
<td>3</td>
</tr>
<tr>
<td>Lumber Industry Organization</td>
<td>3</td>
</tr>
<tr>
<td>For. 438 (Sr. F)</td>
<td>3</td>
</tr>
<tr>
<td>Timber Processing I</td>
<td>3</td>
</tr>
<tr>
<td>For. 385 (Sr. W)</td>
<td>3</td>
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<tr>
<td>Timber Processing II</td>
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<tr>
<td>For. 487 (Sr. S.)</td>
<td>3</td>
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<td>Electives</td>
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<tr>
<td>Ag. 104</td>
<td>212</td>
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</tbody>
</table>

Total 212

*The humanities include art, history, literature, philosophy and music.
*Students in the Forest Products Option are required to select 20 credits from one of the areas of specialized training for the option.
Specialized Training

**Forest Management**

A student in Forest Management may develop an area of special emphasis within the framework of the option. This should be planned in consultation with his adviser. Elective credits are used for this purpose. Where essential to the development of a sound program, substitutions may be arranged subject to the approval of the adviser and the department head. Among the areas in which supporting programs may be developed are the following:

- Range Management
- Business Administration for Forestry
- Foreign Trade and Service
- Forest Recreation

**Forest Products**

Students in the Forest Products Option are required to select 20 credits of course work in one of the following groups:

- Wood Science and Technology
  - Selected courses in Mathematics, Chemistry, Physics, and Engineering Mechanics.
- Timber Industries (Production and Distribution)
  - Selected courses in Economics, Industrial Administration, Industrial Engineering, Psychology, and Statistics.

Selection of appropriate courses to fill this requirement is made by the student in consultation with his adviser.

**Fifth Year Majors**

Students expecting to complete any one of the fifth year groups should consult with their advisers during or before the junior year at which time the subjects to be taken will be outlined for the individual student for the senior and fifth years. This will make possible a proper sequence of subjects and provide for the courses of instruction required for the particular major group of his selection. Major sequences are those leading to the degree Bachelor of Science with majors in one of the following: Forest Management, Forestry Economics, Farm Forestry, Forest Range Management, Forest Products or Wood Technology.

**Curriculum in Horticulture**

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

See also *Technical Agriculture* for two-year program.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Botany</strong></td>
<td><strong>Algebra and Trig 1C</strong></td>
<td><strong>Fund of Soil Science</strong></td>
</tr>
<tr>
<td>Bot 101</td>
<td>Math 101C</td>
<td>Agron 154A</td>
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<tr>
<td>Prin of Composition</td>
<td>The Plant Kingdom</td>
<td>General Chemistry</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Bot 202</td>
<td>Chem 102</td>
</tr>
<tr>
<td>Prin of Horticulture</td>
<td>General Chemistry</td>
<td>Prin of Composition</td>
</tr>
<tr>
<td>Hort 114A</td>
<td>Chem 101</td>
<td>Engl 103</td>
</tr>
<tr>
<td><em>Algebra and Trig 1B</em></td>
<td>Prin of Composition</td>
<td>Vegetable Crops</td>
</tr>
<tr>
<td>Math 101B</td>
<td>Engl 102</td>
<td>Hort 164</td>
</tr>
<tr>
<td></td>
<td>Greenhouse Methods</td>
<td>Gen Psychology 1</td>
</tr>
<tr>
<td></td>
<td>Hort 154</td>
<td>Psych 101</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in the freshman and sophomore years six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

See *Mathematics* for descriptions of beginning courses. Course selected should be consistent with preparation.

<table>
<thead>
<tr>
<th>Sophomore Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag Meteorology</td>
</tr>
<tr>
<td>Agron 206</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in the freshman and sophomore years six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

*See Mathematics* for descriptions of beginning courses. Course selected should be consistent with preparation.
### FALL QUARTER Credits  
Principles of Economics Econ 241 3  
Principles of Zoology Zool 101 5  
General Physics Phys 111 4  
Library Instruction Lib 116 1  

### WINTER QUARTER Credits  
Principles of Economics Econ 242 3  
Plant Propagation Hort 214 3  

### SPRING QUARTER Credits  
Small Fruits Hort 224 3  
Principles of Statistics Stat 201A 3  
Turfgrass Management Hort 313 3  
Fund of Speech Sp 311 3  

**Additional to the general curriculum requirements, the student will include elective courses to meet the minimum number of credits for graduation.**  

*The humanities include art, history, literature, philosophy and music.*

### Specialized Training

The curriculum in horticulture provides opportunities for general or specialized training and preparation for graduate study through a free choice of electives. Students may modify the basic horticulture curriculum to conform with options selected. A faculty adviser will assist in selecting electives and in arranging schedules.

#### Arboriculture

- **Omit from basic curriculum:** Hort 164, 224, 244A, 491, Zool 375; Bot 407  
- **Add to basic curriculum:** For. 301; Bot. 356, 404, 416, Zool 377, T Jl 225, I Ad 384; Hort. 305, 314  
- **Electives:** (40 credits) Bot 216; I Ad 365C, 385, Psych 250, L A 111, 112, 113, 206; T Jl 325

#### Floriculture

- **Add to basic curriculum:** Hort 247B, 305, 314, 446, 447; Geol 100  
- **Electives:** (37 credits) Hort. 457; Psych 250; L A 111, 112, 113, Arch 214, Bot 216, 404

#### Fruit or Vegetable Crops

- **Add to basic curriculum:** Hort. 422, 467; Agron 114A.  
- **Elective:** (43 credits) Hort. 514, Psych 250; Bot 216, 404, 438; Geol 100, Hist. 440, 441, 442; I Ad 365C, Econ 335

#### Nursery Management

- **Omit from basic curriculum:** Hort. 224, 491  
- **Add to basic curriculum:** Agron. 453; A E. 306; Bot. 242; Geol. 100, L A. 206, Hort. 314, 446, 467.  
- **Electives:** (34 credits) Hort 224, 305; Bot. 216, 404, 416, 438; Engl. 205; I Ad 365C, 372, 425, 480; L A 111, 112, 113, 231, 233; T Jl 225.  

**Students wishing to enroll in a 4½ year program in Nursery Management during which they would work five quarters (two spring, two summer, one winter) should consult the Head of the Department of Horticulture.**

#### Science (for those preparing for graduate study)

- **Omit from basic curriculum:** Chem 231; Psych 101; Stat 201A.  
- **Add to basic curriculum:** Chem. 103, 334; Hort. 467, 514; Phys. 112, Stat 201.  
- **Electives:** (37 credits) Chem. 211, 335; Gen. 401; Geol 100; M L 231, 232, 233; Math. 102, 211, 212; Phys. 113; Bot. 404.

#### Turfgrass Management

- **Omit from basic curriculum:** Hort. 164, 224, 321, 414, 491.  
- **Add to basic curriculum:** Agron 114A, 424, 453, 473, 485; A E. 306, Bot 216, 424; Hort. 305, 314.  
- **Electives:** (31 credits) Engl. 205, 414; T Jl 225; I Ad 365, 384; Hist 440, 441, 442; Geol 100; Bot 356; A E 255, I Ed 261; L A 111, 113, 233; P E M 141-157

### Curriculum in Industrial Education

- With options in Teaching and Industry.  
- Administered by the Department of Education.  
- Leading to the degree Bachelor of Science. Total credits required, 202, plus six quarters of physical education.
Teaching Option
Provides preparation for teachers of industrial arts, or trades and industry, or both.

Industry Option
This option is available to those students who do not wish to meet the requirements for a teaching certificate. The work of the freshman and sophomore years is the same for all students. Students pursuing the industrial option may omit the professional courses required for a certificate and take other courses in their place. The program of the junior and senior years is planned to meet the needs of the individual student.

Students who complete satisfactorily at least 96 credits in this option and who find it impracticable to complete a four year program will receive a certificate in industrial education showing the completion of two years of work.

Students in this program generally find employment in industry. They may enter such positions as personnel work, selling, drafting and design, contracting and construction, maintenance and production methods.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawing and Projection</td>
<td>Graphical Theory and Application</td>
<td>Working Drawings and Applied Graphics</td>
</tr>
<tr>
<td>E Gr 131</td>
<td>E Gr 132</td>
<td>E Gr 133</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td>Prin of Composition</td>
<td>Prin of Composition</td>
</tr>
<tr>
<td>Engl 102</td>
<td>Engl 102</td>
<td>Engl 103</td>
</tr>
<tr>
<td>Tech and Appl. of</td>
<td>Algebra and Trig. II</td>
<td>Intro to Ind. Ed</td>
</tr>
<tr>
<td>Finishing Matl</td>
<td>Math. 102</td>
<td>I Ed 150</td>
</tr>
<tr>
<td>I Ed 105</td>
<td>Explor and Fund</td>
<td>Adv Tech of Wood</td>
</tr>
<tr>
<td>Introduction to Sociology</td>
<td>Fabrication of Wood</td>
<td>Fabrication</td>
</tr>
<tr>
<td>Soc 134</td>
<td>I Ed 106</td>
<td>I Ed 205</td>
</tr>
<tr>
<td>Algebra and Trig. I</td>
<td>Ind Arts Design</td>
<td>Basic Metal Processes</td>
</tr>
<tr>
<td>Math. 101</td>
<td>I Ed 250</td>
<td>I Ed 254</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credits</th>
<th>Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>3</td>
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<tr>
<td>3</td>
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</tr>
<tr>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: Ed. 110; and six quarters of physical education.

Students electing to take ROTC may apply ROTC credits toward the elective requirement.

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Principles of Economics</td>
<td>Principles of Economics</td>
<td>Electricity II</td>
</tr>
<tr>
<td>Econ 241</td>
<td>Econ. 242</td>
<td>I Ed 253</td>
</tr>
<tr>
<td>Sheet Metal Fabrication</td>
<td>Machine Metals I</td>
<td>Foundations of American Education</td>
</tr>
<tr>
<td>1 Ed. 255</td>
<td>I Ed 255</td>
<td>Ed 204</td>
</tr>
<tr>
<td>General Botany</td>
<td>Electricity I</td>
<td>Machine Constr</td>
</tr>
<tr>
<td>Bot. 101</td>
<td>I Ed 201</td>
<td>AE 359</td>
</tr>
<tr>
<td>Motor Mechanics I</td>
<td>Principles of Zoology</td>
<td>Basic Freehand Drawing</td>
</tr>
<tr>
<td>I Ed. 261</td>
<td>Zool 101</td>
<td>Arch 214</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>General Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chem. 101</td>
<td>Chem 102</td>
<td>3</td>
</tr>
<tr>
<td>Library Instruction</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Lib. 116</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students must elect, in addition to the courses outlined in the curriculum, one three credit course in either the physical sciences (physics, chemistry or geology) or biological sciences (botany, zoology or genetics) and one 3 credit course in the communicative arts (speech, English, journalism).

<table>
<thead>
<tr>
<th>Junior and Senior Years</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>History of the American Nation</td>
<td>History of the American Nation</td>
<td>History of the American Nation</td>
</tr>
<tr>
<td>Hist. 321</td>
<td>Hist 322</td>
<td>Hist. 323</td>
</tr>
<tr>
<td>Electronics I</td>
<td>School Shop Safety</td>
<td>Machine Metals II</td>
</tr>
<tr>
<td>I Ed. 357</td>
<td>I Ed 356</td>
<td>I Ed. 409</td>
</tr>
<tr>
<td>General Physics</td>
<td>Education</td>
<td>Fund. of Speech</td>
</tr>
<tr>
<td>Phys. 111</td>
<td>I Ed. 350</td>
<td>Sp 311</td>
</tr>
<tr>
<td>Crafts</td>
<td>American Government</td>
<td>Shop Planning and Organ</td>
</tr>
<tr>
<td>I Ed. 207</td>
<td>Govt. 215</td>
<td>1 Ed. 409</td>
</tr>
<tr>
<td></td>
<td>Ornamental Metal Design and Processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I Ed. 204</td>
<td></td>
</tr>
</tbody>
</table>

*History of the American Nation, History of the American Nation, and History of the American Nation must be taken in sequence.*

In addition to the courses listed previously a student electing the Teaching Option is required to take the courses listed below. The student electing the Industry Option must

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In addition to the courses listed previously a student electing the Teaching Option is required to take the courses listed below. The student electing the Industry Option must
complete the work listed previously and elect the balance of his program from the areas listed below, depending upon his educational objective.

### Teaching Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental Psychology</td>
<td></td>
</tr>
<tr>
<td>Psych 230 (F W S)</td>
<td>3</td>
</tr>
<tr>
<td>Educational Psychology</td>
<td></td>
</tr>
<tr>
<td>Psych. 333 (F W S)</td>
<td>3</td>
</tr>
<tr>
<td>Methods of Teaching</td>
<td></td>
</tr>
<tr>
<td>Ed 305 (F W S SSI, II)</td>
<td>4</td>
</tr>
<tr>
<td>Principles of Secondary Education</td>
<td></td>
</tr>
<tr>
<td>Ed 426 (F W S SSI)</td>
<td>3</td>
</tr>
<tr>
<td>Methods of Teaching I A</td>
<td></td>
</tr>
<tr>
<td>I.Ed. 415 (S SSI)</td>
<td>3</td>
</tr>
<tr>
<td>Observation and Supervised Teaching</td>
<td>9-12</td>
</tr>
<tr>
<td>I.Ed. 416 (F W )</td>
<td></td>
</tr>
<tr>
<td>The General Shop</td>
<td></td>
</tr>
<tr>
<td>I.Ed. 456 (F W )</td>
<td>3</td>
</tr>
<tr>
<td>Modern Materials Dsgn. and Constr.</td>
<td></td>
</tr>
<tr>
<td>I.Ed. 358 (F W S)</td>
<td>3</td>
</tr>
<tr>
<td>Teaching Secondary School Drawing</td>
<td>3</td>
</tr>
<tr>
<td>I.Ed. 354 (W S )</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>25-28</td>
</tr>
</tbody>
</table>

### Industry Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td></td>
</tr>
<tr>
<td>Industrial Administration</td>
<td></td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td></td>
</tr>
<tr>
<td>Industrial Psychology</td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>Forestry</td>
<td></td>
</tr>
<tr>
<td>Architecture</td>
<td></td>
</tr>
<tr>
<td>Architectural Engineering</td>
<td></td>
</tr>
<tr>
<td>Electives 25-30 Credits</td>
<td></td>
</tr>
</tbody>
</table>

### Landscape Architecture

Curriculum in Landscape Architecture, with options in Landscape Architecture and Urban Planning, leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

#### FALL QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Fundamentals</td>
<td></td>
</tr>
<tr>
<td>Arch 111</td>
<td>3</td>
</tr>
<tr>
<td>General Botany</td>
<td></td>
</tr>
<tr>
<td>Bot 101</td>
<td>3</td>
</tr>
<tr>
<td>Prin. of Composition</td>
<td></td>
</tr>
<tr>
<td>Engl. 101</td>
<td>3</td>
</tr>
<tr>
<td>L.A. Drawing</td>
<td></td>
</tr>
<tr>
<td>L.A. 111</td>
<td>2</td>
</tr>
<tr>
<td>Algebra &amp; Trig I</td>
<td></td>
</tr>
<tr>
<td>Math 101</td>
<td>5</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: L.A. 110 and six quarters of physical education.

Students electing ROTC may apply ROTC credits toward the elective requirements.

#### WINTER QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Fundamentals</td>
<td></td>
</tr>
<tr>
<td>Arch 112</td>
<td>3</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td></td>
</tr>
<tr>
<td>Engl. 102</td>
<td>3</td>
</tr>
<tr>
<td>L.A. Drawing</td>
<td></td>
</tr>
<tr>
<td>L.A. 112</td>
<td>2</td>
</tr>
<tr>
<td>Algebra &amp; Trig II</td>
<td></td>
</tr>
<tr>
<td>Math 102</td>
<td>5</td>
</tr>
</tbody>
</table>

#### SPRING QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arch Design &amp; Anal 1</td>
<td></td>
</tr>
<tr>
<td>Arch 113</td>
<td>3</td>
</tr>
<tr>
<td>Arch Graphics</td>
<td></td>
</tr>
<tr>
<td>Arch 133</td>
<td>3</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td></td>
</tr>
<tr>
<td>Engl. 103</td>
<td>3</td>
</tr>
<tr>
<td>Landscape Perception</td>
<td></td>
</tr>
<tr>
<td>L.A. 113</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Sophomore Year, Basic Program

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping, Computations, and</td>
<td></td>
</tr>
<tr>
<td>Land Surveying</td>
<td></td>
</tr>
<tr>
<td>C.E. 214</td>
<td>3</td>
</tr>
<tr>
<td>Intro to Geology</td>
<td></td>
</tr>
<tr>
<td>Geol. 102</td>
<td>3</td>
</tr>
<tr>
<td>American Government</td>
<td></td>
</tr>
<tr>
<td>Govt. 215</td>
<td>3</td>
</tr>
<tr>
<td>Plant Materials</td>
<td></td>
</tr>
<tr>
<td>L.A. 232</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Theory of Landscape Design

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.A. 213</td>
<td>3</td>
</tr>
<tr>
<td>Plant Materials</td>
<td></td>
</tr>
<tr>
<td>L.A. 253</td>
<td>3</td>
</tr>
</tbody>
</table>

### Option Requirements

In addition to the courses listed above, a student will be required to complete the courses listed under his selected option:

#### Landscape Architecture

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey of Art</td>
<td></td>
</tr>
<tr>
<td>A.A. 384</td>
<td>3</td>
</tr>
<tr>
<td>Fund of Soil Science</td>
<td></td>
</tr>
<tr>
<td>Agron. 154A</td>
<td>4</td>
</tr>
<tr>
<td>Concepts in Plant Science</td>
<td></td>
</tr>
<tr>
<td>Bot. 105</td>
<td>1</td>
</tr>
<tr>
<td>Plant Taxonomy</td>
<td></td>
</tr>
<tr>
<td>Bot 306</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Urban Planning

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td></td>
</tr>
<tr>
<td>Arch 363</td>
<td>3</td>
</tr>
<tr>
<td>Collaborative Transportation Dev</td>
<td></td>
</tr>
<tr>
<td>Engr. in City Planning</td>
<td></td>
</tr>
<tr>
<td>C.E. 404</td>
<td>3</td>
</tr>
<tr>
<td>Traffic Engineering</td>
<td></td>
</tr>
<tr>
<td>C.E. 450</td>
<td>4</td>
</tr>
</tbody>
</table>
### Landscape Architecture (cont’d)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 101</td>
<td></td>
</tr>
<tr>
<td>Collaborative Transportation Dev</td>
<td>3</td>
</tr>
<tr>
<td>C E 350</td>
<td></td>
</tr>
<tr>
<td>Engr in City Planning</td>
<td>3</td>
</tr>
<tr>
<td>C E 404</td>
<td></td>
</tr>
<tr>
<td>Principles of Economics</td>
<td>6</td>
</tr>
<tr>
<td>Econ 241, 242</td>
<td></td>
</tr>
<tr>
<td>Govt &amp; Conservation Policies</td>
<td>3</td>
</tr>
<tr>
<td>Govt 474</td>
<td></td>
</tr>
<tr>
<td>Garden Flowers</td>
<td>3</td>
</tr>
<tr>
<td>Hort 244B</td>
<td></td>
</tr>
<tr>
<td>Landscape Service</td>
<td>3</td>
</tr>
<tr>
<td>Hort 305</td>
<td></td>
</tr>
<tr>
<td>Turfgrass Management</td>
<td>3</td>
</tr>
<tr>
<td>Hort 313</td>
<td></td>
</tr>
<tr>
<td>History of Landscape Architecture</td>
<td>6</td>
</tr>
<tr>
<td>L A 201, 202</td>
<td></td>
</tr>
<tr>
<td>Details of Construction</td>
<td>9</td>
</tr>
<tr>
<td>L A 301, 302, 303</td>
<td></td>
</tr>
<tr>
<td>Landscape Design</td>
<td>9</td>
</tr>
<tr>
<td>L A 311, 312, 313</td>
<td></td>
</tr>
<tr>
<td>Planting Design</td>
<td>6</td>
</tr>
<tr>
<td>L A 334, 335, 336</td>
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</tr>
<tr>
<td>Travel &amp; Practice</td>
<td>R</td>
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<tr>
<td>L A 341, 342</td>
<td></td>
</tr>
<tr>
<td>Urban Problems &amp; Planning Goals</td>
<td>3</td>
</tr>
<tr>
<td>L A 361</td>
<td></td>
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<td>Public Recreation Facilities</td>
<td>3</td>
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<tr>
<td>L A 404</td>
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<tr>
<td>Advanced Landscape Design</td>
<td>12</td>
</tr>
<tr>
<td>L A 411, 412, 413</td>
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<tr>
<td>Professional Procedure</td>
<td>3</td>
</tr>
<tr>
<td>L A 441</td>
<td></td>
</tr>
<tr>
<td>Intro to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134</td>
<td></td>
</tr>
<tr>
<td>Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 218</td>
<td></td>
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<tr>
<td>Fundamentals of Speech</td>
<td>3</td>
</tr>
<tr>
<td>Sp 311</td>
<td></td>
</tr>
<tr>
<td>Principles of Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Stat 201A</td>
<td></td>
</tr>
<tr>
<td>Publicity &amp; Public Relations</td>
<td>3</td>
</tr>
<tr>
<td>TJI 225</td>
<td></td>
</tr>
<tr>
<td>*Electives</td>
<td>25</td>
</tr>
</tbody>
</table>

**Total** 200

*Electives to include 3 credits of a biological science and 4 credits of a physical science.

### Urban Planning (cont’d)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Principles of Economics</td>
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<tr>
<td>Econ 241, 242</td>
<td></td>
</tr>
<tr>
<td>Public Finance &amp; Fiscal Policies</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 405</td>
<td></td>
</tr>
<tr>
<td>Econ of Urban Dev &amp; City Plan</td>
<td>6</td>
</tr>
<tr>
<td>Econ 461, 462</td>
<td></td>
</tr>
<tr>
<td>Functions of American Govt</td>
<td>3</td>
</tr>
<tr>
<td>Govt 305</td>
<td></td>
</tr>
<tr>
<td>Municipal Govt &amp; Administration</td>
<td>3</td>
</tr>
<tr>
<td>Govt 311</td>
<td></td>
</tr>
<tr>
<td>American Political Thought</td>
<td>3</td>
</tr>
<tr>
<td>Govt 433</td>
<td></td>
</tr>
<tr>
<td>Details of Construction</td>
<td>3</td>
</tr>
<tr>
<td>L A 301</td>
<td></td>
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<tr>
<td>Landscape Design</td>
<td>9</td>
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<tr>
<td>L A 311, 312, 313</td>
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<td>Planting Design</td>
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<td>L A 334</td>
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</tr>
<tr>
<td>Travel &amp; Practice</td>
<td>R</td>
</tr>
<tr>
<td>L A 341, 342</td>
<td></td>
</tr>
<tr>
<td>Urban Problems &amp; Planning Goals</td>
<td>3</td>
</tr>
<tr>
<td>L A 361</td>
<td></td>
</tr>
<tr>
<td>Planning Anal &amp; Techniques</td>
<td>6</td>
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<tr>
<td>L A 372, 373</td>
<td></td>
</tr>
<tr>
<td>Theory of the Planning Process</td>
<td>3</td>
</tr>
<tr>
<td>L A 383</td>
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<tr>
<td>Urban Planning</td>
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</tr>
<tr>
<td>L A 431</td>
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<tr>
<td>Urban Renewal</td>
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</tr>
<tr>
<td>L A 432</td>
<td></td>
</tr>
<tr>
<td>Regional Planning</td>
<td>4</td>
</tr>
<tr>
<td>L A 433</td>
<td></td>
</tr>
<tr>
<td>Planning Law &amp; Administration</td>
<td>3</td>
</tr>
<tr>
<td>L A 432</td>
<td></td>
</tr>
<tr>
<td>Anal Geometry &amp; Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>Math 110</td>
<td></td>
</tr>
<tr>
<td>General Physics</td>
<td>8</td>
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<tr>
<td>Physics 111, 112</td>
<td></td>
</tr>
<tr>
<td>Intro to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134</td>
<td></td>
</tr>
<tr>
<td>Sociology of City Life</td>
<td>3</td>
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<tr>
<td>Soc 410</td>
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<tr>
<td>Human Ecology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 450</td>
<td></td>
</tr>
<tr>
<td>Fundamentals of Speech</td>
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<tr>
<td>Sp 311</td>
<td></td>
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<td>Principles of Statistics</td>
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<td>Stat 201</td>
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</tr>
<tr>
<td>Introd to High Speed Computing</td>
<td>3</td>
</tr>
<tr>
<td>Stat 380</td>
<td></td>
</tr>
<tr>
<td>**Electives</td>
<td>20</td>
</tr>
</tbody>
</table>

**Total** 200

**Curriculum in Plant Pathology**

Administered by the Department of Botany and Plant Pathology.

Leading to the degree Bachelor of Science. Total credits required, 200, plus six quarters of physical education.

The science of plant pathology has significance in agriculture because all cultivated plants are attacked by diseases. These diseases are controlled by procedures developed through experimentation in laboratories, greenhouses and field plots. A plant pathologist requires rigorous training in basic sciences early in his career so he can participate in research by which new disease control procedures are developed.

In addition to providing the basic training in agriculture and science required as undergraduate preparation for advanced study and professional degrees, this curriculum prepares students for positions in business, industry, government service and teaching. For certification requirements for teachers, see *Teacher Education.*
<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
</tr>
<tr>
<td>Freshman Year</td>
<td>Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>*General Chemistry</td>
<td>Chem 103</td>
<td>4</td>
</tr>
<tr>
<td>Chem 101</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>General Botany</td>
<td>The Plant Kingdom</td>
<td>3</td>
</tr>
<tr>
<td>Bot 101</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Algebra and Trig I</strong></td>
<td>Bot 202</td>
<td>5</td>
</tr>
<tr>
<td>Math 101</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td>Prin of Composition</td>
<td>3</td>
</tr>
<tr>
<td>Engl 101</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition to the courses listed, each student will be required to include in his freshman and sophomore years: Bot. 110; six quarters of physical education. Ag. 104 should be taken in the summer between his sophomore and junior years.

Students electing ROTC may apply ROTC credits toward the elective requirements.

*Qualified students may elect 101A and 102A instead of 101 and 102.

**See Mathematics for descriptions of beginning courses. Course selected should be consistent with preparation.

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Junior Year</th>
<th>Senior Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Psychology I</td>
<td>Organic Chemistry</td>
<td>Intro Western Civ</td>
</tr>
<tr>
<td>Psych 101</td>
<td>Chem 334</td>
<td>Hist 313</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Principles of Zoology</td>
<td>Modern Language (German, French or Russian)</td>
<td>Intro Western Civ</td>
</tr>
<tr>
<td>Zool 101</td>
<td>Chem 335</td>
<td>Hist 312</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Analytic Geometry and Calculus II</td>
<td>General Physics</td>
<td>General Bacteriology</td>
</tr>
<tr>
<td>Math 211</td>
<td>Phys 112</td>
<td>Bact 304</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Plant Anatomy</td>
<td>Prin of Economics</td>
<td><strong>Electives</strong></td>
</tr>
<tr>
<td>Bot 404</td>
<td>Econ 242</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Library Instruction</td>
<td>Undergraduate Seminar</td>
<td>Modern Language</td>
</tr>
<tr>
<td>Lib 116</td>
<td>Bot 399</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**A total of 15 of the elective hours is restricted to Agron. 114A or Hort. 114A and other subjects in agriculture.

Curriculum in Poultry Science

With options in Production, Science, Industry and International Service. Leading to the Degree of Bachelor of Science Total credits required, 206. Also see Technical Agriculture for two-year program.

**Production Option**

For those students interested in poultry farming, poultry farm management, county extension work, hatchery or feed service men, or with farm organizations.

**Industry Option**

For those students interested in business aspects of the poultry industry such as feed and hatchery service, plant management, poultry equipment sales, poultry products manufacture, government inspection service, sales advertising, promotion and public relations.
SCIENCE OPTION

For those students interested in research and development positions with feed companies, poultry breeders, egg and poultry products manufacture and firms supplying materials and services to the poultry industry. This option will serve as a pre-graduate program for those students who would like to become college teachers, research workers or extension specialists.

INTERNATIONAL SERVICE OPTION

For those students interested in international aspects of the poultry industry such as overseas employment by technical agencies of the federal government, with development programs of church groups or with foreign trade sections of businesses or industries.

General Requirements

1. Freshman Year:
   During this year the student should complete 9 credits in English (Group I) and at least 5 credits in Mathematics (Group II) and at least 30 credits in two or more of the other groups.

2. Sophomore, Junior and Senior Years:
   a. Requirements—Completion of group and option requirements.
   b. Electives—Completion of courses which will strengthen the student’s over-all program, the selection of courses being based upon the career objectives of the student.

3. Students taking ROTC may apply credits toward elective requirements.

Group Requirements

As a prerequisite to graduation, to provide a broad education in the physical, biological, and social sciences and in the humanities, each student must complete, sometime during the four years, the number of credits in the areas specified in each of the eight groups, including those courses listed.

<table>
<thead>
<tr>
<th>Group</th>
<th>Credits</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. English and Speech</td>
<td>15</td>
<td>Engl 101, 102, 103, Sp 311</td>
</tr>
<tr>
<td>II. Mathematics and Statistics</td>
<td>13</td>
<td>Math 101, 102, Stat 201A</td>
</tr>
<tr>
<td>III. Physical Sciences</td>
<td>16</td>
<td>Chem 101, 102, Phys 111, Biochem &amp; Biophys 301</td>
</tr>
<tr>
<td>IV. Biological Sciences</td>
<td>24</td>
<td>Zool 101, 102, 234, Gen 301, Bact 304</td>
</tr>
<tr>
<td>V. Social Sciences and Humanities</td>
<td>12</td>
<td>Govt 215, 3 crs (Economics, Sociology, Govt, Psychology, 9 crs)</td>
</tr>
<tr>
<td>VI. Poultry Science</td>
<td>28</td>
<td>Po S 101, 110, 301, 302, 305, 401, 402, 403, and 404</td>
</tr>
<tr>
<td>VII. Technical Agricultural and Veterinary Science</td>
<td>16</td>
<td>An S 318, 350, Vet Anat 217, Vet Phys 264</td>
</tr>
<tr>
<td>VIII. Other</td>
<td>7</td>
<td>P E (6 quarters), Library 116</td>
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</table>

Option Requirements

<table>
<thead>
<tr>
<th>Industry</th>
<th>Credits</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Required courses</td>
<td>17</td>
<td>Chem 231, Econ 313, 335, 403, Psych 250</td>
</tr>
<tr>
<td>2 Electives</td>
<td>46</td>
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</table>

<table>
<thead>
<tr>
<th>Production</th>
<th>Credits</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Required courses</td>
<td>8</td>
<td>Chem 231, Psych 250</td>
</tr>
<tr>
<td>2 Electives</td>
<td>55</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Science</th>
<th>Credits</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Required courses</td>
<td>29</td>
<td>Chem 103, 211, 334, 335, Phys 112, Math 110, 211</td>
</tr>
<tr>
<td>2 Electives</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

Students electing ROTC may apply ROTC credits toward elective requirement.
Other Programs in the College of Agriculture

Dairy Plant Operation

Administered by the Department of Dairy and Food Industry.
Leading to a Certificate in Dairy Plant Operation.
This program includes instruction in the manufacture of various milk products and the handling of market milk. The object is to fit students for positions as butter, cheese, and ice cream makers, milk plant operators or managers of dairy plants.

For description of courses in Dairy and Food Industry, see Courses of Instruction.

**FIRST QUARTER—FALL**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Dairy Equipment</td>
<td>3</td>
</tr>
<tr>
<td>D.F.I. 269</td>
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</tr>
<tr>
<td>Dairy Technology</td>
<td>4</td>
</tr>
<tr>
<td>D.F.I. 152</td>
<td></td>
</tr>
<tr>
<td>Testing Milk and Milk Products</td>
<td>4</td>
</tr>
<tr>
<td>D.F.I. 156</td>
<td></td>
</tr>
<tr>
<td>Dairy Bacteriology</td>
<td>6</td>
</tr>
<tr>
<td>D.F.I. 265</td>
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</table>

**SECOND QUARTER—WINTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Dairy Technology</td>
<td>4</td>
</tr>
<tr>
<td>D.F.I. 153</td>
<td></td>
</tr>
<tr>
<td>Ice Cream and Ices</td>
<td>5</td>
</tr>
<tr>
<td>D.F.I. 158</td>
<td></td>
</tr>
<tr>
<td>Mathematics for Two Year</td>
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</tr>
<tr>
<td>Students in Agriculture</td>
<td>5</td>
</tr>
<tr>
<td>Math. 100</td>
<td></td>
</tr>
<tr>
<td>Prin. of Composition</td>
<td>3</td>
</tr>
<tr>
<td>Engl. 101</td>
<td>17</td>
</tr>
</tbody>
</table>

In addition to the courses listed above, each student will be required to include in his schedule: Ag. 104 and two quarters of physical education.

**THIRD QUARTER—FALL**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Market Milk</td>
<td>5</td>
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<tr>
<td>D.F.I. 256</td>
<td></td>
</tr>
<tr>
<td>Condensed and Dried Milk Products</td>
<td>4</td>
</tr>
<tr>
<td>D.F.I. 258</td>
<td></td>
</tr>
<tr>
<td>Voice and Diction</td>
<td>2</td>
</tr>
<tr>
<td>Sp. 207</td>
<td></td>
</tr>
<tr>
<td>Survey of Accounting</td>
<td>3</td>
</tr>
<tr>
<td>T.A. 75</td>
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</tr>
<tr>
<td>Prin. of Composition</td>
<td>3</td>
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<tr>
<td>Engl. 102</td>
<td>17</td>
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</table>

**FOURTH QUARTER—WINTER**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Butter Manufacture</td>
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</tr>
<tr>
<td>D.F.I. 157</td>
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</tr>
<tr>
<td>Cheese Manufacture</td>
<td>5</td>
</tr>
<tr>
<td>D.F.I. 159</td>
<td></td>
</tr>
<tr>
<td>Dairy Plant Management</td>
<td>6</td>
</tr>
<tr>
<td>D.F.I. 260</td>
<td>16</td>
</tr>
</tbody>
</table>

For undergraduate curriculum in dairy industry with options in technology, science and business, see Dairy Industry, Curriculum.

Technical Agriculture

Two-year programs are offered in Agricultural Business, Agronomy, Animal Science, Dairy Science, Farm Operation, Horticulture, Industrial Education and Poultry Science. A student may be recommended for a Certificate in Technical Agriculture if he maintains a 1.75 grade point average and meets the course requirements shown below.

**COURSE REQUIREMENTS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. English</td>
<td>6</td>
</tr>
<tr>
<td>English 101 and 102</td>
<td></td>
</tr>
<tr>
<td>*Speech</td>
<td>3</td>
</tr>
<tr>
<td>II. Mathematics</td>
<td>5</td>
</tr>
<tr>
<td>Math. 100 or 101</td>
<td></td>
</tr>
<tr>
<td>III. Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Govt. 215</td>
<td></td>
</tr>
<tr>
<td>Econ. 241, 242</td>
<td>6</td>
</tr>
<tr>
<td>Sociology</td>
<td>3 or 4</td>
</tr>
<tr>
<td>IV. Physical and Biological Sciences</td>
<td>3 or 4</td>
</tr>
<tr>
<td>Bot. 101 or Zool. 101 or 102</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 101</td>
<td></td>
</tr>
<tr>
<td>Genetics or Physics</td>
<td>3 or 4</td>
</tr>
<tr>
<td>Elective in Physical or Biological Sciences</td>
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</tr>
<tr>
<td>V. Agriculture</td>
<td>5</td>
</tr>
<tr>
<td>An.S. 114</td>
<td></td>
</tr>
<tr>
<td>Agron. 154A</td>
<td>4</td>
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<tr>
<td>Ag. Econ. 130</td>
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</tr>
<tr>
<td>Hort. 114A or Agron. 114A</td>
<td>3 or 4</td>
</tr>
</tbody>
</table>
Science Option

For those students interested in research and development positions with feed companies, poultry breeders, egg and poultry products manufacture and firms supplying materials and services to the poultry industry. This option will serve as a pre-graduate program for those students who would like to become college teachers, research workers or extension specialists.

International Service Option

For those students interested in international aspects of the poultry industry such as overseas employment by technical agencies of the federal government, with development programs of church groups or with foreign trade sections of businesses or industries.

General Requirements

1. Freshman Year:
   During this year the student should complete 9 credits in English (Group I) and at least 5 credits in Mathematics (Group II) and at least 30 credits in two or more of the other groups.

2. Sophomore, Junior and Senior Years:
   a. Requirements—Completion of group and option requirements.
   b. Electives—Completion of courses which will strengthen the student’s over-all program, the selection of courses being based upon the career objectives of the student.

3. Students taking ROTC may apply credits toward elective requirements.

Group Requirements

As a prerequisite to graduation, to provide a broad education in the physical, biological, and social sciences and in the humanities, each student must complete, sometime during the four years, the number of credits in the areas specified in each of the eight groups, including those courses listed.

<table>
<thead>
<tr>
<th>Group</th>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>English and Speech</td>
<td>15 Eng 101, 102, 103, Sp 311</td>
</tr>
<tr>
<td>II</td>
<td>Mathematics and Statistics</td>
<td>13 Math 101, 102, Stat 201A</td>
</tr>
<tr>
<td>III</td>
<td>Physical Sciences</td>
<td>16 Chem 101, 102, Phys 111, Biochem &amp; Biophys 301</td>
</tr>
<tr>
<td>IV</td>
<td>Biological Sciences</td>
<td>24 Zool 101, 102, 234, Gen 301, Bact 304</td>
</tr>
<tr>
<td>V</td>
<td>Social Sciences and Humanities</td>
<td>12 Govt 215, 3 crs (Economics, Sociology, Govt, Psychology, 9 crs)</td>
</tr>
<tr>
<td>VI</td>
<td>Poultry Science</td>
<td>28 Po 101, 110, 301, 302, 305, 401, 402, 403, and 404</td>
</tr>
<tr>
<td>VIII</td>
<td>Other</td>
<td>7 P E (6 quarters), Library 116</td>
</tr>
</tbody>
</table>

Option Requirements

<table>
<thead>
<tr>
<th>Industry</th>
<th>Required courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chem 231, Econ 313, 335, 403, Psych 250</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Production</th>
<th>Required courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chem 231, Psych 250</td>
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<table>
<thead>
<tr>
<th>Science</th>
<th>Required courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Chem 103, 211, 334, 335, Phys 112, Math 110, 211</td>
<td>29</td>
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</table>

<table>
<thead>
<tr>
<th>International Service</th>
<th>Electives</th>
<th>Credits</th>
</tr>
</thead>
</table>

Students electing ROTC may apply ROTC credits toward elective requirement.
Other Programs in the College of Agriculture

Dairy Plant Operation

Administered by the Department of Dairy and Food Industry.
Leading to a Certificate in Dairy Plant Operation.
This program includes instruction in the manufacture of various milk products and the handling of market milk. The object is to fit students for positions as butter, cheese, and ice cream makers, milk plant operators or managers of dairy plants.

For description of courses in Dairy and Food Industry, see Courses of Instruction.

FIRST QUARTER—FALL  
Dairy Equipment  
D.F.I 269  
Dairy Technology  
D.F.I 152  
Testing Milk and Milk Products  
D.F.I 156  
Dairy Bacteriology  
D.F.I 265

SECOND QUARTER—WINTER  
Dairy Technology  
D.F.I. 153  
Ice Cream and Ices  
D.F.I. 158  
Mathematics for Two Year Students in Agriculture  
Math. 100  
Prin. of Composition  
Engl. 101

In addition to the courses listed above, each student will be required to include in his schedule: Ag. 104 and two quarters of physical education.

THIRD QUARTER—FALL  
Market Milk  
D.F.I. 256  
Condensed and Dried Milk Products  
D.F.I. 258  
Voice and Diction  
Sp. 207  
Survey of Accounting  
I.Ad. 75

FOURTH QUARTER—WINTER  
Butter Manufacture  
D.F.I. 157  
Cheese Manufacture  
D.F.I. 159  
Dairy Plant Management  
D.F.I. 260

For undergraduate curriculum in dairy industry with options in technology, science and business, see Dairy Industry, Curriculum.

Technical Agriculture

Two-year programs are offered in Agricultural Business, Agronomy, Animal Science, Dairy Science, Farm Operation, Horticulture, Industrial Education and Poultry Science. A student may be recommended for a Certificate in Technical Agriculture if he maintains a 1.75 grade point average and meets the course requirements shown below.

COURSE REQUIREMENTS

I. English
   English 101 and 102  6
*Speech  3

II. Mathematics
   Math. 100 or 101  5

III Social Sciences
   Govt 215  3
   Econ. 241, 242  6
   Sociology  3 or 4

IV Physical and Biological Sciences
   Bot. 101 or Zool. 101 or 102  3 or 4
   Chem. 101  4
   Genetics or Physics  3 or 4
   Elective in Physical or Biological Sciences  3

V. Agriculture
   An S. 114  5
   Agron. 154A  4
   Ag. Econ. 130  4
   Hort. 114A or Agron. 114A  3 or 4
144/Colleges and Curricula

Electives (in or closely related to field of major interest) to be chosen in consultation with adviser

VI Free Electives 19 to 22

96

*Students who find it feasible to take Eng1 103 and Sp. 311 are encouraged to do so.

Training in Agriculture with Special Objectives

Training for Extension Service

Students interested in preparing for work in the Extension Service may be referred to an Extension adviser who is a member of the Agricultural Extension Service Central Staff. In cooperation between the Extension adviser and the student’s departmental adviser, the following courses may be recommended for substitution in place of required courses or used as electives in the student’s curriculum. The program indicates the quarter in which it would be desirable to take the recommended courses, although the courses might be taken in other quarters. This program should be planned not later than the sophomore year. Such students will remain in one of the regular subject matter curricula.

FALL QUARTER Credits

General Psychology I Psych 101 3
Survey of Extension Education Ag Ed 211B 1

WINTER QUARTER Credits

Sophomore Year

Methods of Teaching Ed 305 3 or 4
Rural Institutions and Organizations Soc 200 4

Junior Year

Adm and Org of Ext Ed Ed 466 3
Methods of Ext Ed Ed 467 3
Publicity and Public Relations TJI 225 3

Senior Year

Hort Entomology Zool 375 4
Community Action Soc 464 3
Group Dynamics Soc 364 3
Mgt of Ten-Op Farms Econ 432 2

Preparation for Graduate Study

The student who expects to earn an advanced degree in an area of technical agriculture should take some of the more fundamental courses indicated below. In addition to these strongly recommended courses, students will find calculus, physical chemistry, genetics, bacteriology, botany, and zoology to be valuable. The student should consult his adviser in determining the extent to which he might substitute these fundamental courses for the more applied courses required in his curriculum.

A knowledge of statistics and the principles of technical writing are essential in the preparation of a thesis, which is required for the Master of Science or Doctor of Philosophy degree in Agriculture. Graduate students usually are required to have a reading knowledge of French, Spanish, Russian or German before the Master’s degree can be conferred; they must have a reading knowledge of two languages before the Doctor’s degree can be conferred.
### FALL QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra and Trig. I, Math. 101</td>
<td>5</td>
</tr>
<tr>
<td>Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 103</td>
<td></td>
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</tbody>
</table>

### WINTER QUARTER

#### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra and Trig. II, Math. 102</td>
<td>5</td>
</tr>
<tr>
<td>Organic Chemistry, Chem 334</td>
<td>4</td>
</tr>
</tbody>
</table>

**Credits**

### SPRING QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytic Geometry and Calculus I, Math. 110</td>
<td>5</td>
</tr>
<tr>
<td>Organic Chemistry, Chem. 335</td>
<td>4</td>
</tr>
</tbody>
</table>

### Junior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative Analysis, Chem 211</td>
<td>5</td>
</tr>
<tr>
<td>General Physics, Phys. 111</td>
<td>4</td>
</tr>
</tbody>
</table>

**Credits**

### Senior Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Knowledge of Sci. French (or German), M L 201A (or 213A)</td>
<td>3</td>
</tr>
<tr>
<td>Principles of Statistics, Stat 201</td>
<td>5</td>
</tr>
<tr>
<td>Reading Knowledge of Sci. French (or German), M L 202A (or 232A)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Credits**

### Training for International Service

Agricultural students desiring to work in foreign countries with private industry, governmental agencies, or private foundations and institutions are referred to the section headed *International Service Programs* for suggested courses they might take as electives or substitute for required courses.
The engineer occupies a unique and a most important position in our modern civilization. He has the responsibility of taking the discoveries of basic science and translating them into products, structures, facilities and services for the use of mankind.

In his professional practice, an engineer may conduct research on problems of fundamental engineering importance; he may develop new materials, structures, machines or devices for civilian or military use; he may design such devices for production; he may develop and design processes and plants for producing raw materials and finished products; he may operate or manage large public utility systems, construction companies or industrial plants; he may engage in technical sales work; or he may become an engineering teacher. In all of these activities, the engineer must combine imagination, resourcefulness, inventive skill, economic sense and good judgment in applying his scientific knowledge in the service of mankind. An engineering education is an excellent foundation for any career in our modern civilization where technology is so important.

Objectives of Curricula in Engineering

The broad objectives of engineering education are to develop the student's professional competence and, by breadth of study, to prepare him for participation as a leader in the affairs of his profession, his community, the state and the nation. Engineering education seeks to develop a capacity for objective and analytical thought. It requires a sound knowledge of English and of the basic sciences of chemistry, physics, mathematics and economics, as well as the specialized phases of these studies needed for particular fields of engineering. The training is characterized by practice in the analysis and solution of problems by the application of knowledge to life situations. Since engineers also must deal with problems involving human relations, about one-fifth of the engineering curricula involve the social sciences and the humanities. Special attention is devoted to a development of the student's ability to write and speak effectively.

The curricula in engineering permit in the outlined four years a thorough preparation in the basic and engineering sciences and in professional analysis and design. About one-fourth of the total content of each curriculum is devoted to each of these three fields, with five to ten percent of the total made up of options and electives. These proportions meet the requirements recommended by the Engineers' Council for Professional Development, the national accrediting agency.

Registration as a professional engineer is required for many types of engineering positions. Such registration is granted by the individual states after the successful completion of an examination in engineering fundamentals, of four years of experience and of a final examination in engineering practice. The curricula at Iowa State University prepare a student for registration and frequently the first examination can be taken at the University shortly before graduation.

More advanced work in the engineering sciences and their application to engineering is offered in the postgraduate programs. For details of graduate study in engineering, see the Graduate College section.

Organization of Curricula

All curricula in engineering are divided into two phases, a basic program and a professional program. The basic program consists primarily of subjects fundamental and common to all branches of engineering and includes chemistry or physics, mathematics, engineering graphics and English. A student who has adequate high school preparation is expected to complete
the basic program in one year. The professional phase of a curriculum includes intensive study in the particular branch of engineering which a student chooses as his major, as well as a continuation of supporting work in mathematics, basic sciences and humanities.

Preparation for the Engineering Curricula
A student who wishes to complete a particular engineering curriculum in four years (five years in the case of Architecture) should present high school credits as follows:

Four years English  Four years mathematics, including two years algebra, one
One year physics  year geometry, one-half year trigonometry.
One year chemistry

A student not having these prerequisites may still enroll in the College of Engineering, but it may take longer than four years to complete the program. The basic program in engineering is flexible with respect to time, and courses in the basic program may be adjusted to fit individual needs. A student is expected to complete the requirements of the basic program before proceeding to the professional curriculum of his choice.

Advising System
The College of Engineering advising system's purpose is to maintain close contact with the student during his college career.

The College also offers counseling service during the summer for students planning to enter in the fall. All prospective engineering students are encouraged to attend one of these sessions. Tests given at this time help determine the student's level of achievement and enable his adviser to prepare an appropriate fall quarter program for the student. Students planning to attend a junior or liberal arts college before entering Iowa State University also are invited to attend one of the sessions.

Cooperative Programs
The College of Engineering offers, through certain of its curricula, cooperative programs in which students may gain practical experience in engineering during their college years.
These programs are set up so the science of engineering is taught at the University and the practice of engineering is obtained by working in industry certain periods each year. The student under a cooperative program receives experience in his chosen profession plus financial return. The company can evaluate the student's potential as a possible future permanent employee. The college gains by the industrial experiences which the cooperative student brings into the classroom.

In general, students under this program will require one year more to complete the usual bachelor's degree program. The first contact with industry usually comes after completion of the first or second year. The college does not guarantee the kind of work or wages but attempts to place students to their best educational and financial advantages.

A student must observe regulations of the employing company and must not expect special treatment. University holidays do not include cooperative students, nor are students allowed time off for University activities. A student may not enroll in classes at any educational institution during a period of cooperative employment without University approval.

Those in the cooperative program are considered by the University to be students while they are employed in industry. Such students are subject to University regulations concerning conduct during this period and are liable to dismissal from the University for misconduct on the job. They may continue living in University housing during work periods.

Cooperative students pay no fees to the University for work periods but may attend student activities provided they pay the activity fee.

### ENGINEERING CURRICULA

<table>
<thead>
<tr>
<th>Administrative Department</th>
<th>Type of Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D joint major</td>
</tr>
<tr>
<td>Agricultural Engineering</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Architecture</td>
<td>5 yr. B.Arch., M.Arch.</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>M.S or Ph.D (graduate only)</td>
</tr>
<tr>
<td>Ceramic Engineering</td>
<td>4 yr B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>4 yr B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Engineering Mechanics</td>
<td>M.S., Ph.D (graduate only)</td>
</tr>
<tr>
<td>Engineering Operations</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Engineering Science</td>
<td>4 yr. B.S.</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>4 yr regular and 5 yr cooperative B.S., M.S., Ph.D</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>4 yr. B.S., M.S., Ph.D joint major</td>
</tr>
<tr>
<td>Metallurgy</td>
<td>M.S., Ph.D (graduate only)</td>
</tr>
<tr>
<td>Nuclear Engineering</td>
<td>2 yr Associate in Applied Science</td>
</tr>
</tbody>
</table>

### Technical Institute Programs

- Chemical Industries Technology
- Construction Technology
- Electronics Technology
- Mechanical Technology

2 yr Associate in Applied Science
Physical Education

In addition to the requirements listed in the various engineering curricula, all students are required to take six quarters of physical education. See Physical Education for Men for details. A student is expected to enroll in Physical Education during his first quarter in school and to continue enrolling in it each subsequent quarter until the requirement is completed. Credits received in the required physical education courses may not be used as electives in any of the engineering curricula.

Basic Program

Selection of Curriculum by the Student. The basic programs for all professional curricula of the College of Engineering are similar, and thus a student may transfer from one department to another within the College without undue loss of time. There are some differences, however, so the student who desires to complete his work in minimum time will find it desirable to select his major department as soon as possible.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>1General Chemistry</td>
<td>1Systematic Inorganic Chemistry</td>
<td>1To be designated by Major Department</td>
</tr>
<tr>
<td>Chem 102A or or</td>
<td>Chem 103 or</td>
<td>or</td>
</tr>
<tr>
<td>1General Physics or</td>
<td>1General Physics</td>
<td>3General Physics</td>
</tr>
<tr>
<td>Phys 221</td>
<td>or</td>
<td>Phys 223</td>
</tr>
<tr>
<td>Drawing and Projection Phys 222</td>
<td>Graphical Theory and Application</td>
<td>2Method of Engr</td>
</tr>
<tr>
<td>E Gr 131</td>
<td>or</td>
<td>E Gr 132</td>
</tr>
<tr>
<td>2Methods of Engr Computation Analytic Geometry and Calculus II</td>
<td>1Analytic Geometry and Calculus II</td>
<td>Analytic Geometry and Calculus III</td>
</tr>
<tr>
<td>1 E 108</td>
<td>Math 211</td>
<td>Math 212</td>
</tr>
<tr>
<td>Analytic Geometry and Calculus I</td>
<td>5Prin of Composition</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td>Library Instruction</td>
<td>Elective</td>
</tr>
<tr>
<td>Engr 101</td>
<td>Lib 106</td>
<td>3</td>
</tr>
<tr>
<td>Orientation</td>
<td>Orientation</td>
<td>Engr 100</td>
</tr>
<tr>
<td>Engr 114</td>
<td>Engr 115</td>
<td>R</td>
</tr>
<tr>
<td>15-16</td>
<td>15-16</td>
<td>17-19</td>
</tr>
</tbody>
</table>

1Basic Program requirements for the individual curricula include:

Aero. E ....... Chem. 102A Fall, Chem 103 Winter; Phys. 221 Spring; Social-humanistic elective in place of E. Gr. 133.

A E .......... Chem. 102A Fall, Chem. 103 Winter, and Phys. 221 Spring.
Arch .................. See Curriculum in Architecture for first year.

Cer E .......... Chem. 102A Fall, Chem. 103 Winter; and Phys. 221 Spring.

Ch E ....... Chem. 102A Fall, Chem. 103 Winter; I.E. 109 Winter; 3 hr. elective plus additional 3 hr. elective outside Chem. E. in place of E. Gr. 133.

C.E. ....... Chem. 102A Fall, Chem. 103 Winter; I.E. 109 Winter; C.E. 111 Spring; C.E. 112 and 113 in S.S.

E E .......... Phys. 221, 222, 223; Econ. 241 in place of E. Gr. 133.

Engr Op ........ See Engineering Operations for the requirements of the curriculum.


M.E. ......... Chem. 102A Fall, Chem. 103 Winter; I.E. 109 Winter; Phys. 221 Spring.

Met .......... Chem. 102A Fall, Chem. 103 Winter; 3 hr. elective plus additional 3 hr. elective outside Met in place of E. Gr. 113.

2Students who begin with Math 101 will take I.E. 104 and 105. All others will take I.E. 108

3Students electing to take Basic ROTC may apply ROTC credits toward this elective requirement. For others, this is an unrestricted elective except that Math. 101, 102, Chem. 101, and I.E. 104, 105 may not be used to satisfy this or other elective requirements of the various engineering curricula.

Based upon the student’s preparation and progress his adviser may require or recommend courses in addition to those specified above. Students must essentially complete the Basic Program and have at least a 2.00 cumulative average before being permitted to enroll in courses offered in the College of Engineering at the 200 level or above.
### Curriculum in Aerospace Engineering

Leading to the degree Bachelor of Science. Total credits required, 211. See also Basic Program.

#### FALL QUARTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerodynamics I</td>
<td>2</td>
</tr>
<tr>
<td>Aero E 244</td>
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</tr>
<tr>
<td>Analytical Geometry and Calculus IV</td>
<td>3</td>
</tr>
<tr>
<td>Math 213</td>
<td></td>
</tr>
<tr>
<td>Aerospace Laboratory</td>
<td>1</td>
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<tr>
<td>Aero E 271</td>
<td></td>
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<tr>
<td>Statics of Engr</td>
<td>4</td>
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<td>E M 274</td>
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<tr>
<td>Intro to Numerical</td>
<td>2</td>
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<tr>
<td>Tech for Computers</td>
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<tr>
<td>Math 215</td>
<td></td>
</tr>
<tr>
<td>Programming of Digital Computers</td>
<td>1</td>
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<tr>
<td>Math 217</td>
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<tr>
<td>8Fundamentals of Speech</td>
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<tr>
<td>Sp 311</td>
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<tr>
<td>2Socio-Humanistic</td>
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#### WINTER QUARTER

**Sophomore Year**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Aerodynamics II</td>
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<tr>
<td>Aero E 245</td>
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<tr>
<td>Introduction to</td>
<td></td>
</tr>
<tr>
<td>Applied Mathematics</td>
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<tr>
<td>Math 321</td>
<td></td>
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<tr>
<td>Aerospace Laboratory</td>
<td>1</td>
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<tr>
<td>Aero E 272</td>
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<tr>
<td>Dynamics of Engr</td>
<td>4</td>
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<tr>
<td>E M 344</td>
<td></td>
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<tr>
<td>Introductory Metallurgy</td>
<td>3</td>
</tr>
<tr>
<td>Met 202</td>
<td></td>
</tr>
<tr>
<td>2Socio-Humanistic</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
</tr>
<tr>
<td>17</td>
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**Junior Year**

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Stress Analysis and Materials</td>
<td>4</td>
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<tr>
<td>Aero E 320</td>
<td></td>
</tr>
<tr>
<td>Aerospace Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Aero E 372</td>
<td></td>
</tr>
<tr>
<td>Stability and Control II</td>
<td>3</td>
</tr>
<tr>
<td>Aero E 343</td>
<td></td>
</tr>
<tr>
<td>Electronic Circuits,</td>
<td>4</td>
</tr>
<tr>
<td>Instruments and Systems</td>
<td></td>
</tr>
<tr>
<td>E E 445</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics I</td>
<td>4</td>
</tr>
<tr>
<td>M E 321</td>
<td></td>
</tr>
<tr>
<td>2Socio-Humanistic</td>
<td>3</td>
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<tr>
<td>Elective</td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
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<tr>
<td>Design and Analysis I</td>
<td>3</td>
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<tr>
<td>Aero E 461</td>
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</tr>
<tr>
<td>Aerospace Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Aero E 472</td>
<td></td>
</tr>
<tr>
<td>1Technical Electives</td>
<td>9</td>
</tr>
<tr>
<td>2Socio-Humanistic Electives</td>
<td>6</td>
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<tr>
<td>Aerospace Seminar</td>
<td>19</td>
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<tr>
<td>Aero E 492</td>
<td></td>
</tr>
<tr>
<td>Design and Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>Aero E 462</td>
<td></td>
</tr>
<tr>
<td>Aerospace Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Aero E 473</td>
<td></td>
</tr>
<tr>
<td>1Technical Electives</td>
<td>9</td>
</tr>
<tr>
<td>2Socio-Humanistic Elective</td>
<td>3</td>
</tr>
<tr>
<td>Aerospace Seminar</td>
<td>16</td>
</tr>
<tr>
<td>Aero E 493</td>
<td></td>
</tr>
</tbody>
</table>

1. Technical electives are to be taken as sequences: (at least two (2) sequences must be taken from Group I):
   - Group I: Aero E 442, 443; Aero E 421, 423 or 480; Aero E 452, 453; Aero E 413, 470B, Aero E 440, 470E.
   - Group II: Electrical Engineering, Mathematics (including 404, 407, and 408), Mechanical Engineering (including M E. 325), Metallurgy, Nuclear Engineering, Junior or Senior Phys., Statistics (including Stat. 201B and 380) and advanced ROTC sequences.
2. These courses are to be chosen from the Department-approved list of Socio-Humanistic sequences. Govt. 215 must be among the courses selected.
3. These courses may be omitted by students taking Basic ROTC.
Curriculum in Agricultural Engineering

With options in Electric Power and Processing, Farm Power and Machinery, Farm Structures, and Soil and Water Control.

Administered jointly by the College of Agriculture and the College of Engineering.

Leading to the degree Bachelor of Science. Credits required for graduation, 210. Six months of practical work in agriculture or industry acceptable to this department is required before graduation.

See also Basic Program and Cooperative Programs

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| **Junior Year** | | | | | |
| Applications of Electrical Energy | A E 352 | 3 | A-c and D-c Circuits | E.E. 442 | 4 |
| A-c and D-c Circuits | E E 441 | 4 | Thermodynamics I | M E 321 | 4 |
| Dynamics of Engr | E M 344 | 4 | Mechanics of Fluids | E M 378 | 4 |
| **Socio-Humanistic Electives** | 3 | **Socio-Humanistic Electives** | 3 | **Socio-Humanistic Electives** | 3 |
| Seminar | A E 301 | R | Seminar | A E 302 | R |
| **Option or Electives** | 3 | **Option or Electives** | 3 | **Option or Electives** | 3 |
| **Total** | 17 | | 18 | | 19 |

| **Senior Year** | | | | | |
| Hydraulic Design of Soil and Water Control Facilities | A E 424 | 3 | Applications of Electrical Principles to Agr Equipment | A E 461 | 4 |
| Principles of Economics | Econ 242 | 3 | Crop Conditioning and Storage | A E 464 | 3 |
| **Socio-Humanistic Electives** | 3 | Environmental Control in Agr Structures | A E 488 | 3 |
| Seminar | A E 401 | R | Prices and Resource Allocation | Econ 307 | 3 |
| **Option or Electives** | 8 | **Socio-Humanistic Electives** | 3 | **Socio-Humanistic Electives** | 3 |
| | | Seminar | A E 402 | R | **Option or Electives** | 3 |
| | | **Option or Electives** | 3 | | **Option or Electives** | 3 |
| **Total** | 17 | | 19 | | 17 |

1Socio-humanistic sequences are to be chosen from the department-approved list.

2In the junior and senior years the student will elect one of the options and take the courses listed in the selected option. Electives must be approved in advance by the department head.

3May be omitted by students appointed to advanced ROTC and NROTC.
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Curriculum in Architecture

A basic concentration leading to the degree of Bachelor of Architecture with alternate concentrations in construction, delineation, planning and structures. Credits required for graduation 267 to 270 plus 6 credits in physical education. Twenty weeks of practical experience with approved architectural or construction firms is required.

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<td>Engi 101</td>
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### SPRING QUARTER

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In addition to the courses listed above, each student will be required to include six quarters of physical education.

### Third Year

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### Curricula

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### Concentrations

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**Structures Concentration**

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**Delineation Concentration**

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<td>(5 F, W, S)</td>
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**Construction Concentration**

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*Students must be in upper half of class to be eligible for 500 level courses in Civil Engineering.
*Students proposing to take additional courses in accounting shall take I.Ad. 384, Cr. 4, instead of I.Ad. 371.

### Curriculum in Ceramic Engineering

Leading to the degree Bachelor of Science. Total credits required, 208. See also Basic Program.
### FALL QUARTER Credits

<table>
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<tr>
<th>Course</th>
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<tr>
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<td>Math 213</td>
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<tr>
<td>General Physics</td>
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### WINTER QUARTER Credits

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<td>Statics of Engineering</td>
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<td>Gen Physics</td>
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<td>Seminar</td>
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In addition to the courses listed above, each student will be required to include in his schedule P.E.M.

### SPRING QUARTER Credits

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### Sophomore Year Credits

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<td>Cer E 214</td>
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<td>Phys 223</td>
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### Junior Year Credits

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<tr>
<td>E M 324</td>
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<tr>
<td>Principles of Economics</td>
<td>3</td>
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<td>E M 327</td>
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<tr>
<td>Seminar</td>
<td>R</td>
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### Ceramic Engineering

- **Ceramic Engineering**
  - **Ceramic Engr Operations I**
  - **Ceramic Engr Quantitative Analysis**
  - **Statics of Engineering**
  - **Gen Physics**
  - **Seminar**
  - **Total**

- **Ceramic Calc and Pyrometry**
  - **Quantitative Analysis**
  - **Chem 212**
  - **Introduction to Applied Math**
  - **Math 323**
  - **Elective**
  - **Elective**
  - **Seminar**
  - **Total**

- **Ceramic Engr Operations II**
  - **Cer E 325**
  - **Dynamics of Engineering**
  - **E M 344**
  - **Materials Laboratory**
  - **E M 327**
  - **Heat Transfer**
  - **M E 325**
  - **Physical Chemistry**
  - **Chem 323**
  - **Socio-Humanistic Elective**
  - **Inspection Trip**
  - **Total**
### 158/Colleges and Curricula

#### FALL QUARTER

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<td>Cer E 430</td>
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<tr>
<td>Mechanics of Fluids</td>
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**Total Credits:** 17

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</table>

**Total Credits:** 19

1 These electives are to be chosen from the department-approved list of socio-humanistic sequences. Govt 215 must be among the courses elected; 6 hours of advanced ROTC may be substituted for 3 hours of socio-humanistic electives and Engl. 414.

2 Students taking basic ROTC may substitute credit in 100 and 200 courses for these electives.

#### CURRICULUM IN CHEMICAL ENGINEERING

Leading to the degree Bachelor of Science with options in Design and Production, Research and Development.

Total credits required, 206 in Design and Production option; 204 in Research and Development option.

See also Basic Program.

#### FALL QUARTER

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<td>Analytic Geometry and Calculus IV</td>
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**Total Credits:** 16

#### WINTER QUARTER

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**Total Credits:** 18

#### SPRING QUARTER

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<td>Phys 223</td>
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**Total Credits:** 17
### Fall Quarter

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<td>2</td>
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<tr>
<td>Process Control</td>
<td>4</td>
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<td>Chem E 435</td>
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<td>Transport Phenomena</td>
<td>3</td>
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<td>Chem E 431</td>
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<tr>
<td>Chem E Thermodynamics</td>
<td>3</td>
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### Winter Quarter

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### Spring Quarter

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<td>Chemical Reactor Design</td>
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<td>Chem E 463</td>
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### Research and Development Option

#### Sophomore Year

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#### Junior Year

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<td>Introd to Applied Math</td>
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#### Senior Year

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<td>Chem E 401</td>
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<td>Process Control</td>
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### Notes

1. May be omitted by students taking basic ROTC.
2. These electives are to be chosen from the department-approved list of socio-humanistic electives. Govt. 215 must be among the courses elected.
3. May be omitted by students appointed to advanced ROTC.
4. E M 274 and either E M. 324 or 344 may be substituted for Phys. 354, 355
Curriculum in Civil Engineering

Leading to degree Bachelor of Science. Total credits required, 218.
See also Basic Program.

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<thead>
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<tbody>
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<td>Principles of Statistics</td>
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<td>Stat 201B</td>
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<tr>
<td>Phys 222</td>
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<td>Analytic Geometry and Calculus IV</td>
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<td>Analysis for Engineering Economy</td>
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<td>Civil Eng Development</td>
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<td>E M 324</td>
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<td>2Socio-Humanistic Studies</td>
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<td>Civil Engr Metrology</td>
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<tr>
<td>Planning of Trans Facilities</td>
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<tr>
<td>C E 352</td>
<td>4</td>
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<td>Dynamics of Engineering</td>
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<td>E M 344</td>
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<td>Materials Laboratory</td>
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<td>E M 337</td>
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<td>Stoichiometry</td>
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<td>Chem E 315</td>
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<td>Professional Development</td>
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<td>C E 432</td>
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<td>Sewerage</td>
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<td>C E 427</td>
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<td>I Ad 35SA</td>
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<td>3Mathematics Elective</td>
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<td>C E 426</td>
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<td>C E 453</td>
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1Students electing to take basic ROTC may apply ROTC credits toward this elective requirement.
2Shall be chosen from department-approved lists. Students appointed to advanced ROTC may substitute 6 hours of advanced ROTC for 6 hours of technical or mathematics electives.

Curriculum in Electrical Engineering

Leading to degree Bachelor of Science Total credits, required, 209.
See also Basic Program.

<table>
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<td>3</td>
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<td>Statics of Engineering</td>
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<td>Dynamics of Engineering</td>
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<td>Math 322</td>
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<td>Thermodynamics</td>
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<td>Intro to Num Tech</td>
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<td>Math 215</td>
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<td>FALL QUARTER</td>
<td>Credits</td>
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<tr>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>Chem 205</td>
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<td>Electric Circuit Theory</td>
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<td>Socio-Humanistic Elective</td>
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Junior Year

| Introduction to Systems Analysis | E E 417 | Introduction to Systems Analysis | E E 418 | Introduction to Systems Analysis | E E 419 |
|                                | 4       |                                | 4       |                                | 4       |
| Technical Electives | 7       | Technical Electives | 7       | Technical Electives | 7 |
| Electives | 3       | Electives | 3       | Electives | 3 |
| Socio-Humanistic Elective | 3       | Socio-Humanistic Elective | 3       | Socio-Humanistic Elective | 3 |
|               | 17      |                | 17      |                | 17      |

Senior Year

1These electives are to be chosen from the department-approved list of socio-humanistic sequences.

2These electives may be either technical or non-technical but must be taken from the department-approved list of electives. Students appointed to advanced military (third and fourth year) may omit 6 hours from this elective group.

3Students electing to take basic ROTC may apply ROTC credits toward this elective requirement. For others this is an unrestricted elective except that Math 101, 102, Chem 101, and I.E. 104, 105, may not be used to satisfy this requirement.

4All students must take at least 12 hours from the E.E. technical electives listed below. Students who plan to enter graduate school and wish to complete a graduate degree in the minimum length of time should take at least 24 hours from the listed E.E. technical electives, preferably 8 hours each quarter of the year. Students who do not plan to enter graduate school may take a portion of their technical electives outside the E.E. Department, providing they are chosen from the department-approved list of such electives.

### E.E. Technical Electives

<table>
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<tr>
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### Curriculum in Engineering Operations

Administered by the Department of Industrial Engineering. Leading to the degree Bachelor of Science. Total credits required, 193.

This program is designed for students who desire a knowledge of the fundamentals of management, engineering, science and human behavior, and who do not wish to pursue the more specialized engineering curricula. Graduates should find opportunities in a number of intermediate administrative areas in industry, such as engineering sales, procurement, maintenance and production.

### Program in Building Construction

A program of study is provided for those who are interested in Building Construction. This program leads to the degree, Bachelor of Science. For particulars, consult the head of the Department of Architecture. See Building Construction under Description of Courses for details.
Program in Engineering Journalism

A program of study is provided for those who are interested in Engineering Journalism. The program also leads to the degree, Bachelor of Science. For particulars, consult the head of the Department of Technical Journalism. See Engineering Journalism under Description of Courses for details.

Program in International Service

Special training for those interested in foreign service also is provided. See International Service under Description of Courses for details.

Required Courses

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<tr>
<th>BASIC SCIENCES</th>
<th>Credits</th>
<th>COMMUNICATION SKILLS</th>
<th>Credits</th>
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<td>Math 101, 102, 110, 211, 212</td>
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<td>E Gr 131, 132, 133</td>
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<td>Chem 101, 102</td>
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<td>Engr 101, 102, 103</td>
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<td>Phys 221, 222, 223</td>
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<td>Sp 311, Engl 414A</td>
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<td>SOCIAL SCIENCES</td>
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<td>Psych 101</td>
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<td>1 E 104, 105</td>
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<td>Econ 241, 243</td>
<td>6</td>
<td>1 E 480 or 1 Ad 365A</td>
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<td>Govt 215</td>
<td>3</td>
<td>1 Ad 384</td>
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<td>Lib 106, Engr 114, 115, (100)</td>
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Other Requirements. Course combinations for each student should be integrated toward a vocational objective. Each student's choice of courses in the following areas must be approved in advance by the Head of the Department of Industrial Engineering.

Engineering Science (Minimums)  Credits
- Engineering Mechanics 9, Electrical Engineering 8, Measurements 3  20
- Sequences in an Engineering area (300 level or above)  27
- Supporting Work (Prerequisites for Sequences in an Engineering area)  15
- Management Production, Business or Sales courses  15
- Socio-humanistic Sequences  18
- ROTC or Free Electives  6

Total program (minimum) 193

Students appointed to advanced ROTC may substitute 6 credits of advanced ROTC for electives in the management and/or supporting work lists.

Curriculum in Engineering Science

Administered by the Department of Nuclear Engineering.
Leading to the degree Bachelor of Science Total credits required, 209.
See also Basic Program.

Fall Quarter

<table>
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<tr>
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<td>Intro to Applied Math 3</td>
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<td>Math 213 3</td>
<td>Dynamics of Engineering 4</td>
<td>Math 322 3</td>
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<td>Statics of Engineering 4</td>
<td>General Chemistry 4</td>
<td>Mechanics of Materials 3</td>
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<tr>
<td>E M 274 4</td>
<td>Phys 206 4</td>
<td>E M 324 5</td>
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<td>Modern Physics 3</td>
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<tr>
<td>Chem 205 4</td>
<td>Modern Language 3</td>
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<td>A-c and D-c Circuits 3</td>
<td>American Government 3</td>
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<td>1 Elective 3</td>
<td>Govt 215 3</td>
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Sophomore Year

Junior Year

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<td>Dynamics of Engineering 4</td>
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<td>Chem E Thermodynamics 3</td>
<td>General Chemistry 4</td>
<td>Mechanics of Fluids 4</td>
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### FALL QUARTER

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### WINTER QUARTER

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### SPRING QUARTER

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### Senior Year

- Engineering Analysis: E S 481 (4 credits)
- Engineering Materials: E S 353 (4 credits)
- Elective: 3
- Transport Phenomena: Chem 431 (3 credits)
- Socio-Humanistic Elective: 3

**Total:** 17 credits

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In addition to the courses listed above, each student will be required to include Seminar, E S 401, 402, 403 in his schedule.

1. Students electing to take Basic ROTC may apply ROTC credits toward this elective requirement.
2. These electives are to be chosen from the department-approved list of socio-humanistic sequences.
3. Engineering Science electives include courses in mechanics of solids, mechanics of fluids, nature and properties of materials, electrical theory, thermodynamics and transport phenomena.
4. May be omitted by students appointed in advanced ROTC.

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### Curriculum in Industrial Engineering

Leading to the degree Bachelor of Science. Total credits required, 206.

See also Cooperative Programs and Basic Program.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
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<td><strong>Total</strong></td>
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### Junior Year

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<td>Industrial Accounting</td>
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<td>I E 315</td>
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<td>Dynamics of Engr</td>
<td>4</td>
</tr>
<tr>
<td>E M 344</td>
<td></td>
</tr>
<tr>
<td>Calculations and Graphic Methods</td>
<td>4</td>
</tr>
<tr>
<td>I E 362</td>
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</tr>
<tr>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>M E 321</td>
<td></td>
</tr>
<tr>
<td>Mech Engr Measurements</td>
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<tr>
<td>M E 342</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Tool Engineering</td>
<td>3</td>
</tr>
<tr>
<td>M E 305</td>
<td></td>
</tr>
<tr>
<td>D-c and A-c Circuits and Machines</td>
<td>4</td>
</tr>
<tr>
<td>E E 342</td>
<td></td>
</tr>
<tr>
<td>Engr. Economy</td>
<td>3</td>
</tr>
<tr>
<td>I E 404</td>
<td></td>
</tr>
<tr>
<td>Writing of Scientific Papers</td>
<td>3</td>
</tr>
<tr>
<td>Engr 414A</td>
<td></td>
</tr>
<tr>
<td>Social Relations in Industry</td>
<td>3</td>
</tr>
<tr>
<td>Soc 380</td>
<td></td>
</tr>
<tr>
<td>American Government</td>
<td>3</td>
</tr>
<tr>
<td>Govt. 215</td>
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<tr>
<td>Industrial Inspection Trip</td>
<td>3</td>
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<tr>
<td>I E 393</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
</tr>
</tbody>
</table>
### FALL QUARTER Credits

- Industrial Engr Design I 1E 441 5
- Manpower Management 1E 424 3
- Industrial Engr Elective 3
- Supporting Elective 3
- Socio-Humanistic Elective 3

### WINTER QUARTER Credits

**Senior Year**

- Industrial Engr Design II 1E 442 5
- Manpower Management 1E 425 3
- Industrial Operations Res 1E 415 3
- Socio-Humanistic Elective 6
- Seminar 1E 492 R

### SPRING QUARTER Credits

- Industrial Engr Design III 1E 443 5
- Industrial Engr Elective 3
- Supporting Elective 3
- Socio-Humanistic Elective 6

---

1. Students electing to take basic ROTC may apply ROTC credits toward this elective requirement. For others, Math 101, 102, Chem. 101, 1 E. 104, 105 may not be used for elective credit.

2. These electives are to be chosen from the department-approved list of courses; six hours of advanced ROTC may be substituted for supporting electives.

3. Industrial engineering electives are to be chosen from the following 407, 416, 421, 422, 462, 480.

---

### Curriculum in Mechanical Engineering

Leading to the degree Bachelor of Science Total credits required, 209.

See also Cooperative Programs and Basic Program

### FALL QUARTER Credits

- Anal Geom and Calc IV Math 213 3
- General Physics Phys 222 5
- Statics of Engineering E M 274 4
- Metal Processing I M E 232 3
- Intro to Literature Engl 201 3

### WINTER QUARTER Credits

**Sophomore Year**

- Introd to Applied Math Math 321 3
- General Physics Phys 223 5
- Mechanics of Materials E M 324 5
- Metal Processing II M E 233 3
- World Literature Engl 354A 3

**Junior Year**

- Thermodynamics I M E 321 4
- Machine Design I M E 316 4
- A-c and D-c Circuits E E 441 4
- Analysis for Engr Econ 1 E 304 3
- Fundamentals of Speech Sp 311 3

### SPRING QUARTER Credits

**Senior Year**

- Heat and Mass Tranfer 1 M E 425 4
- Machine Design IV M E 417 4
- Industrial Organization I E 351 4
- Writing of Scientific Papers Engl 414A 3

**1. Engineering Contracts**

---

**Total Credits:**

- Fall 18
- Winter 19
- Spring 18
- Total 55
Socio-Humanistic Elective 3

SENIOR ELECTIVES: Socio-humanistic electives are to be chosen from the department-approved sequences. Technical electives will be chosen from one of the following groups:

Group 1
M.E. 426, 427, 428, 444, 445, 448, 521, 523, 524, 525, 540, 544, Nuc E. 474, Aero E. 409, 411

Group 2
I Ad. 400, I.E. 407, 421, 424, 425, 441, 475; Psych. 362, 474

Group 3

Group 4

1May be omitted by students appointed to advanced ROTC.

2Choose one of M.E. 426, 444 or 445.

Curriculum in Metallurgy

Leading to the degree Bachelor of Science. Total credits required, 205.

See also Basic Program

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>Credits</th>
<th>WINTER QUARTER</th>
<th>Credits</th>
<th>SPRING QUARTER</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Ana1 Geom and Calc IV</td>
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<td>Intro to Applied Math</td>
<td>3</td>
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<tr>
<td>Math 213</td>
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<td>Math 321</td>
<td></td>
<td>Math 322 or Math 323</td>
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</tr>
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<td>Introductory Metallurgy</td>
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<td>Introductory Metallurgy</td>
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<td>Met 201</td>
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<td>Phys 221</td>
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<td>Phys 222</td>
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<td>Socio-Humanistic Elective</td>
<td>3</td>
<td>Socio-Humanistic Elective</td>
<td>3</td>
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<td>American Government Gov't 215</td>
<td>3</td>
<td>Statics of Engineering E.M. 274</td>
<td>4</td>
<td>Dynamics of Engineering E.M. 344</td>
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Junior Year

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<tr>
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<th>Winter Semester</th>
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<th>Spring Semester</th>
<th>Credits</th>
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<td>Chem 325</td>
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<td>Modern Physics</td>
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<td>Modern Physics</td>
<td>3</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>Phys 301</td>
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<td>Phys 302</td>
<td></td>
<td>Phys 303</td>
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<td>Physical Metallurgy</td>
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<td>Physical Metallurgy</td>
<td>3</td>
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<tr>
<td>Met 301</td>
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<td>Met 302</td>
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<td>Met 303</td>
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<td>Met 305</td>
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<td>Met 306</td>
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<td>Socio-Humanistic Elective</td>
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Senior Year

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<tr>
<th>Fall Semester</th>
<th>Credits</th>
<th>Winter Semester</th>
<th>Credits</th>
<th>Spring Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Met 401</td>
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<td>Met 402</td>
<td></td>
<td>Met 403</td>
<td></td>
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<tr>
<td>A-c and D-c Circuits</td>
<td>4</td>
<td>Electronic Circuits, Instruments and Systems</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.E. 441</td>
<td></td>
<td>E.E. 445</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Thermochernistry</td>
<td>3</td>
<td>Socio-Humanistic Elective</td>
<td>3</td>
<td>Socio-Humanistic Elective</td>
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<tr>
<td>Met 421</td>
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<td>Total</td>
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<tr>
<td>Socio-Humanistic Elective</td>
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<td>Technical Electives</td>
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<td>Technical Electives</td>
<td>7</td>
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<tr>
<td>Total</td>
<td>17</td>
<td></td>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1These electives are to be selected from the department-approved list of socio-humanistic sequences.

2Technical electives will usually be chosen from one of the three groups below and must include nine credits in metallurgy and three credits in written or spoken English beyond English 103.

3Mechanical Metallurgy Emphasis: Met. 408, 450, 532, 533, 540, 571; M.E. 235, 316, 317; E.M. 324; Math 322 or 323.


6Three credits of military, air, or naval science may be substituted for this elective. Three credits of advanced ROTC may be substituted for socio-humanistic and three for technical electives.
The curricula of the College of Home Economics provide for the general or "liberal" education of the student as a person, a citizen and family member; and an education for a variety of professional opportunities.

Qualified professional graduates are much in demand as teachers in facilities for children, home economics teachers in secondary schools and colleges, teachers of physical education for women; county extension home economists, dietitians, food service directors, school lunch supervisors, home service personnel with public utility companies, research workers, technicians in commercial laboratories, business home economists with food, equipment and textile companies, designers of textiles and of interiors, executives in retail clothing and home furnishings departments, members of editorial staffs of magazines and newspapers, and in recreation programs for children.

Faculty Advisory System

Each student in the College of Home Economics has a faculty adviser. A selected group serves as advisers to freshmen; upperclass students are assigned faculty advisers in the departments of their chosen curricula.

All entering students and their parents are encouraged to participate in the summer orientation program. During the two-day program, the students take placement tests, confer with faculty advisers concerning the program of studies for the coming year and become acquainted with the campus.

Child Development
Curricula in Home Economics

Curricula

Applied Art

MAJORS
Advertising Design
Art Education
General Applied Art and Crafts
Interior Design

Child Development

Child Development
Child Development—Elementary Education
Child Development and Related Science

Food and Nutrition

Community Nutrition
Dietetics
Food Science
Food and Nutrition and Related Science

Home Economics Education

Home Economics Education

Home Economics for General Education

Home Economics for General Education
Home Management
International Service

Home Economics Journalism

Home Economics Journalism

Household Equipment

Household Equipment
Household Equipment and Related Science

Institution Management

College Food and Housing Administration
Restaurant Management
School Food Service

Textiles and Clothing

Merchandising
Clothing
Textiles
Textile and Clothing Design
Textiles and Related Science

Physical Education for Women

Physical Education for Women

Cooperative Program

The College of Home Economics has cooperative programs with Morningside College and Central College. A student may take two years at either of these liberal arts colleges and two years at Iowa State University without the usual formalities of transferring.

A special grouping of courses is provided which makes it possible for a student to pursue any of the curricula offered by the College of Home Economics.

Applications for admission to the Cooperative Program in Home Economics should be addressed to Director of Admissions of the appropriate liberal arts college.

The Core Curriculum

The general education of students in the College of Home Economics is provided by a group of required courses known as the core curriculum and by freedom to elect courses of a general nature.

The following courses in the core curriculum are required of all students in the College of Home Economics, except those who choose related science combined with child development, food and nutrition, household equipment or textiles; those who choose the curriculum in physical education for women; and men who choose a major within the Institution Management Department.
Each student must complete credits as listed below. Wherever the semicolon appears in this list, it means "and/or."

<table>
<thead>
<tr>
<th>Course Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Home Economics</td>
<td>17</td>
</tr>
<tr>
<td>II Biological Sciences</td>
<td>8</td>
</tr>
<tr>
<td>III Physical Sciences</td>
<td>14 to 16</td>
</tr>
<tr>
<td>IV Social Sciences</td>
<td>18</td>
</tr>
<tr>
<td>V Written and Spoken English</td>
<td>12</td>
</tr>
<tr>
<td>VI Humanities</td>
<td>15</td>
</tr>
</tbody>
</table>

All students are required to complete six quarters of physical education. See Physical Education for Women for details. A student is expected to enroll in physical education during the first quarter registered and to continue in each subsequent quarter until requirement is completed.

Library instruction is to be completed within the first year of registration.

Students may prepare for work in Extension Service by enrolling in any of the home economics curricula. The following courses should be included: Psych. 333; Ed. 305, 466, 467; H.Mgt. 475.

In addition, the following suggested courses should be considered in consultation with the Assistant Director of Extension in charge of Home Economics, one of the Extension Home Economics supervisors or the Extension Training specialist: A.A. 261; C.D. 575; Ed. 211B; F. & N. 208, 303; H.Eq. 154; H.Ec. 240; H.Mgt. 415, 488, 521, 522; I.Mgt. 280; Soc 364, 464; Sp. 312; T. and C. 123 or 125; T.JI. 225.

Summer appointment as assistants to county extension home economists provides valuable experience for potential extension staff members. It should be considered between the junior and senior years.

Preparation for work as a home economist in the field of television or radio may be combined with several of the above curricula (applied art, child development, food science, home economics for general education, household equipment, and textiles and clothing) which are described in the following pages. The student wishing to combine preparation for work in broadcasting with one of these curricula should consult with the Director of the Telecommunications Training Program in order to schedule a program which shall include: T.C.A. 206, 328, Sp. 326, and selections from the following to total a minimum of 22 credits: A.A. 241; Arch. 214 or A.A. 230; Arch. 321C; E.E. 315; Engl. 315; H.Eq. 315 or 421; Sp. 207, 301, 321; T.C.A. 400A, 400B T.JI. 325, 326, 475. An additional period of study may be necessary for combination with certain majors.

Home Economics and Related Science

These curricula are planned for students who wish to emphasize science in relation to child development, food and nutrition, household equipment, or textiles. Students who have completed one of these majors have found interesting opportunities in research laboratories in colleges and universities, medical laboratories, foundations, and in industry. These majors also provide an excellent background for graduate study basic to professional advancement in the specified fields.

Students are advised to consult the head of the department in which they wish to place major emphasis before planning their program of study.

Each student must complete these courses as listed below:

<table>
<thead>
<tr>
<th>Course Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Home Economics</td>
<td>15 credits of home economics</td>
</tr>
<tr>
<td>II Physical Sciences</td>
<td>12 credits of options from physics, history, psychology and sociology.</td>
</tr>
<tr>
<td>III Social Sciences</td>
<td>12 credits of options from economics, history, psychology and sociology.</td>
</tr>
<tr>
<td>IV Written and Spoken English</td>
<td>Sp. 311.</td>
</tr>
<tr>
<td>V Modern Languages</td>
<td>French, German or Russian. (See explanation above regarding physical education and library.)</td>
</tr>
</tbody>
</table>
Curriculum in Applied Art

Leading to the degree Bachelor of Science. Total credits required, 198.

Four majors are offered to men and women in the Applied Art Department: General Applied Art and Crafts, Interior Design, Advertising Design, and Art Education.

HOME ECONOMICS

Applied Art
103. Design I 4 Credits
104. Design II 3 Credits
206. Lettering 3 Credits
230. Drawing and Composition 4 Credits
261. Interior House Design I 3 Credits
384. Survey of Art 3 Credits
401. Senior Study Tour R
404. Seminar 1 Credit
486. Modern Art 3 Credits
Child Development ............................................. 4 Credits
270. The Individual and His Family I 4 Credits
Food and Nutrition
107. Nutrition and the Family’s Food 4 Credits
Home Economics
105. Orientation to Home Economics 1 Credit
400. Professional Relations R
Home Management
375. Management in the Family 4 Credits

OTHER REQUIRED COURSES

Biological Sciences: Bact., Biochem., Bot., Gen. Zool. 3 Credits
Zool 155 Elementary Human Physiology and Anatomy 5 Credits
Social Sciences
Econ 241, 242 Principles of Economics 6 Credits
Govt 215 American Government 3 Credits
Psych 101 General Psychology I 3 Credits
Soc 134 Introduction to Sociology 3 Credits
Soc 218 Introduction to Cultural Anthropology 3 Credits
Humanities: Hist., Phil., Lit., M.L., Music 15 Credits
Written and Spoken English 12 Credits
Engl 101, 102, 103. Principles of Composition 9 Credits
Sp 311 Fundamentals of Speech 3 Credits
E Gr 121 Drawing and Perspective 3 Credits
Lib 106 Library Instruction R
PE ................................................................. 6 Credits

MAJOR IN ADVERTISING DESIGN

This major prepares students for positions in small or large advertising agencies; for work requiring precision skills such as layout and advertising design, poster art, greeting cards and gift wrap designing, television art, packaging, store display and fashion illustration.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics
Applied Art
233 Watercolor .................................................. 3 Credits
306 Advertising Design I 4 Credits
324. Life Drawing ............................................... 3 Credits
405 Advertising Design II 3 Credits
424. Oil Painting ............................................... 3 Credits
484 History of Ornament 3 Credits
485 Medieval, Renaissance and Oriental Art 3 Credits
490F Special Problems 4 Credits
Psych. 250 Psychology of Sales and Advertising 3 Credits
T Jl. 225. Publicity and Public Relations 3 Credits
Electives 52 Credits

Students interested in a major in fashion illustration would be required to take
16 additional credits
A A 213 Fashion Illustration I 3 Credits
A A 214 Fashion Illustration II 3 Credits
A A 490G Special Problems 4 Credits
T and C 104 Textiles ........................................ 3 Credits
T. and C 454 History of Costume ........................................ 3 Credits

MAJOR IN ART EDUCATION

The major in art education is planned for students preparing to teach art in grades seven through fourteen. Further information appears in the sections on Teacher Education, and
Applied Art, Description of Courses

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Home Economics</th>
<th>36 Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td></td>
</tr>
<tr>
<td>233 Watercolor</td>
<td>3 Credits</td>
</tr>
<tr>
<td>306 Advertising Design I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>324 Life Drawing</td>
<td>3 Credits</td>
</tr>
<tr>
<td>344 Craft Design I</td>
<td>3 Credits</td>
</tr>
<tr>
<td>345 Craft Design II</td>
<td>4 Credits</td>
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<tr>
<td>393 Craft Design III</td>
<td>3 Credits</td>
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<td>424 Oil Painting</td>
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<td>434 Textile Design I</td>
<td>4 Credits</td>
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<tr>
<td>445 Craft Design IV</td>
<td>3 Credits</td>
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<tr>
<td>446 Craft Design V</td>
<td>3 Credits</td>
</tr>
<tr>
<td>485 Medieval Renaissance and Oriental Art</td>
<td>3 Credits</td>
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<table>
<thead>
<tr>
<th>Professional Education</th>
<th>28 Credits</th>
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<tbody>
<tr>
<td>A A 416 Art Methods for the Secondary School</td>
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</tr>
<tr>
<td>A A 417 Supervised Teaching in Art</td>
<td>9 Credits</td>
</tr>
<tr>
<td>Ed 204 Foundations of American Education</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Ed 305 Methods of Teaching</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Ed 426 Principles of Secondary Education</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Psych 230 Developmental Psychology</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Psych 333 Educational Psychology</td>
<td>3 Credits</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Electives</th>
<th>20 Credits</th>
</tr>
</thead>
</table>

**Major in General Applied Art and Crafts**

This major is planned for the art student who may prefer a balanced art program along with a strong emphasis in the area of crafts. A broad background in design, drawing, and art history and varied crafts media would permit men or women to have shops and market quality crafts in weaving, metal, jewelry, and wood, or to work in community and welfare workshops or in adult education.

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Home Economics</th>
<th>43 Credits</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>233 or 424 Watercolor or Oil Painting</td>
<td>3 Credits</td>
</tr>
<tr>
<td>344 Craft Design I</td>
<td>3 Credits</td>
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<tr>
<td>345 Craft Design II</td>
<td>4 Credits</td>
</tr>
<tr>
<td>393 Craft Design III</td>
<td>3 Credits</td>
</tr>
<tr>
<td>434 Textile Design I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>435 Textile Design II</td>
<td>3 Credits</td>
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<tr>
<td>445 Craft Design IV</td>
<td>3 Credits</td>
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<tr>
<td>446 Craft Design V</td>
<td>3 Credits</td>
</tr>
<tr>
<td>484 History of Ornament</td>
<td>3 Credits</td>
</tr>
<tr>
<td>485 Medieval Renaissance and Oriental Art</td>
<td>3 Credits</td>
</tr>
<tr>
<td>490C Special Problems</td>
<td>8 Credits</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
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</tr>
<tr>
<td>104 Textiles</td>
<td>3 Credits</td>
</tr>
</tbody>
</table>

| Electives | 41 Credits |

**Major in Interior Design**

This major is planned for art students who plan to enter the field of interior design and decoration professionally.

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Home Economics</th>
<th>46 Credits</th>
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<tbody>
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<td>Applied Art</td>
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</tr>
<tr>
<td>233 Watercolor</td>
<td>3 Credits</td>
</tr>
<tr>
<td>361 History of Furniture</td>
<td>3 Credits</td>
</tr>
<tr>
<td>434 Textile Design I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>435 Textile Design II</td>
<td>3 Credits</td>
</tr>
<tr>
<td>464 Interior Design I</td>
<td>3 Credits</td>
</tr>
<tr>
<td>485 Interior Design II</td>
<td>9 Credits</td>
</tr>
<tr>
<td>486 Apprenticeship</td>
<td>9 Credits</td>
</tr>
<tr>
<td>484 History of Ornament</td>
<td>3 Credits</td>
</tr>
<tr>
<td>490E Special Problems</td>
<td>9 Credits</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td></td>
</tr>
<tr>
<td>104 Textiles</td>
<td>3 Credits</td>
</tr>
<tr>
<td>414 Historic Textiles</td>
<td>3 Credits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Sciences</th>
<th>6 Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econ 466 Retailing</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Psych 250 Psychology of Sales and Advertising</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Arch 361 Residential Architecture</td>
<td>3 Credits</td>
</tr>
</tbody>
</table>

| Electives | 29 Credits |


Curriculum in Child Development

Leading to the degree Bachelor of Science. Total credits required, 198.

Three majors are offered in the Child Development Department: Child Development, Child Development-Elementary Education, Child Development and Related Science.

HOME ECONOMICS

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>4</td>
</tr>
<tr>
<td>103 Design I</td>
<td>4</td>
</tr>
</tbody>
</table>

Child Development

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>236 Principles of Child Development</td>
<td>3</td>
</tr>
<tr>
<td>240 Literature for Children</td>
<td>4</td>
</tr>
<tr>
<td>270 The Individual and His Family I</td>
<td>4</td>
</tr>
<tr>
<td>336 Development in Early Childhood</td>
<td>3</td>
</tr>
<tr>
<td>337 Development and Guidance in Later Childhood</td>
<td>3</td>
</tr>
<tr>
<td>460 Guidance of Children</td>
<td>4</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>4</td>
</tr>
<tr>
<td>107 Nutrition and the Family’s Food</td>
<td>1</td>
</tr>
<tr>
<td>Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>105 Orientation to Home Economics</td>
<td>R</td>
</tr>
</tbody>
</table>

OTHER REQUIRED COURSES

Biological Sciences

- Zool. 155 Elementary Human Physiology and Anatomy: 5 Credits

Social Sciences

- Econ 241 Principles of Economics: 3 Credits
- Govt 215 American Government: 3 Credits
- Psych 101 General Psychology I: 3 Credits
- Psych 230 Developmental Psychology: 3 Credits
- Soc 134 Introduction to Sociology: 3 Credits
- Soc 218 Introduction to Cultural Anthropology: 3 Credits

Written and Spoken English

- Engl. 101, 102, 103 Principles of Composition: 9 Credits
- Sp. 311 Fundamentals of Speech: 3 Credits

Lib. 106 Library Instruction: R

P.E. 6 Credits

MAJOR IN CHILD DEVELOPMENT

This major is for the student who is interested in working with children up to age 12 in a wide variety of agencies, institutions, hospitals, or programs for children.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics: 29 Credits

Child Development: 25 Credits

- 366 Activities and Materials: 4 Credits
- 368 Study Tour: R
- 461 Curriculum Planning for the Preschool Child: 2 Credits
- 467A Supervised Teaching in Nursery School: 6 Credits
- 467B Home-School Relations: 2 Credits
- 468 Administration of Programs for Young Children: 3 Credits
- 481 Group Work with Children: 8 Credits

Home Management: 4 Credits

- 375 Management in the Family: 4 Credits

Biological Sciences: 3 Credits

- Zool. 358 Physiology of Reproduction: 3 Credits


- Select from at least two areas: 15 Credits

Social Sciences: 21 Credits

- Econ 242 Principles of Economics: 3 Credits
- Psych 430 Psychology of Adolescence: 3 Credits
- Additional Psych: 9 Credits
- Additional Soc: 6 Credits

Humanities: Hist, Phil, Lit, M.L., Music: 15 Credits

Music 364 Creative Activities in Music: 4 Credits

Electives: 40 Credits

MAJOR IN CHILD DEVELOPMENT-ELEMENTARY EDUCATION

This major in child development-elementary education is planned for students interested in preparation for teaching in the elementary grades, kindergarten through sixth. Students should enter the child development-elementary education program by the end of the sophomore year but must apply to, and be accepted by, the department committee on selection and the University Committee on Teacher Education.

In addition to the curriculum requirements the following courses are to be completed:
### Professional Education

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>204 Foundations of American Education</td>
<td>3</td>
</tr>
<tr>
<td>305 Methods of Teaching</td>
<td>1</td>
</tr>
<tr>
<td>356 Activities and Materials</td>
<td>4</td>
</tr>
<tr>
<td>375 The Teaching of Reading</td>
<td>5</td>
</tr>
<tr>
<td>444 Principles of Teaching in the Elementary School</td>
<td>2</td>
</tr>
<tr>
<td>445 Elementary Education Methods I</td>
<td>4</td>
</tr>
<tr>
<td>446 Elementary Education Methods II</td>
<td>4</td>
</tr>
<tr>
<td>457C Student Teaching in the Primary Grades</td>
<td>8</td>
</tr>
<tr>
<td>467D Student Teaching in the Intermediate Grades</td>
<td>8</td>
</tr>
<tr>
<td><strong>Psychology</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>333 Educational Psychology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Biological Sciences</strong></td>
<td><strong>8</strong></td>
</tr>
<tr>
<td>Bot 101 General Botany</td>
<td>3</td>
</tr>
<tr>
<td>Zool 101 General Zoology</td>
<td>5</td>
</tr>
<tr>
<td><strong>Physical Sciences</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>Chem 105 or 101. General Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Geol 100 Introduction to Geology</td>
<td>3</td>
</tr>
<tr>
<td>Geol 304. World Geography</td>
<td>3</td>
</tr>
<tr>
<td>Geol 305 Economic Geography</td>
<td>3</td>
</tr>
<tr>
<td>Math 190 Theory of Arithmetic</td>
<td>3</td>
</tr>
<tr>
<td>Phys 106 Elementary Physics</td>
<td>4</td>
</tr>
<tr>
<td><strong>Humanities</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td>Engl 201 Introduction to Literature</td>
<td>3</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td><strong>9</strong></td>
</tr>
<tr>
<td><strong>Music</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Music 365 Music in the Elementary Schools</td>
<td>3</td>
</tr>
<tr>
<td><strong>Written and Spoken English</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Sp 375 Speech Correction Principles</td>
<td>3</td>
</tr>
<tr>
<td><strong>P E</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>470 Elementary School Physical Education</td>
<td>3</td>
</tr>
<tr>
<td><strong>Academic Area of Concentration</strong></td>
<td><strong>24</strong></td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

### Major in Child Development and Related Sciences

This major is for the student who is planning graduate study in child development, or one of its allied fields. It provides a strong background on which to build a graduate program.

**HOME ECONOMICS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>270 The Individual and His Family I</td>
<td>4</td>
</tr>
<tr>
<td>336 Development in Early Childhood</td>
<td>3</td>
</tr>
<tr>
<td>337 Development and Guidance in Later Childhood</td>
<td>3</td>
</tr>
<tr>
<td>368 Study Tour</td>
<td>R</td>
</tr>
<tr>
<td>450 Guidance of Children</td>
<td>4</td>
</tr>
<tr>
<td>465 Seminar</td>
<td>2</td>
</tr>
<tr>
<td><strong>Home Economics</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>H Ec (courses other than those in the major area)</td>
<td>15</td>
</tr>
<tr>
<td>105 Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>400 Professional Electives</td>
<td>R</td>
</tr>
<tr>
<td><strong>OTHER REQUIRED COURSES</strong></td>
<td><strong>115-117</strong></td>
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</tbody>
</table>

**Biological Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bact 200 Introductory Bacteriology I</td>
<td>3</td>
</tr>
<tr>
<td>Zool 155 Elementary Human Physiology and Anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Zool 355 Principles of Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 359 Kinesiology</td>
<td>5</td>
</tr>
<tr>
<td><strong>Physical Sciences</strong></td>
<td><strong>38-40</strong></td>
</tr>
<tr>
<td>Chem 101, 102 General Chemistry</td>
<td>8</td>
</tr>
<tr>
<td>Chem 105, 106 General Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Chem 103 Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Math 101 Algebra and Trigonometry I</td>
<td>5</td>
</tr>
<tr>
<td>Math 102 Algebra and Trigonometry II</td>
<td>5</td>
</tr>
<tr>
<td>Math 110 Analytic Geometry and Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>Math 211 Analytic Geometry and Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>Phys 111, 112 General Physics</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social Sciences</strong></td>
<td><strong>33</strong></td>
</tr>
<tr>
<td>Govt 215 American Government</td>
<td>3</td>
</tr>
<tr>
<td>Psych 101 General Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Psych 201 General Psychology II</td>
<td>3</td>
</tr>
<tr>
<td>Psych 301 Experimental Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Psych 415 Psychology of Exceptional Children</td>
<td>3</td>
</tr>
<tr>
<td>Psych 440 Psychological Measurement I</td>
<td>3</td>
</tr>
<tr>
<td>Psych 441 Opinion, Attitude and Motivation Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134 Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 218 Introduction to Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 220 Prehistoric Man</td>
<td>3</td>
</tr>
</tbody>
</table>

*May substitute Stat. 201 and Stat. 401 for Math. 110, 211, respectively.*
Curriculum in Food and Nutrition

Leading to the degree Bachelor of Science. Total credits required, 198.

Four majors are offered in the Food and Nutrition Department: Community Nutrition, Dietetics, Food Science, and Food and Nutrition and Related Science.

All majors except Related Science have the following courses in common.

HOME ECONOMICS

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>4</td>
</tr>
<tr>
<td>Child Development</td>
<td>4</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>21</td>
</tr>
<tr>
<td>105. Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>400. Professional Relations</td>
<td>R</td>
</tr>
<tr>
<td>Home Management</td>
<td>4</td>
</tr>
<tr>
<td>375. Management in the Family</td>
<td>4</td>
</tr>
<tr>
<td>Household Equipment</td>
<td>3</td>
</tr>
<tr>
<td>154. Introduction to Household Equipment</td>
<td>4</td>
</tr>
<tr>
<td>Institution Management</td>
<td>4</td>
</tr>
<tr>
<td>380. Quantity Food Production</td>
<td>3</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td>3</td>
</tr>
<tr>
<td>104. Textiles</td>
<td></td>
</tr>
</tbody>
</table>

OTHER REQUIRED COURSES

| Biological Sciences                                          | 10      |
| Bact. 304 General Bacteriology                              | 5       |
| Zool. 155 Elementary Human Physiology and Anatomy           | 5       |
| Physical Sciences                                           | 20-32    |
| Chemistry Sequence I (16 Credits)                           |         |
| Chem 105, 106 General Chemistry                             | 6       |
| Chem 231 Elementary Organic Chemistry                       | 5       |
| B and B 301 Biochemistry                                    | 3       |
| B. and B. 311. Laboratory in Biochemistry                   | 2       |
| Chemistry Sequence II (28 Credits)                          |         |
| Chem 101, 102, or 101A, 102A. General Chemistry             | 8       |
| Chem 103 Systematic Inorganic Chemistry                     | 4       |
| Chem 334, 335 Organic Chemistry                             | 8       |
| B and B 304, 305 Physiological Chemistry                    | 6       |
| B and B 311 Laboratory in Biochemistry                      | 2       |
| Phys 105. Elementary Physics                                | 4       |
| Social Sciences                                              | 18      |
| Econ. 241, 242 Principles of Economics                      | 6       |
| Govt. 215. American Government                              | 3       |
| Psych 101 General Psychology                                | 3       |
| Soc. 134. Introduction to Sociology                         | 3       |
| Soc. 218. Introduction to Cultural Anthropology             | 3       |
| Humanities                                                  | 15      |
| History                                                     | 6       |
| Written and Spoken English                                  | 12      |
| Engl 101, 102, 103 Principles of Composition                | 9       |
| Library 106 Library Instruction R                           | 3       |
| P E                                                         | 6       |

MAJOR IN COMMUNITY NUTRITION

This major is planned for students interested in helping people to use the knowledge of nutrition for the betterment of their health. Basic preparation is provided for students who desire employment with the Home Economics Extension Service, or nutrition services of social welfare agencies, public health departments, or commercial organizations. Electives should be chosen with the major area of interest in mind.
Students in this program may qualify for teaching home economics by using their electives to meet requirements for certification. If interested in Home Economics Extension, Education 305, 466 and 467 should be elected. This major also provides good background for further specialized training or for an advanced degree in nutrition. Students anticipating graduate study should take Chemistry Sequence II.

In addition to the curriculum requirements the following courses are to be completed:

**Home Economics**
- 236 Principles of Child Development: 3 Credits
- 400A Field Study Tour: 3 Credits
- 410 Nutrition During Human Growth and Development: 3 Credits
- 411 Experimental Study of Foods: 4 Credits
- 41A Community Nutrition: 3 Credits
- 418A Seminar in Community Nutrition: 2 Credits
- **Home Management**
- 488 Family Finance: 3 Credits

**Biological Sciences**
- Zool 355 Principles of Physiology: 4 Credits

**Social Sciences**
- Psych 230 Developmental Psychology: 3 Credits
- Psych 333 Educational Psychology: 3 Credits
- Sociology 364 Group Dynamics: 3 Credits
- TII 22S Publicity and Public Relations: 3 Credits

**Electives**
- Major in Dietetics: 21 Credits
- Major in Food Science: 25 Credits

**MAJOR IN DIETETICS**
This major serves the interests of the student desiring to work both in food service and nutrition education. The program meets the academic requirements of the American Dietetic Association for candidates for hospital dietetics and other internships.

In addition to the curriculum requirements the following courses are to be completed:

**Home Economics**
- 236 Principles of Child Development: 3 Credits
- 400A Field Study Tour: R
- 409 Diet Therapy: 3 Credits
- 410 Nutrition During Human Growth and Development: 3 Credits
- 411 Experimental Study of Foods: 4 Credits
- **Home Economics Education**
- 41S Principles of Education for Dietitians: 2 Credits
- **Institution Management**
- 484 Purchasing: 4 Credits
- 486 Organization and Management: 3 Credits
- **Biological Sciences**
- Zool 358 Physiology of Reproduction (3 Credits)
- or
- Zool 355 Principles of Physiology (4 Credits)
- **Social Sciences**
- Psych 430 Industrial Psychology: 1
- I Ad 372B General Accounting (4 Credits)
- or
- Mgt 485 Equipment (4 Credits)
- or
- Mgt 580 Quantity Food Development (3 Credits)
- TII 225 (or English or Speech): 3 Credits

**Electives**
- Psychology 333, Educational Psychology, may be substituted for H. Ed. 415.

**MAJOR IN FOOD SCIENCE**
This major serves those who are interested in developing food products for the market, in food promotion programs in industries, in experimental food kitchens, in food research laboratories, in writing food columns for papers and magazines, and in directing food programs on radio and television. It leads to careers in business or in food research. For emphasis in food marketing and advertising additional courses selected from economics, psychology and statistics are recommended.

In addition to the curriculum requirements the following courses are to be completed:
### Home Economics

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>320 Fundamentals of Food Measurements</td>
<td>3</td>
</tr>
<tr>
<td>400B Field Study Tour</td>
<td>R</td>
</tr>
<tr>
<td>410 Nutrition During Human Growth and Development</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>414A Community Nutrition</td>
<td>3</td>
</tr>
<tr>
<td>421, 422 Principles of Food Science I and II</td>
<td>6</td>
</tr>
<tr>
<td>423 Introduction to Research in Food Science</td>
<td>3</td>
</tr>
<tr>
<td><strong>Home Management</strong></td>
<td></td>
</tr>
<tr>
<td>488 Family Finance</td>
<td>3</td>
</tr>
<tr>
<td><strong>Household Equipment</strong></td>
<td>3</td>
</tr>
<tr>
<td>315 Television Demonstration Techniques</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>421 Training in Demonstration Techniques</td>
<td>3</td>
</tr>
</tbody>
</table>

**Speech elective**

- T JI 225 Publicity and Public Relations 3 Credits
- T JI 335 Feature Articles for Technical Journals 3 Credits

**Engl 414 Writing of Scientific Papers**

*Selection of 5 credits from Physical and Biological Science, Economics, Mathematics or Statistics 5 Credits

**Electives**

- 26-38 Credits

Students may take part of Chemistry Sequence II and complete remaining requirements in Sequence I. Students who earn a grade of A or B in Chem. 105, 106 may enroll in Chem. 103 and continue in Sequence II. Sequence II fulfills option of 5 credits from Physical and Biological Sciences in major.

### Major in Food and Nutrition and Related Science

This major is planned for students who are especially interested in emphasizing physical and biological sciences in relation to food and nutrition. Graduates have positions in research laboratories in colleges and universities, medical laboratories, foundations, and in industry. They also have an excellent background for graduate study, which is basic to teaching in colleges and universities and for professional advancement in the areas of food and nutrition.

**Home Economics**

- 39-40 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>103 Design I (4 Credits)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>384 Survey of Art (3 Credits)</td>
<td>3-4</td>
</tr>
</tbody>
</table>

**Food and Nutrition**

- 23-24 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>214. Foods I</td>
<td>4</td>
</tr>
<tr>
<td>215 Foods II</td>
<td>4</td>
</tr>
<tr>
<td>303 Family Meal Management</td>
<td>3</td>
</tr>
<tr>
<td>305 Nutrition and Dietetics</td>
<td>4</td>
</tr>
<tr>
<td>404 Seminar in Food and Nutrition</td>
<td>2</td>
</tr>
<tr>
<td>421, 422 Principles of Food Science I and II (6 Credits)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>411, 415 Experimental Studies of Food and Introduction to Nutrition Research (7 Credits)</td>
<td>6-7</td>
</tr>
</tbody>
</table>

**Home Economics**

- 1 Credit

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>105 Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>400 Professional Relations</td>
<td>R</td>
</tr>
<tr>
<td>Courses in H. Ec other than those in major area</td>
<td>11-12</td>
</tr>
</tbody>
</table>

**Biological Sciences**

- 19 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bact 304 General Bacteriology</td>
<td>5</td>
</tr>
<tr>
<td>Zool 101, 102 General Zoology</td>
<td>10</td>
</tr>
<tr>
<td>Zool 355 Principles of Physiology</td>
<td>4</td>
</tr>
</tbody>
</table>

**Physical Sciences**

- 61-63 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 101, 102 General Chemistry (8 Credits)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Chem 105, 106 General Chemistry (6 Credits)</td>
<td>6-8</td>
</tr>
<tr>
<td>Chem 103 Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 311 Quantitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td>Chem 334, 335, 336 Organic Chemistry</td>
<td>12</td>
</tr>
<tr>
<td>B and B 304, 305 Physiological Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Math 101, 102 Algebra and Trigonometry I and II</td>
<td>10</td>
</tr>
<tr>
<td>Math 110, 211 Analytic Geometry and Calculus I and II</td>
<td>10</td>
</tr>
<tr>
<td>Phys 111, 112 General Physics</td>
<td>8</td>
</tr>
</tbody>
</table>

**Social Sciences and Humanities**

- 15 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Govt 215 American Government</td>
<td>3</td>
</tr>
<tr>
<td>History</td>
<td>6</td>
</tr>
</tbody>
</table>

**Written and Spoken English**

- 12 Credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng 101, 102, 103 Principles of Composition</td>
<td>9</td>
</tr>
<tr>
<td>Sp 311 Fundamentals of Speech</td>
<td>3</td>
</tr>
</tbody>
</table>

**Lib 106 Library Instruction**

- R

**M L 201, 202 (French) or 211, 232 (German) or 221A, 222A (Russian)**

- 6 Credits

**P E**

- 6 Credits

**Electives**

- 37-40 Credits
Curriculum in Home Economics Education

Leading to the degree Bachelor of Science. Total credits required, 198.

The curriculum is planned for those who wish to prepare for teaching homemaking in junior and senior high schools or home economics extension service.

Further information appears in the sections on Teacher Education and Home Economics Education, Description of Courses.

HOME ECONOMICS

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>10</td>
</tr>
<tr>
<td>103. Design I</td>
<td>4</td>
</tr>
<tr>
<td>261. Interior House Design I</td>
<td>3</td>
</tr>
<tr>
<td>(Select from) 104, 384</td>
<td>3</td>
</tr>
<tr>
<td>Child Development</td>
<td>10</td>
</tr>
<tr>
<td>236. Principles of Child Development</td>
<td>3</td>
</tr>
<tr>
<td>270. The Individual and His Family I</td>
<td>4</td>
</tr>
<tr>
<td>337. Development and Guidance in Later Childhood</td>
<td>3</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>16</td>
</tr>
<tr>
<td>107. Nutrition and the Family’s Food</td>
<td>4</td>
</tr>
<tr>
<td>208. Principles of Food Preparation</td>
<td>5</td>
</tr>
<tr>
<td>303. Family Meal Management</td>
<td>3</td>
</tr>
<tr>
<td>305. Nutrition and Dietetics</td>
<td>4</td>
</tr>
<tr>
<td>Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>105. Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>400. Professional Relations</td>
<td>R</td>
</tr>
<tr>
<td>Home Management</td>
<td>11</td>
</tr>
<tr>
<td>375. Management in the Family</td>
<td>4</td>
</tr>
<tr>
<td>475. Home Management House</td>
<td>4</td>
</tr>
<tr>
<td>488. Family Finance</td>
<td>3</td>
</tr>
<tr>
<td>Household Equipment</td>
<td>3</td>
</tr>
<tr>
<td>154. Introduction to Equipment in the House</td>
<td>3</td>
</tr>
<tr>
<td>Housing (Select from) A A 262, Arch. 361, H Ec 240, H.Eq</td>
<td>3</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td>13-15</td>
</tr>
<tr>
<td>104 Textiles I</td>
<td>3</td>
</tr>
<tr>
<td>245. Clothing Selection</td>
<td>3</td>
</tr>
<tr>
<td>123. Pattern Making and Clothing Construction (5 Credits)</td>
<td>4</td>
</tr>
<tr>
<td>or 125. Pattern Making and Clothing Construction (4 Credits)</td>
<td>4-5</td>
</tr>
<tr>
<td>225. Draping and Clothing Construction (3 Credits)</td>
<td>4</td>
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<tr>
<td>or 223. Pattern Making (4 Credits)</td>
<td>3-4</td>
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<tr>
<td>PROFESSIONAL EDUCATION</td>
<td>35</td>
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<tr>
<td>Education</td>
<td>10</td>
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<tr>
<td>204. Foundations of American Education</td>
<td>3</td>
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<tr>
<td>305. Methods of Teaching</td>
<td>4</td>
</tr>
<tr>
<td>426. Principles of Secondary Education</td>
<td>3</td>
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<tr>
<td>Home Economics Education</td>
<td>19</td>
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<tr>
<td>406. Observation and Methods of Teaching Home Economics</td>
<td>4</td>
</tr>
<tr>
<td>*407. Supervised Teaching in Home Economics</td>
<td>9</td>
</tr>
<tr>
<td>408. Methods in Adult Homemaking Education</td>
<td>3</td>
</tr>
<tr>
<td>409. Planning and Evaluating the Homemaking Program</td>
<td>3</td>
</tr>
<tr>
<td>Psychology</td>
<td>6</td>
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<tr>
<td>Psych 230 Developmental Psychology</td>
<td>3</td>
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<tr>
<td>Psych 333 Educational Psychology</td>
<td>3</td>
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<tr>
<td>OTHER REQUIRED COURSES</td>
<td>79</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>8</td>
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<tr>
<td>Bact 200 Introductory Bacteriology I</td>
<td>3</td>
</tr>
<tr>
<td>Zool 155 Elementary Human Physiology and Anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>17</td>
</tr>
<tr>
<td>Chem 105, 106. General Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Chem 231 Elementary Organic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>B and B 301. Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Phys 106 Elementary Physics</td>
<td>4</td>
</tr>
<tr>
<td>Social Science</td>
<td>18</td>
</tr>
<tr>
<td>Econ 241, 242 Principles of Economics</td>
<td>6</td>
</tr>
<tr>
<td>Govt 215 American Government</td>
<td>3</td>
</tr>
<tr>
<td>Psych 101 General Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134 Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 218 Introduction to Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Choose from at least three areas</td>
<td>15</td>
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<tr>
<td>History, Philosophy, Literature, Modern Languages, Music</td>
<td></td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>15</td>
</tr>
<tr>
<td>Engl 101, 102, 103. Principles of Composition</td>
<td>9</td>
</tr>
<tr>
<td>Sp 311 Fundamentals of Speech</td>
<td>3</td>
</tr>
<tr>
<td>Lib 106 Library Instruction</td>
<td>R</td>
</tr>
<tr>
<td>PE</td>
<td>6</td>
</tr>
<tr>
<td>ELECTIVES</td>
<td>15-17</td>
</tr>
</tbody>
</table>
Opportunities for supervised teaching in home economics are offered in typical Iowa schools. The teaching may be done over the full quarter or concentrated into half of the quarter, the other half being devoted to H.Mgt. 475 and other courses. Reservation should be filed with the department head at least four quarters before teaching.

Curriculum in Home Economics for General Education

Leading to the degree Bachelor of Science. Total credits required, 198.

This curriculum is designed for the student interested in home economics and in a broad cultural education. It offers general education in all areas of home economics and permits options in the social sciences, physical and biological sciences, English, modern languages or mathematics depending upon the particular interests of the student. As soon as possible after choosing this curriculum, the student should plan with the adviser for the selection of a series of courses that will insure a well-balanced program.

### HOME ECONOMICS

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>4</td>
</tr>
<tr>
<td>Design I</td>
<td>4</td>
</tr>
<tr>
<td>Child Development</td>
<td>4</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>9</td>
</tr>
<tr>
<td>Nutrition and the Family's Food</td>
<td>5</td>
</tr>
<tr>
<td>Foods I</td>
<td>5</td>
</tr>
<tr>
<td>Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>Introduction to Family Housing</td>
<td>3</td>
</tr>
<tr>
<td>Professional Relations</td>
<td>R</td>
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<tr>
<td>Senior Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Management in the Family</td>
<td>4</td>
</tr>
<tr>
<td>Household Equipment</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Equipment in the House</td>
<td>3</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td>3</td>
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<tr>
<td>Textiles</td>
<td>3</td>
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### OTHER REQUIRED COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Biological Sciences</td>
<td>5</td>
</tr>
<tr>
<td>Zool 155 Elementary Human Physiology and Anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>10-12</td>
</tr>
<tr>
<td>Chem 105, 106 General Chemistry</td>
<td>6-8</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Chem. 101, 102 General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Chem. 231 Elementary Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>Social Sciences</td>
<td>18</td>
</tr>
<tr>
<td>Govt 215 American Government</td>
<td>3</td>
</tr>
<tr>
<td>Psych. 101 General Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Soc. 134. Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 218 Introduction to Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>12</td>
</tr>
<tr>
<td>Engl 101, 102, 103 Principles of Composition</td>
<td>9</td>
</tr>
<tr>
<td>Lib. 106 Library Instruction</td>
<td>R</td>
</tr>
<tr>
<td>P.E.</td>
<td>6</td>
</tr>
</tbody>
</table>

### MAJOR IN HOME ECONOMICS FOR GENERAL EDUCATION

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>3</td>
</tr>
<tr>
<td>Design I</td>
<td>3</td>
</tr>
<tr>
<td>Principles of Child Development</td>
<td>3</td>
</tr>
<tr>
<td>Home Management</td>
<td>3-4</td>
</tr>
<tr>
<td>Consumers in the Market</td>
<td>3</td>
</tr>
<tr>
<td>Home Management House</td>
<td>4</td>
</tr>
<tr>
<td>Family Finance</td>
<td>3</td>
</tr>
<tr>
<td>Additional Home Economics from at least three different areas</td>
<td>24</td>
</tr>
</tbody>
</table>

### Biological Sciences

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bact. 200. Introductory Bacteriology</td>
<td>3-5</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Bact. 304 General Bacteriology</td>
<td>3-5</td>
</tr>
<tr>
<td>Physical Sciences: Biochem., Earth Science, Math , Phys.</td>
<td>3-5</td>
</tr>
<tr>
<td>Social Sciences: Econ., Hist., Govt., Psych., Soc.</td>
<td>15</td>
</tr>
<tr>
<td>Humanities: Hist., Phil., Lit., M.L., Music</td>
<td>15</td>
</tr>
<tr>
<td>Electives</td>
<td>39-46</td>
</tr>
</tbody>
</table>
MAJOR IN HOME MANAGEMENT

This major is designed for students interested in social welfare, extension service, consumer marketing or business positions requiring a background in home management and social science.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics .................................................. 3 Credits
Food and Nutrition ................................................. 3 Credits
303 Family Meal Management .................................... 3 Credits
Home Management .................................................. 19 Credits
415 Consumers in the Market .................................... 3 Credits
475 Home Management House ................................... 4 Credits
488 Family Finance ................................................ 3 Credits
Additional Home Management .................................. 9 Credits
Household Equipment ............................................. 3 Credits

Biological Sciences
Bact 304 General Bacteriology .................................. 5 Credits

Physical Sciences
Math 101 or 101B Algebra and Trigonometry I or
Algebra and Trigonometry I B .................................... 3-5 Credits
Phys 106 Elementary Physics .................................... 4 Credits

Social Sciences
Econ ................................................................. 3 Credits
Psych ............................................................... 6 Credits
Soc ................................................................. 3 Credits

Humanities Hist, Lit, M.L, Music
Phil 260 Introduction to Philosophy (4 Credits)
or
Phil 350 Introductory Logic (3 Credits) ..................... 3-4 Credits

Written and Spoken English
Engl 201 Introduction to Literature (Select from) Engl, Sp, or TJI
................................................................. 3 Credits

Electives ............................................................ 40-46 Credits

MAJOR IN INTERNATIONAL SERVICE

Students in this curriculum may develop a program with emphasis in International Service. This is designed to provide students with a background for participation in government or agency programs such as Peace Corps, Voluntary International Service Assignments (VISA), etc as well as provide an opportunity for young women to become oriented to national and international affairs as part of their responsibility of citizenship in its broadest sense. Further information appears in the section International Service Programs.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics .................................................. 33-34 Credits
Applied Art ......................................................... 3 Credits
384 Survey of Art .................................................. 3 Credits
Child Development ............................................... 3 Credits
235 Principles of Child Development ......................... 3-4 Credits
Food and Nutrition ............................................... 3-4 Credits
302 Nutrition of the Child and the Family (3 Credits)
or
305 Nutrition and Dietetics (4 Credits) ..................... 3-4 Credits
Home Economics .................................................. 2 Credits
440B Field Trip ..................................................... 2 Credits
Home Management (Select from)
415 Consumers in the Market .................................... 3 Credits
475 Home Management House ................................... 4 Credits
488 Family Finance ................................................ 3 Credits
520 Food Economics ............................................... 3 Credits
Additional Home Economics .................................... 17-20 Credits

Physical Sciences
Geol 304 World Geography ....................................... 3 Credits
Geol 305 Economic Geography ................................... 3 Credits

Social Sciences
Econ 334 Land Economics ....................................... 3 Credits
Govt 241 Comparative Political Systems ...................... 3 Credits
Govt 351, 352 Politics of Developing Nations ............... 6 Credits
Select one of the following: ................................. 3 Credits
440 British and Commonwealth Governments ............... 3 Credits
442 Governments of Asia ........................................ 3 Credits
443 Latin American Governments ............................. 3 Credits

Sociology
425 Intercultural Relations (3 Credits) ....................... 3 Credits
or
445 Population Problems and Policies (3 Credits) ....... 3 Credits
Curriculum in Home Economics Journalism

Administered by the Dean of the College of Home Economics.

Leading to the degree Bachelor of Science Total credits required, 198

A variety of positions is open to women with combined training in home economics and journalism. Such positions include editorial, advertising, radio and television work in media associated with home economics.

Students in home economics with a major in journalism have opportunities for practical experience through work on campus publications, including The Iowa Homemaker, published by home economics students. Many young women also lay foundations for active careers by contributing to magazines and newspapers and by participating in productions for the University stations WOI-AM, FM and TV.

HOME ECONOMICS

Applied Art

103. Design I 4 Credits
261. Interior House Design I 4 Credits
Child Development

236 Principles of Child Development 3 Credits
270 The Individual and His Family I 4 Credits
Food and Nutrition

107 Nutrition and the Family’s Food 4 Credits
208 Foods I 5 Credits
Home Economics

105. Orientation to Home Economics 1 Credit
400 Professional Relations R
420B Senior Seminar 1 Credit
Home Management

375 Management in the Family 4 Credits
Select from the following 3-4 Credits
415 Consumers in the Market 3 Credits
475 Home Management House 4 Credits
488 Family Finance 3 Credits
Household Equipment

154. Introduction to Equipment in the House 3 Credits
Textiles and Clothing

104 Textiles 3 Credits
Choose courses beyond those listed above. Students are expected to select an area of concentration in consultation with adviser 24 Credits

TECHNICAL JOURNALISM

101 Introduction to Mass Communications (Fr) 2 Credits
221, 222, 223 Basic Reporting (So Yr) 10 Credits
325 Technical Advertising 3 Credits
341 Practice in Copy Editing and Typography 3 Credits
430 Law of Communications 3 Credits
Additional . . . . . . . . . . . . . . . . . . . . . . . . . . 13 Credits

OTHER REQUIRED COURSES AND OPTIONS

Biological Sciences:

Zool 155 Elementary Human Physiology and Anatomy 5 Credits
Bact., Biochem., Bot., Gen., Zool 3 Credits
Physical Sciences

Chem 105, 106 or 101, 102 General Chemistry 6-8 Credits
Chem 231 Elementary Organic Chemistry 4 Credits
Biochem., Chem., Geol., Math., Phys 3-5 Credits
Social Sciences

Econ 241 242 Principles of Economics 6 Credits
Govt. 215 American Government 3 Credits
Psych 101 General Psychology I 3 Credits
Soc. 218 Introduction to Cultural Anthropology 3 Credits
Humanities: Hist., Phil., Lit., M.L., Music 15 Credits

Other Required Courses and Options

Choose course beyond those listed above. Students are expected to select an area of concentration in consultation with advisor 24 Credits

Overall Required Courses and Options

63-64 Credits

Total credits 198-199 Credits
Written & Spoken English
- Engl 101, 102, 103 Principles of Composition: 9 Credits
- Sp 311 Fundamentals of Speech: 3 Credits
Lib 105 Library Instruction: R
P E: 6 Credits
ELECTIVES: 23-26 Credits

Curriculum in Household Equipment

Leading to the degree Bachelor of Science. Total credits, 198.

HOME ECONOMICS: 3 Credits
- Applied Art: 3 Credits
- Child Development: 4 Credits
- Food and Nutrition: 11 Credits
- Home Economics: 8 Credits
- Home Management: 4 Credits
- Home Management House: 4 Credits
- Householding Equipment: 35 Credits
- 154 Introduction to Equipment in the House: 3 Credits
- 208 Small Equipment: 3 Credits
- 304 Equipment Technology: 4 Credits
- 308 Home Lighting and Kitchen Planning: 4 Credits
- 400 Senior Observation Trip: R
- 407 Gas and Electric Ranges: 3 Credits
- 408 Laundering and Other Water-Using Equipment: 4 Credits
- 409. Home Refrigeration: 3 Credits
- 421 Training in Demonstration Techniques: 3 Credits
- 422 Professional Orientation: 3 Credits
- 425 Seminar: 2 Credits
- 445 House Utilities: 3 Credits

OR
- 446 House Evaluation: 3 Credits
- Textiles and Clothing: 3 Credits
- 104 Textiles I: 3 Credits
- Group I Choose A, B, or C: 3-4 Credits
  - A Arch 334 Residential Architecture: 3 Credits
  - B Arch 335 Residential Architecture: 3 Credits
  - C T & C 304 Intermediate Textiles: 3 Credits

Other Required Courses
- Biological Sciences Bact., Biochem., Bot., Gen., Zool: 3 Credits
- Zool 155 Elementary Human Physiology and Anatomy: 5 Credits
- Physical Sciences: 50-52 Credits
- Chem 105, 106 or 101, 102 General Chemistry: 6-8 Credits
- Chem 231 Elementary Organic Chemistry: 4 Credits
- Math 101 Algebra and Trigonometry I: 5 Credits
- Phys 106 Elementary Physics: 4 Credits
- Social Sciences: 21 Credits
- Econ 241, 242 Principles of Economics: 6 Credits
- Gov't 215 American Government: 3 Credits
- Psych 101 General Psychology I: 3 Credits
- Psych 250 Psychology of Sales and Advertising: 3 Credits
- Soc. 134 Introduction to Sociology: 3 Credits
- Soc 218 Introduction to Cultural Anthropology: 3 Credits
- Humanities Hist. Phil. Lit., M. L., Music: 15 Credits
- Written and Spoken English: 18 Credits
- Engl 101, 102, 103 Principles of Composition: 9 Credits
- Engl 414 Writing of Scientific Papers: 3 Credits
- Sp 302 Television and Radio Speech: 3 Credits
- Sp 311 Fundamentals of Speech: 3 Credits
- Lib 106 Library Instruction: R
- P E: 6 Credits
ELECTIVES: 37-40 Credits

For students who are interested in testing and development or going into graduate work in equipment, the following courses are recommended Math 102, Stat 201.
MAJOR IN HOUSEHOLD EQUIPMENT AND RELATED SCIENCE

A major area of study for students interested in sciences, mathematics and/or graduate work.

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics</td>
<td>59 Credits</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>8 Credits</td>
</tr>
<tr>
<td>107. Nutrition and the Family's Food</td>
<td>4 Credits</td>
</tr>
<tr>
<td>214. Foods I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Home Economics</td>
<td>1 Credit</td>
</tr>
<tr>
<td>105. Orientation to Home Economics</td>
<td>R</td>
</tr>
<tr>
<td>400. Professional Relations</td>
<td></td>
</tr>
<tr>
<td>Household Equipment</td>
<td>25 Credits</td>
</tr>
<tr>
<td>154. Introduction to Equipment in the Home</td>
<td>3 Credits</td>
</tr>
<tr>
<td>304. Equipment Technology</td>
<td>4 Credits</td>
</tr>
<tr>
<td>407. Gas and Electric Ranges</td>
<td>3 Credits</td>
</tr>
<tr>
<td>408. Laundering and Other Water-Using Equipment</td>
<td>4 Credits</td>
</tr>
<tr>
<td>409. Home Refrigeration</td>
<td>3 Credits</td>
</tr>
<tr>
<td>490. Special Problems</td>
<td>6 Credits</td>
</tr>
<tr>
<td>Lighting</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Additional</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td>2 Credits</td>
</tr>
<tr>
<td>104. Textiles</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Group I</td>
<td>7 Credits</td>
</tr>
<tr>
<td>F. and N 215, Foods II and</td>
<td>3 Credits</td>
</tr>
<tr>
<td>F and N 411. Experimental Studies of Food or</td>
<td>4 Credits</td>
</tr>
<tr>
<td>T and C. 304. Intermediate Textiles and</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Chem 466. Textile Chemistry</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Group II</td>
<td>15 Credits</td>
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<tr>
<td>Home economics courses in addition to major area and to home economics courses listed</td>
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</tr>
<tr>
<td>Biological Sciences</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Bact 304. General Bacteriology</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>54-56 Credits</td>
</tr>
<tr>
<td>Chem 101, 102 or 105, 106. General Chemistry</td>
<td>6-8 Credits</td>
</tr>
<tr>
<td>Chem 103. Systematic Inorganic Chemistry</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Chem 231. Elementary Organic Chemistry</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Math 101. Algebra and Trigonometry I</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Math 102. Algebra and Trigonometry II</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Math 110. Analytic Geometry and Calculus I</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Math 211. Analytic Geometry and Calculus II</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Phys. 111, 112, 113. General Physics</td>
<td>12 Credits</td>
</tr>
<tr>
<td>Phys. or Chem elective</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Stat 201. Principles of Statistics</td>
<td>5 Credits</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>15 Credits</td>
</tr>
<tr>
<td>Govt 215. American Government</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Additional</td>
<td>12 Credits</td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>15 Credits</td>
</tr>
<tr>
<td>Engl 101, 102, 103. Principles of Composition</td>
<td>9 Credits</td>
</tr>
<tr>
<td>Engl. 414. Writing of Scientific Papers</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Sp 311. Fundamentals of Speech</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Lib 106. Library Instruction</td>
<td>R</td>
</tr>
<tr>
<td>Modern Languages—M.L. 201, 202 (French) or M.L. 231, 232 (German) or M.L. 221A, 222A (Russian)</td>
<td></td>
</tr>
<tr>
<td>P.E.</td>
<td>6 Credits</td>
</tr>
<tr>
<td>TJI. 225. Publicity and Public Relations</td>
<td>6 Credits</td>
</tr>
<tr>
<td>Electives</td>
<td>33-35 Credits</td>
</tr>
</tbody>
</table>

Curriculum in Institution Management

Leading to the degree Bachelor of Science Total credits required, 198.

For men selecting a major in this department, the following adjustments will be made:
Add—recommended electives (8 credits); omit—F. and N. 303, H Ec. 105 and H. Mgt. 375 (total 8 credits).

The three majors within the Institution Management curriculum, College Food and Housing Administration, Restaurant Management, and School Food Service, meet the academic requirements for membership in the American Dietetic Association and qualify the student for an internship approved by the Association. Graduates of this curriculum are eligible for membership in the American School Food Service Association and the National Restaurant Association.
By careful planning of program and use of electives, a student majoring in School Food Service may meet the certification requirements for teaching home economics in high school.

The following courses, totaling 152-154 credits, are required for each degree student in Institution Management. Additional courses for each specific major will follow.

**HOME ECONOMICS**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Art</td>
<td>4 Credits</td>
</tr>
<tr>
<td>103. Design I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Child Development</td>
<td>4 Credits</td>
</tr>
<tr>
<td>270. The Individual and His Family</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>15 Credits</td>
</tr>
<tr>
<td>107. Nutrition and the Family's Food</td>
<td>4 Credits</td>
</tr>
<tr>
<td>214. Foods I</td>
<td>4 Credits</td>
</tr>
<tr>
<td>215. Foods II</td>
<td>4 Credits</td>
</tr>
<tr>
<td>303. Family Meal Management</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Home Economics</td>
<td>1 Credit</td>
</tr>
<tr>
<td>105. Orientation to Home Economics</td>
<td>1 Credit</td>
</tr>
<tr>
<td>400 Professional Relations</td>
<td>R</td>
</tr>
<tr>
<td>Home Management</td>
<td>4 Credits</td>
</tr>
<tr>
<td>375 Management in the Family</td>
<td>4 Credits</td>
</tr>
<tr>
<td>Household Equipment</td>
<td>3 Credits</td>
</tr>
<tr>
<td>154. Introduction to Equipment in the House</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Institution Management</td>
<td>23 Credits</td>
</tr>
<tr>
<td>287 Introduction to Food Service Management</td>
<td>2 Credits</td>
</tr>
<tr>
<td>380 Quantity Food Production Management</td>
<td>4 Credits</td>
</tr>
<tr>
<td>400 Study Tour</td>
<td>1 Credit</td>
</tr>
<tr>
<td>404 Seminar</td>
<td>2 Credits</td>
</tr>
<tr>
<td>484. Purchasing</td>
<td>4 Credits</td>
</tr>
<tr>
<td>485. Equipment</td>
<td>4 Credits</td>
</tr>
<tr>
<td>487 Organization and Management</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Additional</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Textiles and Clothing</td>
<td>3 Credits</td>
</tr>
<tr>
<td>114 Textiles</td>
<td>3 Credits</td>
</tr>
</tbody>
</table>

**CONCENTRATION A OR B**

**CONCENTRATION A**

- B and B 301. Biochemistry | 3 Credits
- Ed. 305 Methods of Teaching | 3 Credits
- F and N 305. Nutrition and Dietetics | 4 Credits
- F. and N 411. Experimental Studies of Food | 4 Credits

**OR**

**CONCENTRATION B**

- Econ 305 Labor Economics and Labor Relations | 3 Credits
- I.Ad. 365D. Business Law I | 3 Credits
- I Ad 385 Accounting II | 3 Credits
- I Mgt Selection | 3 Credits

**OTHER REQUIRED COURSES**

- Biological Sciences | 10 Credits
- Bact. 304 General Bacteriology | 5 Credits
- Zool 155 Elementary Human Physiology and Anatomy | 5 Credits
- Physical Sciences | 15 Credits
- Chem. 105, 106 or 101, 102 General Chemistry | 6-8 Credits
- Chem 231 Elementary Organic Chemistry | 4.5 Credits
- Select from Biochem, Chem., Earth Science, Math, Phys. | 2-5 Credits
- Social Sciences | 21 Credits
- Econ 241, 242 Principles of Economics | 6 Credits
- Govt 215 American Government | 3 Credits
- Psych 101 General Psychology I | 3 Credits
- Psych 450 Industrial Psychology | 3 Credits
- Soc 134 Introduction to Sociology | 3 Credits
- Soc. 218. Introduction to Cultural Anthropology | 3 Credits
- Humanities: Hist., Phil., Lit., M.L., Music | 15 Credits
- Written and Spoken English | 12 Credits
- Engl. 101, 102, 103. Principles of Composition | 3 Credits
- Sp. 311. Fundamentals of Speech | 3 Credits

**I.Ad. 372B. General Accounting**

**OR**

- I Ad 384 Accounting I | 4 Credits
- Lib 106. Library Instruction | R
- P.E. | 6 Credits

**MAJOR IN COLLEGE FOOD AND HOUSING ADMINISTRATION**

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Economics</td>
<td>8 Credits</td>
</tr>
<tr>
<td>Institution Management</td>
<td>8 Credits</td>
</tr>
<tr>
<td>486A Institution Management Experience</td>
<td>2 Credits</td>
</tr>
<tr>
<td>486B Institution Management Experience</td>
<td>3 Credits</td>
</tr>
<tr>
<td>489 House Administration</td>
<td>3 Credits</td>
</tr>
<tr>
<td>I E. 475 Motion and Time Study</td>
<td>3 Credits</td>
</tr>
<tr>
<td>I E Selection</td>
<td>3 Credits</td>
</tr>
<tr>
<td>Electives</td>
<td>30-32 Credits</td>
</tr>
</tbody>
</table>
MAJOR IN RESTAURANT MANAGEMENT

In addition to the curriculum requirements the following courses are to be completed:

Home Economics
Institution Management
486A Institution Management Experience 5 Credits
486B Institution Management Experience 2 Credits
486C Institution Management Experience 3 Credits

Electives 39-41 Credits

MAJOR IN SCHOOL FOOD SERVICE

In addition to the curriculum requirements the following courses are to be completed:

Home Economics
Food and Nutrition 3 Credits
410 Nutrition During Human Growth and Development 3 Credits

Institution Management
486A Institution Management Experience 3 Credits
486B Institution Management Experience 1 Credit

Ed. 204. Foundations of American Education 3 Credits

Electives 35-37 Credits

CERTIFICATE PROGRAM

The Cooperative Restaurant Management Program leading to a Certificate in Restaurant Management includes six quarters of University classes and a specified amount of on-the-job management experience. The six-quarter program includes professional courses related to business management and large quantity food production and service, as well as courses in the basic sciences and the humanities. Credits earned in this program may be applied to the major in restaurant management if a student wishes to finish the requirements for a degree.

This educational program provides an opportunity for the students to gain fundamentals related to various aspects of restaurant management. In addition, it provides for general education as well as technical preparation. As a result of combining the academic program with on-the-job experience, some advanced courses are made available to the student within the six-quarter program.

The on-the-job experience provides an opportunity for a student to make application of what he learns and thereby develop certain skills and understandings needed for effective restaurant management. The background afforded by the on-the-job experience provides motivation for greater interest in University classes. Remuneration during the work experience periods can help finance the student’s education.

Curriculum in Physical Education for Women

Leading to the degree Bachelor of Science. Total credits required, 198

See College of Science and Humanities for Group Requirements leading to a degree through the College of Science and Humanities.

The curriculum in physical education for women prepares the student to teach physical education and/or dance in the public schools and colleges. Other opportunities include professional work in related areas.

PHYSICAL EDUCATION
190. Introduction to Physical Education 3 Credits
265. Fundamentals of Modern Dance 1 Credit
452 Evaluation in Physical Education 4 Credits
480 Scientific Bases of Physical Education 5 Credits

HEALTH EDUCATION
4. and N 107 Nutrition and the Family’s Food 4 Credits
Hyg. 104 Health Education 4 Credits
Hyg. 604 School Health Problems 3 Credits

PROFESSIONAL EDUCATION
Education
204 Foundations of American Education 3 Credits
305 Methods of Teaching 4 Credits
426 Principles of Secondary Education 3 Credits
Physical Education
385. Techniques and Methods of Social Folk and Square Dance 2 Credits
427 Supervised Teaching in Physical Education 9 Credits
470 Elementary School Physical Education 3 Credits

13 Credits
11 Credits
10 Credits
30 Credits

14 Credits
### 186/Colleges and Curricula

**Psychology**
- 220 Developmental Psychology: 3 Credits
- 333 Educational Psychology: 3 Credits

**OTHER REQUIRED COURSES**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Sciences</td>
<td></td>
</tr>
<tr>
<td>Zool 155 Elementary Physiology and Anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Zool 359 Kinesiology</td>
<td>5</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td></td>
</tr>
<tr>
<td>Physics 106 Elementary Physics</td>
<td>4</td>
</tr>
<tr>
<td>Social Sciences</td>
<td></td>
</tr>
<tr>
<td>Econ 241 Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Govt 215 American Government</td>
<td>3</td>
</tr>
<tr>
<td>Psych 101 General Psychology I</td>
<td>3</td>
</tr>
<tr>
<td>Psych 430 Psychology of Adolescence</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134 Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Humanities</td>
<td></td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>12</td>
</tr>
<tr>
<td>Eng 101, 102, 103 Principles of Composition</td>
<td>9</td>
</tr>
<tr>
<td>Sp 311 Fundamentals of Speech</td>
<td>3</td>
</tr>
</tbody>
</table>

**CONCENTRATIONS**
- Select 15 credits from one of the following areas: English, History, Math, Modern Language, Sociology, Physical Sciences, Biological Sciences, or Home Economics.
- 15 Credits

### MAJOR IN PHYSICAL EDUCATION FOR WOMEN

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Education</td>
<td></td>
</tr>
<tr>
<td>150, 151, 152 Fundamentals of Physical Education Activities</td>
<td>3 Credits</td>
</tr>
<tr>
<td>250, 251, 252 Fundamentals of Physical Education Activities</td>
<td>3 Credits</td>
</tr>
<tr>
<td>270, 271 Officiating</td>
<td>4</td>
</tr>
<tr>
<td>390, 391, 392 Educational Bases of Physical Education</td>
<td>18 Credits</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td></td>
</tr>
<tr>
<td>Zool 101 Elementary Zoology</td>
<td>5</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td></td>
</tr>
<tr>
<td>Chem 105, 106 or 101, 102 or 101A, 102A General Chemistry</td>
<td>6-8 Credits</td>
</tr>
<tr>
<td>Social Sciences</td>
<td></td>
</tr>
<tr>
<td>Econ 242 Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>Soc 364 Group Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>Humanities</td>
<td></td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>12</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
</tr>
<tr>
<td>- 18-20 Credits</td>
<td></td>
</tr>
</tbody>
</table>

The state requirement of a minimum of 30 credits to qualify to teach physical education half-time or less can be met by completing PHYS 150, 151, 152, 190, 250, 251, 252, 265, 385, 390, 391, 392

### MAJOR IN PHYSICAL EDUCATION—DANCE OPTION

In addition to the curriculum requirements the following courses are to be completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Education</td>
<td></td>
</tr>
<tr>
<td>150, 151, 152, 250, 251, 252. Fundamentals of Physical Education Activities. (Select 3 courses)</td>
<td>3 Credits</td>
</tr>
<tr>
<td>210, 211, 212 Composition, Concert Dance, Techniques (1 cr each)</td>
<td>3 Credits</td>
</tr>
<tr>
<td>310, 311 Dance Production</td>
<td>2</td>
</tr>
<tr>
<td>390 History and Philosophy of Dance</td>
<td>3</td>
</tr>
<tr>
<td>396 Methods of Teaching Modern Dance</td>
<td>3</td>
</tr>
<tr>
<td>390, 391, 392 Educational Bases of Physical Education (Select 2 courses.)</td>
<td>12 Credits</td>
</tr>
<tr>
<td>490D Special Topics in Dance</td>
<td></td>
</tr>
<tr>
<td>Physical Sciences</td>
<td></td>
</tr>
<tr>
<td>A.A. 103 Design I</td>
<td>4</td>
</tr>
<tr>
<td>Select from the following courses</td>
<td></td>
</tr>
<tr>
<td>Eng 255 Modern Literature (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Eng 366 World Drama Greeks to Ibsen (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Eng 367 World Drama Ibsen to the Present (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Eng 388 Modern Poetry (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Sp 304 Oral Interpretation (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Sp 324A, 324B Dramatic Production (3 Credits each)</td>
<td></td>
</tr>
<tr>
<td>Sp 325 Technical Theatre (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Sp 334 Persuasion (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Phil 260 Introduction to Philosophy (4 Credits)</td>
<td></td>
</tr>
<tr>
<td>Phil 370 Introductory Logic (3 Credits)</td>
<td></td>
</tr>
<tr>
<td>Phil 430 Aesthetics (4 Credits)</td>
<td></td>
</tr>
<tr>
<td>Soc 218 Introduction to Cultural Anthropology (3 Credits)</td>
<td></td>
</tr>
</tbody>
</table>
Soc 364 Group Dynamics (3 Credits)
A A 230 Drawing and Composition (4 Credits)
A A 424 Oil Painting (3 Credits)
A A 486 Modern Art (3 Credits)
Music 344 Music in Radio and Television (2 Credits)
Music 364 Creative Activities in Music (4 Credits)

Electives 17-19 Credits

Any student with a teaching major in another area can meet the state requirement to qualify to teach dance activities half-time or less by completion of the following courses

Curriculum in Textiles and Clothing

Leading to the degree Bachelor of Science. Total credits required, 198.
Five majors are offered in the Textiles and Clothing Department: Merchandising, Clothing, Textiles, Textile and Clothing Design, and Textiles and Related Science.

HOME ECONOMICS 43-44 Credits
Applied Art ............................. 7 Credits
103. Design I ........................... 4 Credits
384 Survey of Art ....................... 3 Credits
Child Development ........................ 4 Credits
270 The Individual and His Family I .......... 4 Credits
Food and Nutrition .......................... 4 Credits
107 Nutrition and the Family’s Food .......... 1 Credit
Home Economics ........................... 4 Credits
105 Orientation to Home Economics .......... 1 Credit
400 Professional Relations ........................ R
Home Management .......................... 4 Credits
375 Management in the Family .......... 23-24 Credits
Textiles and Clothing .......................... 4 Credits
104. Textiles ............................ 3 Credits
123 or 125. Pattern Making and Clothing Construction 4-5 Credits
245 Clothing Selection .......................... 3 Credits
304 Intermediate Textiles .......................... 3 Credits
365 Professional Opportunities in Textiles and Clothing 3 Credits
401. Senior Study Tour ........................ R
410 Textiles and Clothing Department Seminar .......... 1 Credit
414 Historic Textiles .......................... 3 Credits
464 Family Clothing Consumption .......................... 3 Credits
OTHER REQUIRED COURSES 66-68 Credits
Biological Sciences .......................... 5 Credits
Zool 155 Elementary Human Physiology and Anatomy .......... 5 Credits
Humanities, Hist., Phil., Lit., M.L., Music .......................... 9 Credits
Hist 311, 312 Introduction to Western Civilization .......... 6 Credits
Physical Sciences .......................... 10-12 Credits
Chem 105, 106 or 101, 102. General Chemistry ........................ 6-8 Credits
Chem 231 Elementary Organic Chemistry .......................... 4 Credits
Social Sciences .......................... 18 Credits
Econ. 241, 242 Principles of Economics .......................... 6 Credits
Govt. 215. American Government .......................... 3 Credits
Psych 101. General Psychology I .......................... 3 Credits
Soc 134 Introduction to Sociology .......................... 3 Credits
Soc 218 Introduction to Cultural Anthropology .......................... 3 Credits
Written and Spoken English .......................... 12 Credits
Engl 101, 102, 103 Principles of Composition .......................... 9 Credits
Sp 311. Fundamentals of Speech .......................... 3 Credits
Lib 106 Library Instruction .............................. R
P.E. .............................. 6 Credits

MAJOR IN MERCHANDISING

This major prepares the student for work in merchandising; supervised work experience in a department store may be arranged.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics ............................. 25 Credits
Applied Art ............................. 10 Credits
213 Fashion Illustration I .......................... 3 Credits
230. Drawing and Composition .......................... 4 Credits
261. Interior House Design I .......................... 3 Credits
Home Management ............................. 3 Credits
415. Consumers in the Market .......................... OR
Econ. 305 Labor Economics and Labor Relations .......................... 3 Credits
Textiles and Clothing .......................... 12 Credits
225. Draping and Clothing Construction .......................... 3 Credits
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345 Costume Design and Selection  3 Credits
404 Advanced Textiles  3 Credits
454 History of Costume  3 Credits

Biological Sciences  Bact., Biochem., Bot., Gen., Zool

Social Sciences
Econ 465 Retailing  3 Credits
Psych 250 Psychology of Sales and Advertising  3 Credits
Soc 380 Social Relations in Industry  3 Credits

Written and Spoken English
Engl 101, 102, 103 Principles of Composition  9 Credits
Sp 311 Fundamentals of Speech  3 Credits

P.E.

Home Economics
Applied Art
213 Fashion Illustration I  3 Credits
230 Drawing and Composition  4 Credits
261 Interior House Design I

OR
434 Textile Design I  4 Credits

Household Equipment
154 Introduction to Equipment in the House  3 Credits

Textiles and Clothing
225 Draping and Clothing Construction  3 Credits
326 Children's Clothing  3 Credits
345 Costume Design and Selection  3 Credits
404 Advanced Textiles  3 Credits
454 History of Costume  3 Credits

Additional Clothing Construction  3 Credits

Biological Science  Bact., Biochem., Bot., Gen., Zool

Electives  15-20 Credits

Major in Clothing
This major is planned for students interested in teaching in stores, home or extension, custom dress making, or working with pattern companies.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics
Applied Art
11 Credits

Electives  32 Credits

Major in Textiles
This major prepares the student for work in quality control laboratories or as consultants for promotional work in textiles.

In addition to the curriculum requirements the following courses are to be completed:

Home Economics
Applied Art
3 Credits

Electives  16 Credits

Major in Textile and Clothing Design
This major is planned for students interested in designing.

In addition to the curriculum requirements the following courses are to be completed:
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home Economics</strong></td>
<td></td>
</tr>
<tr>
<td>Applied Art</td>
<td>20</td>
</tr>
<tr>
<td>213. Fashion, Illustration I</td>
<td>3</td>
</tr>
<tr>
<td>230. Drawing and Composition</td>
<td>4</td>
</tr>
<tr>
<td>344. Craft Design I</td>
<td>3</td>
</tr>
<tr>
<td>434. Textile Design I</td>
<td>4</td>
</tr>
<tr>
<td>485. Medieval, Renaissance and Oriental Art</td>
<td>3</td>
</tr>
<tr>
<td>486. Modern Art</td>
<td>3</td>
</tr>
<tr>
<td><strong>Textiles and Clothing</strong></td>
<td></td>
</tr>
<tr>
<td>225. Draping and Clothing Construction</td>
<td>3</td>
</tr>
<tr>
<td>236. Children's Clothing</td>
<td>3</td>
</tr>
<tr>
<td>345. Costume Design and Selection</td>
<td>3</td>
</tr>
<tr>
<td>454. History of Costume</td>
<td>3</td>
</tr>
<tr>
<td>490D. Special Problem in Design</td>
<td>2</td>
</tr>
<tr>
<td><strong>Biological Sciences</strong></td>
<td></td>
</tr>
<tr>
<td>Bact 304. General Bacteriology</td>
<td>5</td>
</tr>
<tr>
<td>Zool 101 and 102. General Zoology (8 Credits)</td>
<td></td>
</tr>
<tr>
<td>Zool 155. Elementary Human Physiology and Anatomy (5 Credits)</td>
<td>8-5</td>
</tr>
<tr>
<td><strong>Physical Sciences</strong></td>
<td>8-6</td>
</tr>
<tr>
<td>Chem 101, 102 or 105, 106. General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 103. Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 211. Quantitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td>Chem 334, 335. Organic Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Chem 456. Textile Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Math 101. Algebra and Trigonometry</td>
<td>5</td>
</tr>
<tr>
<td>Math 102. Algebra and Trigonometry II</td>
<td>5</td>
</tr>
<tr>
<td>Math 110. Analytic Geometry and Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>Math 211. Analytic Geometry and Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>Phys. 111, 112. General Physics</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social Sciences</strong></td>
<td>24</td>
</tr>
<tr>
<td>Govt 215. American Government</td>
<td>3</td>
</tr>
<tr>
<td>Hist 311, 312. Introduction to Western Civilization</td>
<td>6</td>
</tr>
<tr>
<td>Psych 101. General Psychology I</td>
<td>3</td>
</tr>
<tr>
<td>Soc 134. Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Soc 218. Introduction to Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>Written and Spoken English</td>
<td>15</td>
</tr>
<tr>
<td>Engl 101, 102, 103. Principles of Composition</td>
<td>9</td>
</tr>
<tr>
<td>Engl 414A. Technical Research and Business Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>Sp. 311. Fundamentals of Speech</td>
<td>3</td>
</tr>
<tr>
<td>Lib 106. Library Instruction</td>
<td>R</td>
</tr>
<tr>
<td>M.L. 201, 202. (French) or 231, 232. (German) or 221A, 222A (Russian)</td>
<td></td>
</tr>
<tr>
<td><strong>P.E</strong></td>
<td></td>
</tr>
<tr>
<td>38-44 Credits</td>
<td></td>
</tr>
</tbody>
</table>

**Major in Textiles and Related Science**

This major is for the student who is interested in textiles research or graduate study.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home Economics</strong></td>
<td></td>
</tr>
<tr>
<td>Applied Art</td>
<td></td>
</tr>
<tr>
<td>103. Design I</td>
<td>4</td>
</tr>
<tr>
<td>Child Development</td>
<td>4</td>
</tr>
<tr>
<td>270. The Individual and His Family I</td>
<td>4</td>
</tr>
<tr>
<td><strong>Food and Nutrition</strong></td>
<td></td>
</tr>
<tr>
<td>107. Nutrition and the Family's Food</td>
<td>4</td>
</tr>
<tr>
<td><strong>Home Economics</strong></td>
<td></td>
</tr>
<tr>
<td>105. Orientation to Home Economics</td>
<td>1</td>
</tr>
<tr>
<td>Professional Relations</td>
<td>R</td>
</tr>
<tr>
<td><strong>Home Management</strong></td>
<td></td>
</tr>
<tr>
<td>375. Management in the Family</td>
<td>4</td>
</tr>
<tr>
<td><strong>Household Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>154. Introduction to Equipment in the House</td>
<td>3</td>
</tr>
<tr>
<td><strong>Textiles and Clothing</strong></td>
<td></td>
</tr>
<tr>
<td>104. Textiles</td>
<td></td>
</tr>
<tr>
<td>123 or 125. Pattern Making and Clothing Construction</td>
<td>5-4</td>
</tr>
<tr>
<td>245. Clothing Selection</td>
<td>3</td>
</tr>
<tr>
<td>304. Intermediate Textiles</td>
<td>3</td>
</tr>
<tr>
<td>401. Senior Study Tour</td>
<td></td>
</tr>
<tr>
<td>404. Advanced Textiles</td>
<td>3</td>
</tr>
<tr>
<td>410. Textiles and Clothing Department Seminar</td>
<td>1</td>
</tr>
<tr>
<td>414. Historic Textiles</td>
<td>3</td>
</tr>
<tr>
<td>or 454. History of Costume</td>
<td>3</td>
</tr>
<tr>
<td><strong>Biological Sciences</strong></td>
<td></td>
</tr>
<tr>
<td>Bact 304. General Bacteriology</td>
<td>5</td>
</tr>
<tr>
<td>Zool 101 and 102. General Zoology (8 Credits)</td>
<td></td>
</tr>
<tr>
<td>Zool 155. Elementary Human Physiology and Anatomy (5 Credits)</td>
<td>8-5</td>
</tr>
<tr>
<td><strong>Physical Sciences</strong></td>
<td>8-6</td>
</tr>
<tr>
<td>Chem 101, 102 or 105, 106. General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem 103. Systematic Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 211. Quantitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td>Chem 334, 335. Organic Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Chem 456. Textile Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Math 101. Algebra and Trigonometry</td>
<td>5</td>
</tr>
<tr>
<td>Math 102. Algebra and Trigonometry II</td>
<td>5</td>
</tr>
<tr>
<td>Math 110. Analytic Geometry and Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>Math 211. Analytic Geometry and Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>Phys. 111, 112. General Physics</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social Sciences</strong></td>
<td>24</td>
</tr>
<tr>
<td>Govt 215. American Government</td>
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<td></td>
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<tr>
<td><strong>P.E</strong></td>
<td></td>
</tr>
<tr>
<td>38-44 Credits</td>
<td></td>
</tr>
</tbody>
</table>
The complexities of modern life can no longer be appreciated or faced intelligently without the basic knowledge provided by education in the sciences and the humanities. The activities of agriculture, commerce, government, industry and medicine depend more and more on the development and communication of ideas and values provided by those prepared in the mathematical, physical, biological and social sciences and in history, language, literature and philosophy. Opportunities for careers as scientists, technicians, managers, writers and teachers thus arise in laboratories, offices and classrooms under diverse sponsorship and for manifold purposes.

Curriculum in Sciences and Humanities

Leading to the degree Bachelor of Science.

Group Requirements

As a prerequisite to graduation, to insure breadth of educational experience, and to provide a foundation for later work in a major field, each student must complete, some time during the four years, credits in the basic areas of learning specified below. A minimum total of 105 credits must be distributed in the seven groups. Wherever the semicolon appears in this list, it means “and/or.”

<table>
<thead>
<tr>
<th>Group</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Written and Spoken English: Engl 101, 102, 103, Sp 311, Engl 205, 304, 414</td>
</tr>
<tr>
<td>II</td>
<td>Mathematics, statistics. At least 10 credits must be in mathematics</td>
</tr>
<tr>
<td>III</td>
<td>Chemistry, physics, earth science, biochemistry, biophysics</td>
</tr>
<tr>
<td>IV</td>
<td>Botany, zoology, bacteriology, genetics.</td>
</tr>
<tr>
<td>V</td>
<td>Economics; sociology; psychology; government, industrial administration (except courses in accounting) Govt 215 is required of all students</td>
</tr>
<tr>
<td>VI</td>
<td>History; literature, philosophy</td>
</tr>
<tr>
<td>VII</td>
<td>Modern languages. At least 9 credits of one language</td>
</tr>
</tbody>
</table>

General Requirements

Degree programs must be approved by the department of the major (see list of majors below) and by the Dean of the College of Sciences and Humanities. All candidates for a degree in the College of Sciences and Humanities are expected to achieve a passing grade in every course pursued in this College. Each degree program will contain:

1. At least 198 credits including Group Requirements described above, and the major, two minors, and electives (which may include ROTC) described below to which must be added six quarters of physical education and a course in library science.

2. One major, minimum of 30 credits, and two minors, totaling 30 credits, related to each student’s basic educational objectives. See, however, the Distributed Studies Program, described below, which requires essentially four minors totaling 60 credits. Credits applied to the Group Requirements may not be counted toward the major or the minors. Student programs sometimes contain as many as 33 elective credits beyond the Group Requirements and the major and minors.

The student will plan a program as follows:

**Freshman Year**

During this year, the student must complete 9 credits in written English (Group 1) and at least 10 credits in mathematics (Group 2). In addition, 24 to 27 credits will be chosen from
courses offered by departments in Groups 3, 4, or 5, with more than one group represented. Students in Naval Science may postpone completion of group requirements equivalent in credits to the required work in Naval Science.

Sophomore Year

If only four of the seven groups were represented in the freshman year, the sophomore program must include courses in a fifth group (minimum of 3 credits). During the sophomore year the student may experiment further with the basic fields of learning, in order to discover aptitude and interest, or may elect courses in a field already chosen, including related work suggested by the major department. Normally, the student should know by the third quarter of the sophomore year what his major will be.

Junior and Senior Years

Requirements

(1) The completion of whatever Group Requirements remain after the freshman and sophomore years.

(2) The completion of the major and two minors (defined under "General Requirements").

(3) Elective courses.

Each student must work out a complete program of courses for the junior and senior years in conference with the head of the major department or his representative.

A major consisting of at least 30 credits may be chosen from the following list. See Index for page references.

<table>
<thead>
<tr>
<th>Bacteriology</th>
<th>Metallurgy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>Modern Languages</td>
</tr>
<tr>
<td>Biophysics</td>
<td>Naval Science</td>
</tr>
<tr>
<td>Botany</td>
<td>Physical Education for Men</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Physical Education for Women</td>
</tr>
<tr>
<td>Economics</td>
<td>Physics</td>
</tr>
<tr>
<td>English and Speech</td>
<td>Psychology</td>
</tr>
<tr>
<td>Genetics</td>
<td>Sociology</td>
</tr>
<tr>
<td>Geology</td>
<td>Statistics</td>
</tr>
<tr>
<td>History, Government</td>
<td>Science Journalism</td>
</tr>
<tr>
<td>Industrial Administration</td>
<td>Zoology</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Modern Languages</td>
</tr>
</tbody>
</table>

The two minors, totaling 30 credits, should be related to the student's basic educational objectives and should be composed of courses ordinarily of senior college rank. These minors may be chosen from the list of fields which appears above, and from the following:

Modern Languages
science, climatology and meteorology, military science, philosophy, telecommunicative arts, or fields in other colleges If justified by the student’s vocational objective, a minor may include closely related courses offered by more than one department.

Distributed Studies Program in the Sciences and Humanities

In addition to opportunities for study in specific fields, the College of Sciences and Humanities also administers programs composed of courses distributed somewhat broadly among fields. These are the Distributed Studies Programs which are to be worked out in conference between the student and the appropriate adviser and must be approved by the Dean. The programs will include, in addition to the Group Requirements, the following:

(1) Concentrations in four related fields of study, each field to consist of from 9 to 21 credits, all totaling 60 credits. Courses acceptable in the field concentrations must be based on a prerequisite of three or more courses. Fields may be those of departments either within or outside the College of Sciences and Humanities, as well as certain non-departmentalized areas of instruction. Students may elect a program in Distributed Studies in preparation for areas such as the following:

- General Science
  Preparation for secondary school teaching in the mathematical, physical, biological or social sciences. See Teacher Education.
  Preparation for study in law, medicine or medical technology.
  Telecommunicative arts (radio and television).

(2) Electives chosen only from courses numbered 300 or above, except with permission of the Dean.

Preparation for the Study of Law

Preparation may be made for the study of law by the satisfactory completion of three years of study under the curriculum in Sciences and Humanities. If followed by transfer of suitable credits from later study at a recognized law college, Iowa State University will grant the degree Bachelor of Science. The program at Iowa State should be planned not later than the sophomore year and must be approved by the department concerned and by the Dean. Students commonly use majors in economics or sociology, English and speech, history or government, industrial administration, psychology or distributed studies to prepare for the study of law.

Preparation for the Study of Medicine

Students preparing for the regular curriculum in Veterinary Medicine may take the preliminary years in the College of Sciences and Humanities, as outlined in the preceding pages, with modifications suggested by the student’s adviser. Students in Veterinary Medicine who wish to receive both the degrees Doctor of Veterinary Medicine and Bachelor of Science will take at least three years’ work in the curriculum in sciences and humanities. Such a program must have the approval of the Dean of Sciences and Humanities and the Dean of Veterinary Medicine. Students preparing for the study of human medicine or medical technology will take at least the work of the first three or four years of the curriculum in sciences and humanities. The general outline, as described in the preceding pages, will be followed with modifications in terms of the requirements of the medical or hospital school which the student plans to enter. Modifications will be suggested by the student's adviser and submitted to the Dean of the College of Sciences and Humanities for approval. Students completing three years of preprofessional work at Iowa State University may finish requirements of the curriculum in sciences and humanities by transfer of acceptable credits from a recognized medical or hospital school.

Preparation for International Service

Academic study of international affairs and preprofessional training for careers in the foreign service, other government agencies, or in foreign trade sections of business, are provided through the International Service Program. Students in this program will major in economics, government, history, industrial administration, modern languages, or sociology.
Curriculum in Chemistry

Leading to the degree Bachelor of Science and offering specialization in chemistry alternative to the major in chemistry under the curriculum in sciences and humanities.

Freshman Year

Each student will be required to include physical education in his schedule each quarter in addition to the courses listed below.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>Credits</th>
<th>WINTER QUARTER</th>
<th>Credits</th>
<th>SPRING QUARTER</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td>4</td>
<td>Syst. Inorganic Chem.</td>
<td>4</td>
<td>Quantitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td>Chem 102A*</td>
<td></td>
<td>Chem 103*</td>
<td></td>
<td>Chem 214*</td>
<td></td>
</tr>
<tr>
<td>Prin of Composition</td>
<td>3</td>
<td>Prin of Composition</td>
<td>3</td>
<td>Engl 103</td>
<td>3</td>
</tr>
<tr>
<td>Engl 101</td>
<td></td>
<td>Engl 102</td>
<td></td>
<td>Anal Geom and Calc I</td>
<td>5</td>
</tr>
<tr>
<td>Algebra and Trig I**</td>
<td>5</td>
<td>Math 102</td>
<td>5</td>
<td>Math 110</td>
<td>5</td>
</tr>
<tr>
<td>Math 101</td>
<td></td>
<td>Reading Knowledge of Scientific German</td>
<td>3</td>
<td>Reading Knowledge of Scientific German</td>
<td>3</td>
</tr>
<tr>
<td>Reading Knowledge of Scientific German</td>
<td>3</td>
<td>M L 232A</td>
<td>3</td>
<td>M L 233A</td>
<td>3</td>
</tr>
<tr>
<td>M L 231A</td>
<td>3</td>
<td>Orientation</td>
<td>1</td>
<td>Orientation</td>
<td>1</td>
</tr>
<tr>
<td>Orientation</td>
<td>1</td>
<td>Chem 100</td>
<td>1</td>
<td>Chem 100</td>
<td>1</td>
</tr>
</tbody>
</table>

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*Students not having had high school chemistry will take Chem. 101, 102, 103 during freshman year and will take Chem. 214 and Chem. 203 during fall and spring quarters of the sophomore year, respectively.*

**Students with superior training and ability in mathematics may expect to begin with Math 102 or Math. 110.*
Sophomore Year
Each student will be required to include physical education in his schedule each quarter in addition to the courses scheduled below.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>Inorganic Chemistry</td>
<td>3</td>
<td>Quantitative Analysis</td>
</tr>
<tr>
<td>Chem 203*</td>
<td>Anal Geom and Calc II</td>
<td>Chem 215</td>
</tr>
<tr>
<td>Math 211</td>
<td>General Physics</td>
<td>Anal Geom and Calc III</td>
</tr>
<tr>
<td>Phys 221</td>
<td>American Government</td>
<td>Math 212</td>
</tr>
<tr>
<td>Govt 215*</td>
<td></td>
<td>General Physics</td>
</tr>
<tr>
<td></td>
<td>Intro to Organic Chem.</td>
<td>Phys 222</td>
</tr>
<tr>
<td></td>
<td>Chem 237</td>
<td></td>
</tr>
</tbody>
</table>

*May be taken any quarter.

Physical Chemistry
Chem 325, 327
Organic Chemistry
Chem 330, 331
Fundamentals of Speech
Sp 311**
Electives

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
</tr>
</tbody>
</table>

**May be taken any quarter.

<table>
<thead>
<tr>
<th>Senior Year</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Engr</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Electives</td>
<td>10</td>
</tr>
</tbody>
</table>

Curriculum in Physical Education for Men

Leading to the degree Bachelor of Science A program alternative to the major in physical education for men under the curriculum in sciences and humanities

One unit (one year) of high school algebra is required for admission into this curriculum

Two hundred five credits must be earned in accordance with the following regulations for graduation

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
</tr>
<tr>
<td>Prin of Composition</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Engl 101</td>
<td>Intro to Geology</td>
<td>Phys Ed Techniques</td>
</tr>
<tr>
<td>Geol 100</td>
<td>Intro to Phys Ed</td>
<td>P E M 214, 215, 219</td>
</tr>
<tr>
<td>P E M 213</td>
<td>General Psychology</td>
<td>Intro to Sociology</td>
</tr>
<tr>
<td>Psych 101</td>
<td>Health Education</td>
<td>Principles of Zoology</td>
</tr>
<tr>
<td>Hyg 104</td>
<td>Animal Kingdom</td>
<td>Zool 101 or</td>
</tr>
<tr>
<td></td>
<td>Zool 102</td>
<td></td>
</tr>
</tbody>
</table>

*This program will be modified to allow qualified students to carry mathematics and chemistry each quarter.
Sophomore, Junior and Senior Years

The student shall, with the aid of his adviser, submit a degree program for the approval of his department head and the Dean of the College of Sciences and Humanities not later than the spring quarter of his sophomore year.

Such a degree program shall include:

1. Basic General Courses: A minimum of 30 credits distributed in the areas of English, literature, speech, history-sociology, and economics.
2. A minimum of 48 credits in physical education, including PEM 407, but not more than 60 credits may apply for the degree.
3. A minimum of 16 credits in the areas of animal biology and hygiene.
4. Courses selected toward proper vocational preparation in accordance with the student's interests:

   Teaching and Coaching
   a. A maximum of 60 credits in physical education shall apply toward the degree.
   b. Completion of prescribed core education professional courses. See Teacher Education.
   c. Completion of prescribed requirements in either two half-time areas or one full-time area of teaching certification in addition to physical education. These may be elected from agricultural sciences, driver education, English, industrial education, social studies, general science or mathematics.

Journalism and Broadcasting in preparation for sports writing and sportscasting.
   a. A maximum of 60 credits in physical education.
   b. Partial completion of the core education professional courses including 3 credits in education, 9 credits in educational psychology, 3 credits in American Government.
   c. A minimum of 40 credits in journalism and telecommunicative arts.

Supervised Recreation in preparation for leadership of community or industrial supervised recreation programs. Limited to those seniors who elect the Supervised Recreation Program for specialization during their last year.
   a. A maximum of 60 credits in physical education, 20 of which may be concentrated in the area of Supervised Recreation.
   b. Partial completion of the core education professional courses including 3 credits in education, 9 credits in psychology, 3 credits in American Government.
   c. A minimum of 45 credits shall be distributed among the areas of driver-training, English, industrial education and social studies.
The Iowa State University College of Veterinary Medicine was established in 1879 and is now the oldest school of veterinary medicine in the United States.

It includes the Departments of Anatomy, Hygiene, Clinical Sciences, Pathology, and Physiology and Pharmacology. Instruction in chemistry and other related sciences is provided by other colleges of the University. In addition to the strictly educational departments and the hospital and ambulatory clinics, there are also the Veterinary Medical Research Institute and the Iowa Veterinary Medical Diagnostic Laboratory, which give the student opportunity to observe those phases of veterinary medicine for which these laboratories especially are responsible.

The location of the college in the center of the richest livestock country in the world provides a rare opportunity for the veterinary student to study animal industry; it also enables him to observe a wealth of clinical cases both at the hospital clinic and under general practice conditions through the ambulatory clinic.

A minimum of two years of prescribed preprofessional college work, with a creditable academic average, is required for admission to the professional curriculum in veterinary medicine. Students in Veterinary Medicine who wish to receive both the degrees Doctor of Veterinary Medicine and Bachelor of Science will take at least three years' work in the curriculum in Sciences and Humanities. Such a program must have the approval of the Deans of Sciences and Humanities and Veterinary Medicine. The professional curriculum extends over a period of four years and leads to the degree Doctor of Veterinary Medicine.

To earn the degree Doctor of Veterinary Medicine, candidates must be 21 years of age, of good moral and professional character, must have at least 2 quality points per credit in all courses taken in the professional curriculum, and must be approved by all departments of the college.

Opportunities in Veterinary Medicine for the Graduate

Private Practice. The extent and importance of the livestock industry in the United States assure the veterinarian opportunity to establish a professional career in private practice. The success of livestock production is becoming more and more a problem of controlling animal diseases. The veterinarian has definite responsibilities in a successful animal industry, and the majority of veterinarians enter some phase of veterinary medicine practice upon graduation. In recent years there has been a developing tendency toward specialization in certain fields of practice, for example, in breeding diseases, or in cattle, swine, or poultry practice. One of the currently attractive fields of professional work is what is referred to as "small animal practice" in larger towns and cities. Many veterinarians now maintain private hospitals adequately equipped for the diagnosis and treatment of diseases of household pets, and devote their entire time to this field of specialization.
The Agricultural Research Service The Agricultural Research Service of the United States Department of Agriculture employs more veterinarians than any other agency, many hundreds being utilized in its widespread national activities. Its services include federal meat inspection, animal quarantine, control and eradication of preventable animal diseases, supervision of the production of biological products and an extensive program of animal disease research, both in laboratories and in the field. These positions are obtained through the United States Civil Service Commission by examination and ordinarily are available for those who enter this service.

State and Municipal Governments Every state has a state veterinarian or similar officer, often with a number of assistant veterinarians whose duties are to investigate and control preventable diseases of animals by enforcing the laws and regulations established for this purpose. Veterinary medical health officials cooperate with those of human medicine in state health matters, as many animal diseases are communicable to man. Many cities employ veterinarians on a full or part time basis as sanitarians in their public health departments. Their responsibilities are to insure the healthfulness of the cities' food supply with special reference to milk and meat products. The milk supply is supervised as to its source and sanitary conditions under which it is produced, and the health of the dairy herds supplying the milk is investigated.

Veterinary Corps, United States Army and United States Air Force Students in veterinary medicine usually are deferred by their local Selective Service Boards in order to complete their professional education. Upon graduation, however, they are required to serve two years in some branch of the Armed Services. This service, is provided by the Army and by the Air Force. Upon entering the service, the veterinary graduate is commissioned as a first lieutenant. If he wishes to remain in service, advancement is made in the various grades through the rank of colonel, with one officer appointed in the grade of brigadier general. One of the major responsibilities of the veterinary corps officers is determining that food products, especially those of animal origin, issued to the Armed Services are wholesome and suitable for food purposes. Of course, the protection of all animals and birds essential to war activities is a responsibility of the Army and Air Force veterinarian. His familiarity with diseases transmissible from animals to man, his training in laboratory techniques and knowledge of parasitic diseases make him a valuable addition to the public units of the military service.

Commercial Work Veterinarians are employed extensively by commercial concerns engaged in the production of biological and pharmaceutical products used in the control and treatment of both animal and human diseases. These positions may require some special training and include both technical laboratory and field work.

Education and Research Veterinarians qualified by special training are in demand to fill teaching and research positions in veterinary medical and agricultural colleges. Almost every agricultural school has a veterinary medical department employing several veterinarians, and the veterinary medicine colleges of the country constantly are looking for veterinarians qualified for institutional work. Research veterinarians are attached to state agricultural experiment stations in addition to those employed by the United States Agricultural Research Service.

Public Health Service Many veterinarians are employed in public health. The Communicable Disease Center of the United States Public Health Service assigns veterinarians in their employ to various sections of the country where special disease problems exist. Cities and small towns often employ veterinarians to aid in controlling the food supply and also diseases which are transmissible from animals to man, such as rabies. Some of these positions are on a full time basis but many are part time employment. In many of the states a veterinarian is employed by the State Health Department to assist in the field of epidemiology and health education. Veterinarians also are employed by the Pan-American Sanitary Bureau and by the World Health Organization.

Other Fields of Service Many private interests now employ veterinarians. Among these are artificial breeding organizations, zoological societies, livestock ranches, humane societies and the fur industries.
Veterinary Medical Societies

All veterinary students are members of the Iowa State Student Chapter of the American Veterinary Medical Association. The bi-weekly meetings of the society, devoted to discussions of professional topics, promote the literary and social development of the members.

Students of veterinary medicine also may qualify for membership in the national honor societies Phi Kappa Phi, Alpha Zeta, Gamma Sigma Delta. Graduate students are eligible for membership in Sigma Xi.

Honors Program

Students with high ability and a desire to initiate independent study are encouraged to participate in the College of Veterinary Medicine Honors Program. See University Honors Program.

Admission Requirements

Applicants for admission to the College of Veterinary Medicine must present 1½ units of algebra and 1 unit of geometry from an approved high school and a total of not less than 90 quarter (60 semester) credits from an approved college or university. The college credits must include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>12 qr crs (8 sem crs)</td>
</tr>
<tr>
<td>Must include 3 qr crs (2 sem crs) of speech-making (Sp 311 or equivalent)</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>20 qr crs (14 sem crs)</td>
</tr>
<tr>
<td>General</td>
<td>12 qr crs (8 sem crs)</td>
</tr>
<tr>
<td>Organic</td>
<td>8 qr crs (6 sem crs)</td>
</tr>
<tr>
<td>Mathematics (algebra &amp; trig)</td>
<td>9 qr crs (6 sem crs)</td>
</tr>
<tr>
<td>Physics</td>
<td>12 qr crs (8 sem crs)</td>
</tr>
<tr>
<td>Biological Science</td>
<td>14 qr crs (10 sem crs)</td>
</tr>
<tr>
<td>Zoology</td>
<td>8 qr crs (5 sem crs)</td>
</tr>
<tr>
<td>Botany</td>
<td>3 qr crs (2 sem crs)</td>
</tr>
<tr>
<td>Genetics</td>
<td>3 qr crs (2 sem crs)</td>
</tr>
<tr>
<td>American Government</td>
<td>3 qr crs (2 sem crs)</td>
</tr>
<tr>
<td>Electives</td>
<td>20 qr crs (12 sem crs)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>90 qr crs (60 sem crs)</td>
</tr>
</tbody>
</table>

A course in library orientation is required for graduation and should be included in the pre-veterinary program.

Pre-professional students at Iowa State University enroll in either the College of Agriculture or the College of Science and Humanities. A pre-veterinary student at Iowa State University may elect a three-year pre-veterinary program which when combined with the veterinary curriculum will lead to a Bachelor of Science Degree in the College of Agriculture or in the College of Science and Humanities.

All pre-veterinary students must have completed at least 45 quarter (30 semester) credit hours prior to filing an application for admission to the College of Veterinary Medicine. Applications must be filed with the Director of Admission and Records (Room 104 Beardshear Hall) prior to March 1 of the year in which the applicant seeks admission. A transcript of all high school and college credits must accompany the application. All pre-veterinary requirements must be fulfilled by the time of filing or scheduled for completion by June 15 of the year in which the applicant seeks admission. A list of courses in progress at the time of filing or scheduled for completion by June 15 should accompany the application and transcript. Pre-professional college credits must average at least 2.25 on a four-letter marking system with "A" as the highest mark (4.0) and "D" as the lower mark (1.0). The preceding scholastic requirements are minimum and do not assure admission even though these requirements have been fulfilled.

Because of limited facilities, admission to the College of Veterinary Medicine is on a competitive and selective basis. A pre-admission conference with members of the veterinary faculty or other persons designated by the Dean is required. High school records, scholastic performance in pre-professional course studies, aptitude, character and personality are given special consideration in the selection of candidates. Other qualifications being equal, residents of the state of Iowa are given preference.

Admission to the College of Veterinary Medicine is granted annually at the beginning of the fall quarter only.
Readmission

Any student who voluntarily withdraws from the College of Veterinary Medicine or who is dropped for cause, forfeits his standing and must make written application for reinstatement to this college 30 or more days prior to the opening of the quarter in which the student desires readmission.

Curriculum in Veterinary Medicine

Leading to the degree Doctor of Veterinary Medicine.

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
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<tbody>
<tr>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
<td><strong>Credits</strong></td>
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<tr>
<td><strong>First Year</strong></td>
<td></td>
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<tr>
<td>Physiological Chemistry B and B 304, 311</td>
<td>5</td>
<td>Microscopic Anatomy</td>
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<tr>
<td>Microscopic Anatomy V Anat 101</td>
<td>5</td>
<td>Gross Anatomy V Anat 112</td>
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<td>Gross Anatomy V Anat 111</td>
<td>6</td>
<td>V Phys and Pharm 266</td>
</tr>
<tr>
<td>Poisonous Plants Bot 456</td>
<td>3</td>
<td>Virology V Hyg 225</td>
</tr>
<tr>
<td>General Bacteriology V Hyg 224</td>
<td>6</td>
<td>General Pathology V Path 255</td>
</tr>
<tr>
<td>General Pathology V Path 254</td>
<td>5</td>
<td>Parasitology V Path 257</td>
</tr>
<tr>
<td>Mammalian Physiology V Phys and Pharm 265</td>
<td>6</td>
<td>Mammalian Physiology V Phys and Pharm 266</td>
</tr>
<tr>
<td><strong>Second Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbances of Reproduction V Obst and Rad 345</td>
<td>5</td>
<td>Small Animal Surgery I V Med and Surg 337</td>
</tr>
<tr>
<td>Pharmacology V Phys and Pharm 367</td>
<td>4</td>
<td>Pharmacology V Phys and Pharm 368</td>
</tr>
<tr>
<td>Chmcs Med Obst Clin 381, required without credit</td>
<td></td>
<td>Chmcs Med Obst Clin 382, required without credit</td>
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<tr>
<td><strong>Third Year</strong></td>
<td></td>
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<tr>
<td>Infectious Diseases V Hyg 421</td>
<td>4</td>
<td>Infectious Diseases V Hyg 422</td>
</tr>
<tr>
<td>Fertility Evaluation V Obst and Rad 445</td>
<td>3</td>
<td>Dairy Hygiene V Hyg 420</td>
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<tr>
<td>Radiology V Obst and Rad 440</td>
<td>3</td>
<td>Applied Anatomy V Anat 402</td>
</tr>
<tr>
<td>Applied Avian Pathology V Path 450</td>
<td>3</td>
<td>Veterinary Toxicology Vet Path 451</td>
</tr>
<tr>
<td>Professional Orientation V Med and Surg 438</td>
<td>3</td>
<td>Clinics Med Obst Clin 482</td>
</tr>
<tr>
<td>Chmcs Med Obst Clin 481</td>
<td>3</td>
<td><strong>Clinics</strong></td>
</tr>
<tr>
<td><strong>Fourth Year</strong></td>
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<tr>
<td>Infectious Diseases V Hyg 423</td>
<td>5</td>
<td>Infectious Diseases V Hyg 426</td>
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<tr>
<td>Meat Hygiene V Hyg 420</td>
<td>4</td>
<td>Applied Med and Surg V Med and Surg 484</td>
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<tr>
<td>Post Mortem and Clin Path V Path 456</td>
<td>3</td>
<td>Credit given this quarter for work extending throughout the year</td>
</tr>
<tr>
<td>Chmcs Med Obst Clin 483</td>
<td>3</td>
<td><strong>Clinics</strong> Med Obst Clin 483</td>
</tr>
</tbody>
</table>
Biomedical Engineering—heart machine
Graduate College

Iowa State University has offered opportunities for graduate work to qualified students since the founding of the institution. The first advanced degree was conferred in 1877. In the earlier years, the work of graduate students was in immediate charge of the departments concerned, under the supervision of the General Faculty. Later, each of the faculties of the Colleges of Agriculture, Engineering, Home Economics, Science and Veterinary Medicine assumed control of graduate work. In 1913, a distinct Graduate Faculty was organized, and an executive Graduate Committee was appointed. In 1915, the Graduate Faculty held its first meeting, and in 1916 it granted the first degree of Doctor of Philosophy.

The Graduate Faculty consists of the President, the Dean of the Graduate College, the Vice President for Academic Affairs, deans of the five colleges, the Librarian, Registrar, heads of departments offering graduate work, the Examiner in Modern Languages, the Examiner in English and members of the General Faculty who are elected to membership in recognition of their accomplishments in their respective disciplines.

The Graduate College offers opportunities to pursue advanced study in the different fields of agriculture, engineering, home economics, the sciences and veterinary medicine.

Most of the graduate programs offered are research-oriented and lead to the degrees Master of Science and Doctor of Philosophy.

For those persons interested in advanced study directed more particularly toward meeting vocational or professional objectives, the degrees Master of Architecture, Master of Engineering, Master of Landscape Architecture and Master of Education are offered. These degrees permit greater program latitude than is permitted for the degree Master of Science.

Graduate Appointments

Graduate assistantships, industrial fellowships and certain special research grants have been established at Iowa State University for the encouragement of graduate work and the promotion of research. Such appointments and research opportunities are available through the various departments of instruction, the Agriculture and Home Economics Experiment Station, the Sciences and Humanities Research Institute, the Statistical Laboratory, the Computation Center and the Institute for Atomic Research.

Graduate assistantships pay a maximum of $310-$320 per month and permit the holder to enroll for two-thirds of a full schedule, or 11 credits per quarter. Recipients of these assistantships are exempt from payment of other fees except for $52 per quarter. A graduate assistant is expected to give half-time service to the teaching or research projects of his department. These appointments are open to students who have graduated from approved colleges in the highest quartile of their respective classes and who present the requisite undergraduate or graduate preparation. Further information may be obtained by writing to the department head concerned, or to the Dean of the Graduate College.

Fellowships and training grants supported by the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, United States Office of Education and other agencies of the federal government are offered. University-supported fellowships also are available. Applicants for these awards must present evidence of superior scholarship. Further information may be secured by writing to the Dean of the Graduate College.

The satisfactory completion of one appointment will ordinarily make a student eligible for reappointment.

Post Doctoral Study

Arrangements for formal post doctoral study should be made through application to the Graduate Dean.
Graduate Study by Members of the Staff

Any member of the research, instructional or extension staffs of the rank of instructor, associate or junior scientist, subject to the approval of the head of his department or section, may carry not more than five credits of graduate work per quarter, provided such does not interfere with his other duties. This privilege may be extended to members of the research, instructional or extension staffs of the rank of assistant professor upon approval of the dean concerned and the Dean of the Graduate College.

Staff members holding the rank of professor or associate professor cannot become candidates for degrees from this institution.

Admission

A prospective student is invited to correspond with the head of the department in which he wishes to study for information concerning graduate study in that academic discipline.

Application blanks are available from the Office of Admissions, 104 Beardshear Hall. These blanks, together with official transcripts and statement of quartile rank, should be forwarded to the Office of Admissions at least one month prior to the opening of the quarter when the student wishes to matriculate.

An applicant who is a graduate of an institution in the United States whose requirements for the bachelor's degree are substantially equivalent to those at Iowa State University, and who ranks in the upper one-half of his class, may be admitted to the Graduate College. Admission does not constitute acceptance as a candidate for a degree.

Admission to the Graduate College may not be granted to a graduate of an institution in the United States which is not accredited by a recognized regional association.

Restricted Admission. An applicant who is a graduate of an accredited university in the United States, but who does not rank in the upper one-half of his class, may be granted restricted admission if such consideration seems justified. This will require the recommendation by the department head and approval by the Graduate Dean.

Transfer from restricted admission to full admission requires recommendation of the major professor and approval by the Graduate Dean.

Graduates of recognized universities located outside the United States may be granted restricted admission only.

Medical Examination. Each new graduate student entering Iowa State University is required to have a physical examination which must include a tuberculin test and/or chest X-ray taken within the past year. Students accepted for admission will be sent forms to be completed by a personal physician who should return them promptly to the University Hospital. Any student unable to have his physical examination before coming to the University may make arrangements to have the examination by the Student Health Service staff for the regular fee.

Foreign students are required to carry adequate health and accident insurance while in residence.

Graduate Record Examination. No uniform examination is currently required of all applicants for admission.

English Requirement. All graduate students, except those who have met the requirement as undergraduates at Iowa State University within the last two years, are required to take a qualifying examination in English at the time scheduled during the first quarter or summer term of residence.

Those who fail the examination must report to the Writing Clinic for assistance. A student may expect to be dropped from the Graduate College if the examination in English is not passed by the end of the third quarter of registration. The Graduate Dean may make an exception for students to whom English is not the native language.

Time Limit. It is expected that work for the master's degree shall be completed within a term of three years or five summer quarters; for the doctorate, work shall be completed within a term of five years. Only in exceptional cases, upon recommendation of a student's advisory committee and with approval by the Graduate Committee, is credit allowed for courses taken over a period of more than five years.
Probation Students must maintain an average of "B" on all work taken in the Graduate College to remain in good standing. The Graduate Committee may place a student on probation for failure to meet scholastic or other requirements. Removal from probation is accomplished upon specific recommendation from the student's major professor to the Graduate Committee. Students will not be admitted to candidacy while on probation. Generally registration beyond the third quarter will be refused to a student whose quality of work is unsatisfactory.

Registration

Planning Graduate Study Scholastic competence, independence, and maturity of thought should have dominance over other objectives of graduate study. The student must accept responsibility for his own education and should recognize that excessive emphasis on course work will not leave time to explore and master aspects of learning which will give him confidence in his own judgments. As soon as possible, in conference with the head of his department, the student should select his major professor and advisory committee and in consultation with them outline his program of study.

Residence Registration Classification in courses carrying full graduate credit is limited to a maximum of 15 credits per quarter. The maximum, if part of the work is supporting (not for graduate credit), is 16 credits. Schedules for graduate assistants are limited to a maximum of 11 credits; for full-time staff members, to 5 credits.

Graduate students (even though course and residence requirements have been met) must register in any quarter in which the facilities of the institution are being used in preparation of thesis or in preparation for examination. The number of credits under these circumstances shall be consonant with the amount of work done, laboratory facilities used and staff direction involved.

Interim Registration Registration for special work between quarters and during certain vacation periods cannot exceed one credit for each week that the student is in residence. The fee is $17 per credit.

In Absentia Registration Graduate work by correspondence is not permitted, nor is it accepted in transfer. In exceptional cases, the Graduate Committee may authorize registration in absentia. Generally, such registration is restricted to thesis preparation after completion of research or for research under special conditions. The total credit thus obtained cannot be used to reduce residence requirements.

Extension and Off-campus Registration Classes away from the campus in some areas of engineering and education are taught by members of the University graduate staff. Credits earned in such classes cannot be applied toward the residence requirement for a graduate degree.

Auditing Courses may be audited upon recommendation of the student's major adviser. Each audited course will reduce the permitted credit load by one, but fees will be assessed on the basis of catalog credit.

Graduate Credit for Seniors Under special circumstances, a department head may request from the Graduate Dean permission to classify a senior student in certain graduate courses if he is within six credits of fulfilling requirements for the baccalaureate degree. Then, after the student has received his bachelor's degree and has been registered in the Graduate College, the head of his major department may request that the credits so received be applied toward an advanced degree.

Special Regulations for Students in Veterinary Medicine Specially qualified graduates in scientific curricula, when the request has been approved by the Dean of Veterinary Medicine and the Dean of the Graduate College, may pursue work coincidently toward the degrees of Master of Science and Doctor of Veterinary Medicine. The major graduate work of such students must be completed in courses not required in the undergraduate curriculum in veterinary medicine. A student taking advantage of this opportunity will classify with both the Dean of Veterinary Medicine and the Dean of the Graduate College.
Degree Requirements

A "Guide to Graduate College Procedures" is available in the Office of the Graduate Dean, 7 Beardshear Hall. Each new graduate student is urged to secure a copy.

Master of Science:

A student becomes eligible for candidacy after completing one quarter's work with a "B" average. General requirements for the degree are as follows:

**Program of Study** A program of study should be developed in consultation with the student's committee. This should be submitted for approval by the end of the second quarter in residence.

**Residence** Three quarters, or a minimum of 30 weeks of full-time graduate study, must be spent in residence at Iowa State University. In some programs, arrangements have been made whereby residence credit earned at specific sister institutions may be accepted as residence credit on this campus.

**Credits** At least 45 credits of acceptable graduate work must be completed, not less than 36 of which must be taken in this institution. Any transfer of credits from another institution must be recommended in the Program of Study by the student's advisory committee. Transfer of graduate credit will be approved only if it is of "B" grade or better.

**Major and Minor** The exact number of credits in major and minor fields is not prescribed. To obtain the specialization which is considered essential for an advanced degree, approximately two-thirds of the work should be devoted to the major field, but this is not necessarily restricted to one department. Designation of a minor field is advisable to avoid too-narrow specialization. If the minor is taken in the major department, it must be a distinct subdivision of that department.

A graduate student may not change from one major to another without written permission from the heads of both departments and the Dean of the Graduate College.

**Modern Languages** Except when specifically waived in the description of requirements of the student's major department in the Graduate College catalog, a satisfactory reading knowledge of German, French, Russian or any other foreign language which a department may designate as acceptable for all of its students, must be certified by the Examiner in Modern Languages. This requirement must be met before the final examination can be scheduled.

For students whose native language is not English, the ability to communicate adequately in English (certified by the Department of English) will be acceptable as a substitution for the reading knowledge of one foreign language. This option will apply only when specifically recommended by the student's advisory committee.

**Application for Graduation** Application for graduation must be made by midterm of the quarter before the student expects to receive the degree. This requires the presentation of an approved diploma slip to the Office of the Graduate Dean.

**Thesis** A thesis is required in all areas in which the M.S. is granted. Joint authorship is not permitted. Copies of the completed thesis must be in the hands of the examining committee and the Librarian for approval two weeks prior to the date fixed for the final examination. After the final examination two complete and approved copies of the thesis shall be deposited with the Librarian. These copies of the thesis must be deposited not less than two weeks prior to Commencement. A charge of $25 will be made to cover library costs and title publication in the *Iowa State Journal of Science*.

The student should consult the *Thesis Manual*, prepared for the use of students in the Graduate College, before arranging for the typing of his thesis.

**Final Examination** The final examination shall be taken on all graduate work, including the thesis. It will ordinarily be oral, but may be written in whole or in part, as determined by the committee in charge.

**Graduation Approval Slip** Upon completion of other requirements, the candidate will request from the Office of the Graduate Dean a graduation approval slip. This must be filled out completely and returned to the Registrar by the date indicated thereon.
Master of Architecture:

General requirements are the same as those for the degree Master of Science with 36 credits in residence required. The student may elect to pursue a no-thesis program which requires 54 credits.

Master of Engineering:

The academic standards and the general level of attainment are the same for the Master of Engineering and Master of Science degrees. Master of Engineering programs are intended to be more flexible in their educational objectives, and they are offered to meet the expanding needs for off-campus graduate engineering programs at locations with adequate library and laboratory facilities, and for special situations of professional-oriented programs on campus. Requirements for the Master of Engineering are as follows:

General requirements are the same as those for the degree Master of Science with the exception that upon recommendation of the student's committee, the thesis requirement may be waived. Choice of this option requires the completion of an additional seven credits of acceptable graduate work.

Of the minimum credit requirement of 45, 36 credits must be received from Iowa State University. At least 12 credits must be earned in residence at Iowa State University during one quarter or two summer terms, not necessarily consecutive sessions.

Master of Landscape Architecture:

General requirements are the same as those for the degree Master of Science except that one full year of successful professional practice is required in addition to the thesis.

Master of Education:

For the degree Master of Education, a minimum of 57 credits will be required. Of this minimum, not more than three-fifths can be accepted from the major field. Under certain conditions, the Graduate Committee may authorize acceptance of not more than 12 credits of non-graduate course work basic to the candidate's teaching field. The modern language requirement may be waived and a special report written in lieu of a thesis. Credit for off-campus work will not be permitted beyond the present allowance of nine hours unless the library, laboratory and other facilities are approved by the Graduate Committee prior to initiation of the student's program.

Doctor of Philosophy:

The degree Doctor of Philosophy is strongly research-oriented. The primary requirements for the degree are (1) high attainment and proficiency of the candidate in his chosen field, (2) development of a dissertation which shall be a significant contribution to knowledge and which shall show power of independent and creative thought and work, and (3) successful passing of detailed examinations over the field of the candidate's major work, with a satisfactory showing of his preparation in related and minor courses.

Appointment of Committee. Upon admission of the graduate student to work looking toward the degree Doctor of Philosophy, the department head shall recommend to the Dean of the Graduate College a committee of the Graduate Faculty to be in charge of his work. This committee shall consist of the following: at least five members of the Graduate Faculty—two of whom must come from outside the major discipline, with one of these from a different department. An associate member of the Graduate Faculty may not serve as chairman of a doctoral committee.

Program of Study. A program of study should be developed in consultation with the student's committee. This should be submitted for approval by the end of the third quarter in residence.

Residence. A minimum of three years shall be spent in full-time graduate study, at least one-half of which is to be in residence at Iowa State University. At least three quarters of resident study must be during the academic year. To satisfy any one-year residence requirement at least 36 credits must be earned. Any transfer of graduate credit from another institution must be recommended in the Program of Study by the student's advisory committee. Transfer of graduate credit will be approved only if it is of "B" grade or better.
**Major and Minor** To avoid overspecialization, a significant body of pertinent course work must be taken outside of the major field. The work outside the major field should amount to approximately 18 hours of applicable graduate credit as required by the student's committee.

The major field is equivalent to the major department except for: (1) established interdisciplinary majors and (2) disciplines within departments which may be approved by the Graduate Committee.

**Modern Languages** At the discretion of the student's committee, the modern language requirement may be met in either of two ways:

1. Demonstrate a satisfactory reading knowledge of two of the following—German, French, Russian or any modern language which a department may designate as acceptable for all of its students.
2. Demonstrate a significantly higher degree of communication competence for one of the languages indicated under the preceding alternative.

For students whose native language is not English, the ability to communicate in English, certified by the Department of English, will be acceptable as a substitution for reading knowledge of one foreign language.

Reading knowledge will be demonstrated by acceptable translation from material in the candidate's field which is not to be made available to the candidate prior to the examination. Communication competence will be demonstrated by showing ability to read, write and speak the language. The examination will require competence equivalent to that obtained in at least two years' collegiate study in the language.

The language requirement must be met before the preliminary examination is held.

**Preliminary Examination.** The student must pass satisfactorily a preliminary examination before he is granted advancement to candidacy for the degree. The examination is usually both written and oral, unless otherwise specifically recommended by the committee. The preliminary examination must be passed at least three quarters before the final examination. Exceptions to this rule will be made only upon special recommendation of the student’s committee and approval of the Graduate Committee. In no case may the final examination be given in less than six months from the time of the preliminary examination.

**Diploma Slip** A diploma slip must be filled out and returned by midterm of the quarter before the student expects to receive the degree.

**Dissertation** A doctoral dissertation shall be completed on some topic connected with the major subject. To be acceptable it must constitute a significant contribution to knowledge. Joint authorship is not permitted.

Copies of the completed dissertation must be in the hands of the examining committee and the Librarian for approval two weeks prior to the date fixed for the final examination. After the examination, and at least two weeks prior to Commencement, two complete and approved copies of the dissertation shall be deposited with the Librarian.

At the same time the dissertation is deposited, two typewritten copies of an abstract which meets the requirements as set forth in the *Thesis Manual* must also be filed with the Librarian. A charge of $50 will be made to cover library costs, microfilming of the dissertation and publication of a 600-word abstract in *Dissertation Abstracts*. The abstract should cover the entire dissertation and should not be considered as excluding publication of a journal article.

**Final Examination.** A final examination shall be taken on all graduate work, including dissertation. This examination shall be conducted by the student's committee with such other members of the faculty as may be designated by the Dean of the Graduate College. It will be written or oral, or both, as determined by the committee.

**Graduation Approval Slip** Upon completion of other requirements, the candidate will request from the Office of the Graduate Dean a graduation approval slip. This must be filled out completely and returned to the Registrar by the date indicated thereon.

Hoods Candidates for the degree Doctor of Philosophy will be required either to purchase or to rent hoods to be used at the time the degree is conferred. Arrangements are made through the Registrar's office.
Description of Courses

**Definition of a Credit** The value of each course is stated in quarter credits. A one-credit course requires one recitation involving two hours of preparation or one three-hour laboratory period or other combination of teacher-student contact and outside preparation involving a total of three clock hours per week for twelve weeks. The abbreviation "Cr R" in a course description indicates that the course is required but no credit is given.

**Course Numbers** The courses in each department are numbered from 1 to 699, according to the following groups:
- 1-99—Courses not carrying credit toward a bachelor's degree
- 100-299—Courses primarily for freshman and sophomore students
- 300-499—Courses primarily for junior and senior students
- 500-599—Courses primarily for graduate students, but open to qualified undergraduates
- 600-699—Courses for graduate students only

After the title of each course are two numbers in parentheses. The first indicates the number of lectures and recitations a week and the second the number of hours of laboratory a week. For example, a course title followed by (1-3) is a course with one lecture or one recitation and three hours of laboratory a week.

At the end of the first line of each course description will be found one or more of the following letters: F, W, S, SS, indicating which of the four quarters—fall, winter, spring, summer session—of the academic year the course is offered. Alt is the abbreviation for alternate. "Alt W Offered 1966" identifies courses to be available during the 1965-66 academic year. The abbreviation Yr is used to designate a sequence of three courses taught fall, winter, and spring, respectively. If there is sufficient demand, courses may be offered more frequently than announced.

Prerequisites may be waived by permission of the instructor.

**Aerospace Engineering**

Ernest W. Anderson, Ph.D., Head of Department

**Professors:** Cheng-Ting Hsu, Ph.D.; Merlin L. Millett, Jr., Ph.D.

**Associate Professors:** Dale A. Anderson, Ph.D.; James D. Iversen, Ph.D.; Frederick W. Stuve, M.S.

**Assistant Professors:** Paul J. Hermann, M.S.; William D. James, M.S.; Leverne K. Sevgsike, Ph.D.

**Instructors:** Larry L. Northup, M.S.; Darryl J. Trulin, M.S.; Jerald M. Vogel, M.S.

**Opportunities for Undergraduate Study**

For undergraduate curriculum in aerospace engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula.

The curriculum in aerospace engineering is designed to provide the student with basic training in the scientific principles pertaining to the structure and design, dynamics, propulsion, and testing of flight vehicles which operate in an atmosphere and space. To the graduate in aerospace engineering, the field offers a wide variety of opportunities ranging from research and development, design and production to sales and management. These opportunities extended into the fields of space, missile and aircraft flight.

A cooperative work-study program is available in the Aerospace Engineering Department. See College of Engineering Cooperative Programs.

**Opportunities for Graduate Study**

The department offers major work for the degree Master of Science in aerospace engineering and minor work to students taking major work in other departments. Work may be
taken for the degree Doctor of Philosophy as a divided major with other departments offering work in related fields for this degree.

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in aerospace engineering at this institution.

Open to graduate students for minor only: 309, 321, 331, 342, 343, 344, 352, 353, 411, 413, 421, 423, 431, 440, 441, 442, 443, 452, 453, 461, 462, 470, 480.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Technical Lecture. (1-0) Cr. R S
Orientation in the field of aerospace engineering.

244. Aerodynamics I. (2-0) Cr. 2 F
Prerequisite: Math. 212, Phys 221.
Introduction to aerodynamics. Stream functions. Compressible and incompressible effects.

245. Aerodynamics II. (3-0) Cr. 3 W
Prerequisite: 244
Wing Theory: nature and theory of drag. Trajectories of flight within the atmosphere and space.

271. 272, 273. Aerospace Laboratory. (0-3) Cr 1 each F.W.S.
Prerequisite: 271 244; 272: 245, 273 342, E.M. 304
Practical application of aerospace principles and concepts through laboratory experiments.

300. Inspection Trip. S
Prerequisite: Junior Aer E classification
Inspection trip to aerospace industrial and government facilities.

309. Reaction Propulsion I. (3-0) Cr. 3 S
Prerequisite: M E 3 21
One-dimensional gas-dynamics and applications to nozzles, ducts and diffusers.

320. Stress Analysis and Materials. (4-0) Cr. 4 W
Prerequisite: E.M. 324, Met 202
Properties of materials used in flight vehicles, fabrication techniques, objectives of design; analysis of elementary structures.

321. Structural Analysis. (3-0) Cr. 3 S
Prerequisite: 320
Use of energy methods and matrices in the calculations of deflections of structures of flight vehicles and in the analysis of statically indeterminate structures of flight vehicles. Analysis of webs in shear, compression of stable and unstable sections.

331. Aerospace Instrumentation. (3-0) Cr. 3 S
Prerequisite: E.E. 445.
Instrumentation theory and applications in aerospace engineering.

340. Introduction to Aerodynamics. (3-0) Cr. 2 W
Prerequisite: Math 212
Introduction to the aerodynamics of powered flight of manned aircraft and missiles for non aerospace engineering majors.

342. Performance of Aerospace Vehicles. (3-0) Cr. 3 S
Prerequisite: 245
Performance of Aerospace Vehicles.

343. Stability and Control I. (3-0) Cr. 3 F
Prerequisite: 342, classification in Math 323
Static stability and control of flight vehicles.

344. Stability and Control II. (3-0) Cr. 3 W
Prerequisite: 343
Dynamic stability and control of flight vehicles.

352. Missile and Space Theory I. (3-0) Cr. 3 F
Prerequisite: Math. 323, E.M. 344 or permission of instructor.
Introduction to astronautics and orbital flight mechanics.

353. Missile and Space Theory II. (3-0) Cr. 3 S
Prerequisite: 352
Trajectories of missiles and space flight vehicles.

371. 372, 373. Aerospace Laboratory. (0-3) Cr. 1 each F.W.S.
Prerequisite: 371: 343, 352; 372. 350, 344; 373. 309, 321, 331, 353.
Practical application of aerospace principles and concepts through laboratory experiments.

411. Reaction Propulsion II. (3-0) Cr. 3 F
Prerequisite: 309.
Turbojet, ramjet and rocket propulsion.

413. Reaction Propulsion III. (3-0) Cr. 3 S
Prerequisite: 411
Advanced propulsion theory: Exotic and space propulsion systems.

421. Problems in Flight Vehicle Heating. (3-0) Cr. 3 W
Prerequisite: 321, M.E. 321
Sources of flight vehicle heating. Effect of heating on the structural analysis and design.

423. Advanced Structural Analysis. (3-0) Cr. 3 S
Prerequisite: 421
Stability of structures typical of modern aerospace vehicles, thermal effects on deflection and stiffness, analysis of typical structures subject to aerodynamic loading.

431. Fundamentals of Automatic Controls for Flight Vehicles. (3-0) Cr. 3 F
Prerequisite: 344, E.E. 445, Math 323.
Fundamental knowledge pertaining to the analysis of automatic control system for flight vehicles.

440. Flight Systems Testing. (2-6) Cr. 4 S
Prerequisite: 331, 342.
Application of instrumentation to flight systems. Reduction and analysis of experimental data as obtained from aerospace systems. Aircraft, missile and satellite testing.

441. Aerodynamic Theory I. (3-0) Cr. 3 F
Prerequisite: 343, M.E. 321
Introduction to classical theory compressible and incompressible fluids. Shock and expansion waves.

442. Aerodynamic Theory II. (3-0) Cr. 3 W
Prerequisite: 441
Principles of compressible and incompressible flow. Application to airfoils, wings and solids of revolution.

(3-0) Cr 3. S.
Prerequisite: 441, 442, Math 323.

452. 453. Missile and Space Theory III and IV.
Cr 3 each. W.S.
Prerequisite: 353

461. Design and Analysis I.
(1-0) Cr 3. S.
Prerequisite: Senior classification.
Application of the principles and methods of analysis and design to the solution of aerospace problems.

462. Design and Analysis II.
(1-0) Cr 3. S.
Prerequisite: 461
Application of the principles and methods of analysis and design to the solution of aerospace problems.

470. Aerospace Problems.
Arr. Cr 1 to 6. W.S.
Prerequisite: 344.
a. Aero and/or Gasdynamics.
b. Propulsion.
c. Stress Analysis.
d. Missile and Space Theory.
e. Flight Systems.

471, 472, 473. Aerospace Laboratory.
(0-3) Cr 1 each. F.W.S.
Prerequisite: 411, 431, 441; 472: 471, 473: 472
Practical application of aerospace principles and concepts through laboratory experiments.

480. Fundamentals of Aerelasticity.
(3-0) Cr. 3. S.
Prerequisite: 344, E.M. 444
Wing-torsional divergence, control surface reversal, effects of structural deformation on aerodynamic characteristics, flutter.

491. 492, 493. Aerospace Seminar.
(1-0) Cr. R. Yr.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

520. 521. Missile Theory.
(3-0) Cr. 3 each. F.W.
Prerequisite: 344, Math. 323.
Dynamics, propulsion, and guidance of missiles. Orbital flight.

522. Performance Analysis.
(2-3) Cr. 3. S.
Prerequisite: 521.
Performance of aircraft, missiles and space vehicles.

523 Entry Dynamics.
(3-0) Cr. 3. S.
Prerequisite: 521.
Atmospheric entry and entry dynamics of missiles and space vehicles.

524. Thermodynamics of Compressible Flow II.
(M.E. 524) See Mechanical Engineering.

531. Automatic Controls for Flight Vehicles.
(3-0) Cr. 3. S.
Prerequisite: 431.
Theory of the automatic control of flight vehicles. Application of servo-mechanisms to weapon systems.

532. Automatic Controls for Flight Vehicles.
(3-0) Cr. 4. F.
Prerequisite: 531.

COURSES FOR GRADUATE STUDENTS, major or minor

610. 611. Aeroelasticity.
(3-0) Cr. 3 each. Alt. W.S. Offered 1966.
Prerequisite: 644, E.M. 444 or equivalent.
Interaction of aerodynamic, elastic and inertial forces and the influence of this interaction on airplane design. Steady and unsteady aeroelastic problems.

620. Seminar.
(1-0) Cr. 1. Messrs E. Anderson, Hsu, Millet.

(M.E. 623, 624) (3-0) Cr. 3 each. F.W.
Prerequisite: 541, 542, 543 or equivalent, Math 323.
623: Electromagnetic Theory. Motion of charged particle in electromagnetic field. Equations of motion for viscous, heat and analysis and design to the solution of aerospace problems.

(3-0) Cr. 3 each. Alt F.W. Offered 1965, 1966.
Prerequisite: 543 or equivalent.
Opportunities of engineering research, application and education include developing and manufacturing farm building materials and equipment, and in the design, construction, merchandising and contracting of farm buildings. Students may also prepare for employment in design, development, construction, sales and service in the areas of soil erosion control, drainage and irrigation; rural electrification; crop processing and storage; and materials handling in agriculture.

The department has cooperative programs established, for interested and qualified students, with certain companies in the farm machinery industry. The four-year curriculum is extended over a five-year period and interspersed with work periods in a farm machinery manufacturing plant. This plan offers valuable practical experience and financial assistance during the years in college.

In addition to the courses for students majoring in agricultural engineering, the department offers a number of courses for students from the College of Agriculture. These include courses in farm mechanics, soil and water control, farm power and machinery, farm electrification, farm structures, and crop storage and conditioning.

AGRICULTURAL BUSINESS

For description of courses, see Economics and Sociology.

AGRICULTURAL EDUCATION

For description of courses, see Education.

AGRICULTURAL ENGINEERING

Clarence W. Bockhoph, Ph. D., Head of Department


Associate Professors: Landy B. Altman, Ph.D.; Craig E. Beer, Ph.D.; Vernon M. Meyer, M.S.; Fred W. Roth, M.S.; Robert A. Saul, M.S.; Norval J. Wardle, Ph.D.; Ted L. Willrich, Ph.D.

Assistant Professors: Willard R. Anderson, M.S.; David B. Palmer, Ph.D.; Larry Van Fossen, M.V. Ed.

Instructors: Donald L. Ahrepp, B.S.; George E. Ayres, B.S.; James C. Frisby, M.S.; Thomas A. Hoerner, M.S.; Duane W. Mangold, M.S.; Stephen J. Marley, M.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in agricultural engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula.

The curriculum in agricultural engineering provides training in the major fields of engineering applications to the industry of agriculture. Graduates from the curriculum find employment in agricultural production enterprises, in the industries which supply goods and services to agriculture, and in the state and federal agencies responsible for agricultural engineering research, application and education.

Employment for agricultural engineers is available in many agricultural industries. Professional services performed in the farm machinery industry include engineering design, development, manufacturing, product education and sales. Services are rendered to industries supplying farm building materials and equipment, and in the design, construction, merchandising and contracting of farm buildings. Students may also prepare for employment in design, development, construction, sales and service in the areas of soil erosion control, drainage and irrigation; rural electrification; crop processing and storage; and materials handling in agriculture.

The department has cooperative programs established, for interested and qualified students, with certain companies in the farm machinery industry. The four-year curriculum is extended over a five-year period and interspersed with work periods in a farm machinery manufacturing plant. This plan offers valuable practical experience and financial assistance during the years in college.

In addition to the courses for students majoring in agricultural engineering, the department offers a number of courses for students from the College of Agriculture. These include courses in farm mechanics, soil and water control, farm power and machinery, farm electrification, farm structures, and crop storage and conditioning.
Opportunities for Graduate Study

The department offers major work for the degrees Master of Science, Master of Engineering, and Doctor of Philosophy in soil and water control; agricultural field power and machines; agricultural electric power and crop processing; agricultural structures and equipment; agricultural crops and materials storage, conditioning and processing; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum in agricultural engineering substantially equivalent to that required of undergraduate students at this institution.

Minor work in agricultural engineering is offered for students in other departments, and minor work in agricultural mechanics is offered for students in agriculture.

Open to graduate students for minor only in agricultural engineering: 346, 424, 425, 436, 447, 461, 463, 464, 465, 476. Open to graduate students for minor only in agricultural mechanics: 345, 412, 415, 416, 489.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Technical Lecture. (1-0) Cr R. S
The field of agricultural engineering, its relation to the agricultural industry and to the engineering profession.

157. Dairy Mechanics. (0-6) Cr. 2 S
For dairy and food industries students. Sanitary and common pipe fitting, soldering and sheet metal, oxy-acetylene and arc welding, silver soldering, electricity, and service and repair of dairy equipment.

217. Engineering Problems in Livestock Production. (4.0) Cr 4 W
Prerequisite: Math. 212, credit or classification in Phys. 222
Environmental influences on livestock production. Functional design of livestock housing and equipment.

219. Engineering Problems in Livestock Management. (3.0) Cr 3 A W; B S
Prerequisite A For winter quarter and two year programs in agriculture only; B For four year programs in agriculture only
Space and equipment needs and arrangements for livestock production. Environmental influence on animal performances and behavior. Materials handling problems.

224. Fundamentals of Soil and Water Control Engineering. (3-6) Cr 5 S
Prerequisite Agron. 154, credit or classification in Math 212

236 Agricultural Machines. (2.3) Cr 3 F
Prerequisite Credit or classification in Phys 212
Development, economic requirements, construction, efficiency, capacity, cost of use, testing and selection of agricultural machines.

254. Metal Construction and Maintenance. (2-4) Cr 3 F W S SSII
Selection and application of ferrous and non-ferrous metals. Welding, cold working and hot working metal in agricultural construction and maintenance.

255 Agricultural Construction Materials and Procedures. (2-4) Cr 3. F W S SSII
Selection of building materials and their application to agricultural construction.

259 Construction Methods and Materials. (0-6) Cr. 2. F
Prerequisite: Engr. classification.

301, 302, 303. Seminar. (1.0) Cr R Yr
Preparation, presentation, and discussion of papers on agricultural engineering subjects.

Engineering aspects of soil and water conservation for students in agriculture. Use of the level. Land description. Design, location and construction of erosion control and draining facilities. Field trips to problem areas.

334. Farm Machinery and Power Management. (3-3) Cr 4. F.W.S.
Mechanics and materials of farm machinery construction. Adjustment, selection, capacity and cost of use of farm machinery. Transmision, measurement, and cost of use of farm power.

345 Tractor Power. (2.3) Cr 3 W
Prerequisite 334
Construction, operation, adjustment, capacity and care of tractors and internal combustion engines.

346 Agricultural Tractor Power. (3-3) Cr 4. S.SSI
Prerequisite: M.E. 344
Kinematics and dynamics of tractor power application; draw bar, power take-off, and traction mechanisms. Thermodynamic principles and construction of the internal combustion engine. Fuels and carburetion. Ignition. Rating and testing of tractors.

354. Advanced Metal Construction and Maintenance. (2-4) Cr 3. F.W.S.SSI
Prerequisite 254
Advanced techniques in metal construction and repair of agricultural equipment including oxy-acetylene and arc welding.
436. Agricultural Machinery Design.  
(2-6) Cr. 4. W.  
Prerequisite: 236, M.E. 318  
Design, development, and testing of farm machinery to meet the functional requirements of machines for tillage, seeding, cultivation and weed control, harvesting, crop processing, and farm power units.

447. Agricultural Engineering Applications.  
(3-0) Cr. 3. S  
Prerequisite: 236, 346, E.M. 324  
Summarization, correlation and extension of the agricultural engineering techniques. Economic limitations in design and management.

441. Applications of Electrical Principles to Agricultural Equipment.  
(2-6) Cr. 4. W.  
Prerequisite: Credit or classification in E.E. 442  
Selection and use of electrical equipment as related to efficiency and economy of agricultural production, processing and storage of feeds, forage crops and grains in connection with the livestock, poultry and dairy enterprises.

463. Farm Electrification Design.  
(3-3) Cr. 4. S  
Prerequisite: 461  
Engineering problems in the design of electric distribution systems. Design of control circuits and equipment used in livestock, grain, and forage production.

464. Crop Conditioning and Storage.  
(2-3) Cr. 3. W.  
Prerequisite: Math. 321, M.E. 344  
Mass and energy balances involved in the conditioning and storage of agricultural crops. Fans and air distribution in ducts. In-storage, heated-air, and supplemental-heat drying.

(2-3) Cr. 3. S  
Prerequisite: 464  
Theory and practice involved in the handling of agricultural products on the farm.

475. Agricultural Structures.  
(2-3) Cr. 3. F.  
Prerequisite: 217, E.M. 324  
Structural problems in agricultural buildings. Valuation appraisal and estimation. Design of major service and processing buildings.

476. Advanced Agricultural Structures.  
(2-3) Cr. 3. S  
Prerequisite: 217, credit or classification in C.E. 434A  
Analysis of statically indeterminate agricultural building frames. Analysis and design of specialized structures for service, storage, or processing of agricultural commodities. Specifications. Special reports.

488 Environmental Control in Agricultural Structures.  
(2-3) Cr 3. W.  
Prerequisite: 475 or C.E. 331A, M.E. 344  
Analysis of psychrometric data; calculation of heat losses. Heat and moisture production of animals and stored crops. Design of insulation, ventilation, heating and cooling systems for animal production.

489. Farm Buildings and Equipment.  
(2-3) Cr 3 W.  
Prerequisite: Senior classification  
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

524. Erosion and Sediment Transport. (3-0) Cr. 3. W.
Prerequisite: Math 213 and one of the following: 424, C.E. 521, Geol. 460, Agron. 577.

528. Special Topics. Cr 1 to 5. F.W.S.SSI, II.

531. Agricultural Structures and Equipment. (3-0) Cr. 3. F.
Prerequisite: 488
Critical analysis of the design and functional relation of farm structures and equipment, including research methods, project planning and reporting of results.

532. Advanced Soil and Water Control Engineering. (3-0) Cr. 3. W.
Prerequisite: 425.
Critical analysis of the design and functional relations of soil and water conservation facilities, including experimental techniques.

533. Agricultural Power and Machinery. (3-0) Cr. 3. S.
Prerequisite: 461.
Critical analysis of power and equipment for agricultural production with emphasis on functional design requirements, and techniques for testing and evaluating performance.

534. Advanced Farm Electrification. (3-0) Cr. 3. S.
Prerequisite: 461.
Critical analysis of electric power, heat, light and controls in agricultural production with emphasis on functional design requirements; instrumentation methods and results.

COURSES FOR GRADUATE STUDENTS, major or minor

628. Research. F.W.S.SSI, II.
Messrs. Beresford, Bockhop, Buchele, Charity, Giese, Hazen, Hukill, Johnson.

661. 662. 663. Seminar. (1-0) Cr. 1 each. F.W.S. Mr. Bockhop.
Discussion of research problems, methods, procedures, and reports.

AGRICULTURE

Floyd Andre, Ph.D., Dean of Agriculture
Louis M. Thompson, Ph.D., Associate Dean

PROFESSOR: James J Wallace, B.S.
ASSOCIATE PROFESSOR: Roger L Mitchell, Ph.D.
ASSISTANT PROFESSOR: Jack M. Alexander, M.S.
INSTRUCTORS: Donald L. Ahrens, B.S.; Roger J. Bruene, B.S.; Ronald D. Kay, B.S.; Jerry R. Ladman, B.S.; Neil Patrick, B.S.

Courses Administered by the College of Agriculture

Courses listed below are offered for undergraduate students in all curricula of the College of Agriculture. See also individual curricula in the section Colleges and Curricula.

104. Practical Work.
A minimum of six months' practical work in the student's field of study is required for graduation. This requirement should be met before the beginning of the junior year.

105. Basic Principles of Agriculture.
Cr 1 to 4 SS
For Special Groups. Soil management; crop production; livestock production; farm machinery; farm leadership; agricultural leadership.

Survey of opportunities in agriculture.

450. Farm Operation.
(3-4) Cr. 4. F.W.S.SSI, II.
Prerequisite: Junior classification in College of Agriculture Messrs. Alexander, Wallace.
Credit not to exceed 4 in any quarter and not to exceed a total of 8. Participation in the management and operation of an Iowa farm. The class is responsible for the plans, records and decisions of buying and selling of livestock, crops and equipment. Trips to farms and markets.

AGRONOMY

John T. Pesek, Jr., Ph.D., Head of Department

PhD; Frank W Schaller, Ph D ; Wayne H Scholtes, Ph D ; A Duncan Scott, Ph D ; Robert H. Shaw, Ph D.; William D Shradar, Ph D.; Willis H Skrdla, Ph.D; David W Stanforth, Ph D; Harvey E. Thompson, Ph D; Louis M. Thompson, Ph D; Charles R Weber, Ph D; Walter F Wedin, Ph D; Carroll P Wilie, Ph D

ASSOCIATE PROFESSORS Minoru Amemiya, Ph D ; Irvin C. Anderson, Ph D ; Charles R Ballantyne, M A ; Irving T. Carlson, Ph D ; Lloyd Dumenil, Ph.D; John C. Eldredge, Ph D.; Charles D Hutchenroft, Ph D ; Roger L. Mitchell, Ph D ; William C. Moldenhauer, Ph D ; Peter A Peterson, Ph D; Richard M Shibles, Ph.D ; Joseph A. Stritzel, Ph D; John R Webb, Ph D; Donald G Woolley, Ph D

ASSISTANT PROFESSORS : Arthur P Edwards, Ph D ; Alfred J Englehorn, M.S ; Detroy E Green, Ph D ; Oliver A Knott, M A ; G Douglas Minion, Ph D ; Raymond P Nicholson, B S ; Frederick R Troeh, Ph D ; Regis D Voss, Ph D

INSTRUCTORS : Vernon B. Cardwell, M S ; Robert G Palmer, M S

Opportunities for Undergraduate Study

For undergraduate curriculum in agronomy, see College of Agriculture, Curricula.

The curriculum in agronomy provides a thorough training in crop science, soil science and agricultural climatology. It also provides general training in other fields of agriculture, in natural and social sciences, and in the humanities.

The four-year curriculum, with its three options and six areas of specialization outlined under the agronomy curriculum, prepares students for independent farming and for positions in industry, service organizations, educational institutions and state and federal agencies. Graduates accept positions in the seed, fertilizer and chemical industries as agronomists, production managers, product inspectors and sales and promotion specialists. They are employed in state and federal agencies as extension agronomists, county extension directors, soil conservationists and soil scientists. There are also opportunities for agronomy graduates as land appraisers, golf course superintendents, turf-grass specialists and farm managers.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy with specialization in crop production and physiology, plant breeding, soil physics, soil chemistry, soil fertility, soil microbiology and biochemistry, soil morphology and genesis, soil management and agricultural climatology and minor work to students taking major work in other departments.

Prerequisite to major graduate work in crop science and soil science is completion of an undergraduate curriculum substantially equivalent to that recommended for pre-graduate training in the agronomy curriculum at this institution. Completion of the prerequisites listed under Agronomy Curriculum, Graduate Study Preparation, is necessary for major graduate work in agricultural climatology.

Open to graduate students for minor only 315, 354, 415, 416, 424, 444, 453, 455, 464, 473, 483, 485.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Technical Lecture.
(10) Cr R F W
Survey of different branches of agronomy.

114. Principles of Crop Production.
A (3-2) Cr 4 FWS SS
B (3-0) Cr 3 F W For students in winter quarters Farm Operation Program only.
C (3-2) Cr 4 S For students in agricultural engineering and science.

A (3-3) Cr 4 FW SS
Prerequisite: A Chem. 101
B (3-0) Cr 3 For students in winter quarter Farm Operation Program only.

120. Agricultural Meteorology.
(3-0) Cr 3 F W
Introduction to basic meteorological processes related to agriculture. Study of weather maps and forecasting.

212. Grain and Forage Crops.
(3-2) Cr 4 W
Prerequisite 114
For two year students only. Characteristics, culture and management of grain and forage crops. Identification of crop and weed species; seed and grain quality.

300. Crop Production and Soil Management.
Cr Arr FWS SS
For special groups Distribution, production,
harvesting and utilization of crops; formation, characteristics and classification of soils; principles and practices of soil conservation, fertility maintenance and soil management.

310. Seminar. 
(1-0) Cr 1. F.W.S. 
Prerequisite 206, 315, 354, Stat. 201A. Mr L. Thompson. 
Interpretation of research data relating to soil-plant and soil-plant-climate relationships.

314. Turfgrass Management. 
(Hort. 313, 314) See Horticulture.

315. Crop Growth and Culture. 
(4-0) Cr 4 F.S. Alt. SSI Offered 1966. 
Prerequisite 114, Bot. 101 or 210. Mr. Mitchell. 
Basic concepts and physiologic aspects of growth and culture of crop plants; application of these principles to cultural practices.

354. Soil Fertility. 
(3-3) Cr. 4. F.W.S. Alt. SSI Offered 1966. 
Prerequisite 154, Chem 231 Mr. Frederick. 
Chemical, biological and physical properties of soils in relation to plant nutrition. Principles relating to the use of lime, manure and fertilizers.

357 Forest Soils. 
(For 357) (4-3) Cr 5 W 
Prerequisite Chem. 231. Mr. Scholtes. 
Formation, classification and occurrence of soils. Physical, chemical and biological soil factors affecting forest growth.

400. Agricultural Travel Course, Cr 4 SS 
Prerequisite Junior classification, permission of instructor 
B European Tour Offered 1966. 
Students taking this course will be required to register also for An S, 400 for 4 credits. Tour and study of production methods in major crop and livestock regions of the United States and other countries. Influence of climate, soil, topography, markets, and other factors on livestock and crop production.

406 Climates of the Continents. 
(3-0) Cr. 3 W. 
Prerequisite: Senior classification. Mr. Shaw. 
World climateology and factors controlling it. Climatic analogues as a means of comparing climates. The climates of different continents.

411. Seminar. 
(1-0) Cr 1 W S 
Prerequisite: 310, senior classification. Mr. Wooley. 
Interpretation and presentation of research data relating to crop science.

415. World Crop Resources. 
(3-0) Cr 3 F.W. Alt. SSI Offered 1967 
Prerequisite. 114, Bot. 101 or 210. Mr. Woolley. 
Basic concepts of origin and adaptation of world crops. Production of cereal, oil fiber, sugar and other crop plants as affected by environmental conditions.

416 Principles of Crop Production and Management. 
(1-0) Cr 3 Off-campus 
Prerequisite 114, Bot 101 graduate classification. Staff. 
Primarily for graduate students not majoring in agronomy. Application of principles of crop science and current research information in the solution of crop production problems.

424 Principles of Plant Breeding. 1. 
(3-0) Cr 3 F. 
Prerequisite 415 or 315; Gen. 301 Mr. Atkins. 
Basic principles and methods used in improvement of important crops.

444. Soil and Crop Management. 
(4-0) Cr. 4. F.W.S. Alt. SSI. Offered 1966. 
Prerequisite 315 or 415, 354 and senior classification. Messrs. Striszel and Wooley. Integrating the principles of agronomic science with soil and crop management systems and practices. Basic plant-soil-climate relationships are used in solving field problems with emphasis on achieving optimum land use and efficient crop production.

450. Special Problems. 
Cr. arr. F.W.S.S.S. Staff. 
Open to qualified students, after consultation with professor in special area of interest. Selected studies in crops, soils, or climatology according to needs and interests of student. For foreign students, an analysis of soil, climatic and crop production resources of the student’s home country is suggested. 
H. Honors Program.

(1-0) Cr. 1 W. 
Prerequisite 310, senior classification. Mr. Peseck. 
Interpretation and presentation of research data relating to soil science.

453. Fertilizers. 
(3-0) Cr. 3 F. 
Prerequisite: 354. Mr. Frederick. 
Types, properties, and production of fertilizers; use and choice of fertilizer in relation to soil properties, environmental conditions, crop requirements, and economic factors; out-of-town field trips.

(10-0) Cr. 3 Alt. SS Offered 1967. Three weeks. 
Prerequisite 154, Chem. 231. Staff. 
Primarily for graduate students not majoring in agronomy. Application of principles of soil science in the interpretation and use of recent research relating to problems in soil management, fertility and conservation.

(2-3) Cr. 3. F.S. 
Prerequisite: 354. Mr. Scholtes. 

473. Crop Development and Classification. 
(3-2) Cr. 4 F.S. 
Prerequisite: 154 Mr. Scholtes. 
Development, characteristics, and identification of soils; study of soil profiles; theory and practice of soil mapping; interpretation and utilization of soil survey information; two 2-day field trips.

483. World Soil Resources. 
(2-2) Cr. 3 W. 
Prerequisite: Chem. 101; junior or senior classification Mr. Trow. 
Properties of soils; world soil geography; present and potential productivity of soils in various continents, and factors influencing their utilization.

485. Agro-Microbiology. 
(Day 485) (3-3) Cr. 4 S. 
Prerequisite: 154, Bot 300 or 304 Mr. Frederick. 
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

505. Plant Climate.  
(3-0) Cr 3  S  
Prerequisite 154, Bot 310 Mr Shaw  
The heat exchange near the ground. Relation of topography and plant cover to the microclimate. Modification of microclimate by agricultural operations.

506. Methods in Climatology.  
(3-0) Cr 3 Alt. S. Offered 1966.  
Prerequisite 505, Stat 448 Mr Shaw  
Physical and statistical processes in the study of the climate and the analysis of agro-climatic data.

514. Crop Adaptation.  
(3-0) Cr 3  F  
Prerequisite 114, Bot 330, Gen 301, senior classification Mr Wilse  
Principles and concepts of origin, adaptation and distribution of crop plants. Genetic and physiological aspects of plant response to environmental factors. Distribution of world crops on a climatic basis.

518. Advanced Crop Production.  
(3-0) Cr 3  S  
Prerequisite 315 or 444 Mr. Woolley  
Basic concepts in plant-soil-climate relationships with emphasis on recent advances in crop culture and management.

524. Principles of Plant Breeding II.  
(3-0) Cr 3  W  
Prerequisite 424, Bot 407 Mr Atkins  
Application of genetic principles to improvement of important farm crops.

(3-0) Cr 3  W  
Prerequisite 315, 354 Mr Wedin  
Forage resources, ecology and dynamics. Principles of pasture management. Evaluation techniques in grassland research.

550. Special Topics.  
Cr arr F.W.S.S.  
Prerequisite 15 Cr in Agron Staff  
Literature reviews and conferences on selected topics in crops, soils, or climatology according to needs and interest of student. For foreign students, an analysis of soil, climatic, and crop production resources of the student's home country is suggested.

553. Soil-Plant Relationships.  
(3-0) Cr 3  F  
Prerequisite. 354 Mr Black  
Composition and properties of soils in relation to the nutrition and growth of plants.

556. Laboratory Methods of Soils Investigations.  
(0-4-6) Cr. 2 to 3. A Alt. S. offered 1966; B F, C W  
Prerequisite A: 485, 585. Messrs Bremner, Frederick; B: 354, Chem 211. Messrs. Black, Bremner; C 577. Mr Kirkham.  
A. General Microbiology and Biochemistry B: Soil Chemistry. C: Soil Physics.

(3-0) Cr 3  W  
Prerequisite: 464, 473, A E 306. Mr Shreadr  
Fundamental principles involved in the management, improvement and conservation of soils.

577. Soil Physics.  
(Phys 577) (3-0) Cr. 3  F  
Prerequisite. 354 Mr Kirkham  
Relation of physical properties of soils to plant growth. Particle-size distribution, soil structure, clay minerals, soil moisture, rheological properties and soil temperature.

585. Soil Microbiology and Biochemistry.  
(Bact 585) (3-0) Cr. 3 Alt. W Offered 1967  
Prerequisite 485 Mr Frederick  
Nature of the microbiological population of the soil; activities of soil microorganisms, interactions between soil population and soil properties and plant growth; interpretation of biological data.

COURSES FOR GRADUATE STUDENTS, major or minor

601. Seminar.  
(1-0) Cr 1  F.W.S.  
A Farm Crops. Messrs Carlson, Frey, Wilse  
B. Soils. Mr Black  
C. Plant-Soil Climate Relationships Mr Shaw  
Reports and discussions of recent literature and current investigations.

606. Research in Agro-Climatology.  
F.W.S.S. Mr. Shaw  
Consultation with instructor, exhaustive examination of the literature pertaining to and original thought on a special research problem of special interest to the student.

609. Conference in Agro-Climatology.  
(0-1) Cr 1  F.W.S.S. Mr Shaw  
Consultation with instructor, special problems and/or reading assigned in consultations with the instructor on which the student reports.

615. Physiological Aspects of Crop Production.  
(3-0) Cr 3  S  
Prerequisite Bot 512. Mr Shibles  
A basic consideration of the physiology—environment interaction in relation to the growth and production of crop communities. Topics include the nature of plant competition; basic principles of competition for radiant energy, water, carbon dioxide, and nutrients; energy storage and utilization; cold and frost hardiness; heat and drought tolerance.

623. Cytogenetics in Relation to Plant Breeding.  
(3-0) Cr 3  F  
Prerequisite. 524, Gen 630, Bot. 605 Mr Peterson  
Cytogenetic considerations in plant breeding. Topics include chromosome recombination, aberrations, polyploidy, aneuploids and interspecific hybrids.

624. Advanced Plant Breeding I.  
(3-0) Cr 3  W  
Prerequisite 524, Gen 630 Mr Russell  
Types of gene action in crop breeding. Topics include heritability, inbreeding depression and heterosis, development and evolution of parental materials, prediction of hybrid performance, procedures and problems in testing for general and specific combining ability, factors limiting efficiency of selection and testing.

625. Advanced Plant Breeding II.  
(3-0) Cr 3  S  
Prerequisite 524, 624, Gen 630 Mr. Frey  
Relation of population structure to crop breeding. Topics include breeding systems; relation of population structure to inducing variability.
and to selection procedures; theory of pure lines, synthetics, and multiline varieties; importance of genetic shifts and homeostasis in crop breeding.

640. Research.
F.W.S.S.S.

655. Advanced Soil Fertility.
(3-0) Cr. 3. Alt. W. Offered 1967.
Prerequisite: 553. Mr. Black.
Evaluation of soil fertility and fertilizers; theory and applications.

657. Soil Chemistry.
Prerequisite: 553, Chem. 484 or equivalent. Mr. Scott.
Chemical and mineralogical properties of soil colloids. Ion exchange and soil reaction.

675. Advanced Soil Genesis and Classification.
(0-2) Cr. 2. Alt. S. Offered 1966.
Prerequisite: 575. Mr. Riecken.
Processes, reactions and theories in soil formation; principles of soil classification.

677. Advanced Soil Physics.
(Phys. 677) (3-0) Cr. 3. Alt. S. Offered 1967.
Prerequisite: 577. Math. 212. Mr. Kirkham.
Physical characteristics of soil and principles underlying flow and distribution of water in soils.

685. Advanced Soil Biochemistry.
(3-0) Cr. 3. Alt. S. Offered 1967.
Prerequisite: 585. Mr. Bremer.
Nature of soil organic matter, and biochemical transformations brought about by soil microorganisms.

690. Research.
F.W.S.S.S.
A. Soil Microbiology and Biochemistry. (Bact. 690) Messrs. (1) Bremner, (2) Frederick.
C. Soil Physics. (1) Mr. Kirkham.
E. Soil Morphology and Genesis. Messrs. (1) Riecken, (2) Ruhe, (3) Scholtes.
F. Soil Chemistry. Messrs. (1) Black, (2) Bremner, (3) Scott.

ANIMAL SCIENCE

Leslie E. Johnson, Ph.D., Head of Department


Instructors: Robert E. Hunsley, M.S.; D. Kent Nelson, M.S.

Opportunities for Undergraduate Study

For undergraduate curricula in animal science and dairy science, leading to the degree Bachelor of Science, see College of Agriculture, Curricula.

The curricula in animal science and dairy science with options in Production, Science and Industry provide training in the field of agriculture as applied to all phases of the production and distribution of livestock and livestock products. A liberal allowance of elective credits is permitted in each option of the curricula.

Students graduating from these curricula with their various options go into many lines of work. Men well trained in animal and dairy science are in demand as operators of livestock or dairy farms; directors of extension work; extension assistants in youth activities, fieldmen
for farm management, banks and insurance companies; for management, buying, sales or supervisory positions with meat packing, produce, feed, merchandising, dairy and farm equipment companies; positions in the teaching field, and employment with various agencies of state and federal governments. Opportunities in college work in teaching, research, and extension usually require graduate training.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in breeding, meats, nutrition and reproduction. Advanced graduate study in meats is offered as a joint major in meat science and food technology. A Master of Science degree is offered in livestock production and dairy cattle production with emphasis on environmental physiology. Minor work is offered to students with a major in other departments.

Graduate study in Animal Science will include courses listed in other departments when such courses are appropriate to the students previous training, major interests and thesis problem. Thus, those taking major work in all the above fields will often include courses in mathematics and statistics. Those taking major work in animal breeding will include courses in genetics and zoology; those taking major work in meat science will include courses in dairy and food industry, chemistry, bacteriology and zoology; those taking major work in animal nutrition will include courses in physiology, chemistry and bacteriology; those taking major work in animal reproduction will take courses in anatomy, physiology and chemistry.

Prerequisite to major graduate work is the completion of an undergraduate program in animal science, dairy science and/or related sciences necessary for the pursuance of the chosen area in animal science. Basic courses in chemistry, mathematics and zoology are helpful in all animal science graduate work.

Open to graduate students for minor only: 319, 350, 403, 425, 427, 429, 431, 434, 436, 437, 450, 470, 490.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Technical Lecture. 
(1.0) Cr. R. F.W.S.SSI Messrs. Haynes, Sims. 
Survey of animal science field.

114. Elements of Livestock Production. 
(3.4) Cr. 5. F. W.S. SSI Messrs. Foreman, Haynes, Hunsley, Kiser, Porter, Sjms, Taylor. 

115. Horses and Ponies. 
(2.2) Cr. 3. W. Mr. Kiser. 
Breeds of horses and ponies for work and pleasure. Selecting, judging, breeding, feeding, care, management, and marketing.

125. Livestock Husbandry Practices. 
(0.3) Cr. 1. F. SSI Mr. Hunsley. 
Practical problems, demonstrations, participation in skills and practices encountered in the care, handling, and exhibiting of farm livestock.

(2.4) Cr. 4. F.W.S.SSI. 
Prerequisite: 114. Sophomore classification. Mr. Warner. 
Breeds of beef cattle, sheep and swine, their development, evaluation, use and adaptability in commercial livestock production.

216. Livestock Feeding and Management. 
(3.2) Cr. 4. W. 
Prerequisite: 114. Staff. 
Practical feeding and management of hogs, beef and dairy cattle, and sheep. Not accepted for credit for Animal and Dairy Science degree.

235. Dairy Cattle Performance. 
(2.2). Cr. 3. F.W.S.SSI. 
Prerequisite: 114 Messrs. Porter, Sims. 

(2.2) Cr. 3. F.S. 
Prerequisite: 114 or F. and N. 107. Mr. Kline. 
Composition of meat and its nutritive value. Selection, grading, identifying, curing and freezing meats.

305. Livestock Selection and Meat Evaluation. 
(0.6) Cr. 3. F. 
Prerequisite: 214, 270. 115 recommended. Mr. Kiser. 
Beef cattle, hogs, sheep and horses.

315. Light Horse Husbandry. 
(1.4) Cr. 3. F. SSI. 
Prerequisite: 115. Mr. Kiser. 
Feeding, breeding and selection, care, handling, training and marketing of light horses and ponies. English and Western equitation. Field trips.

(4.0) Cr. 4. F.W.S.SSI. 
Prerequisite: Chem 231 or equivalent. V. Phys 264 recommended. Mr. Haynes. 
Digestion and metabolism of carbohydrates, fats, proteins, minerals, and vitamins. Measures of energy.

(3.0) Cr. 3. F.W.S.SSI. 
Prerequisite: 318. Mr. Foreman. 
Essential nutritive requirements of livestock and poultry; sources and composition of nu-
335. Dairy Cattle Selection.  
(3-0) Cr. 2. S.  
Prerequisite: 235, Mr. Sims.  
Selection of breeding animals for dairy herds.  
Comparative terminology, decision making and  
presentation of oral reasons. Trips to dairy  
cattle farms.

350. Animal Breeding I.  
(4-0) Cr. 4. F.W.S.  
Prerequisite: Gen. 301, Mr. Taylor.  
An approach of genetic principles to animal  
improvement. Selection and systems of mating  
for farm animals. The use and value of  
performance testing.

(3-3) Cr. 4. W.S.  
Prerequisite 270, Mr. Kline.  
Effect of nutrition, breeding and management  
on qualitative and quantitative aspects of  
meat production. Meat merchandising and  
marketing practices. One-day field trip.

400. Agricultural Travel Course.  
Cr 4. (Agron. 400, Cr. 4; also required  
for students taking this course.) SS.  
Prerequisite Junior classification and/or per  
mission of instructor.
B: European Tour. Offered 1966.  
Tour and study of production methods in  
major livestock and crop regions of the  
United States and other countries. Influence  
of climate, soil, topography, markets and other  
factors on livestock and crops produced.  
Livestock management and crop production practices.

403. Marketing Livestock and Meat.  
(Econ. 403) See Economics.

405. Advanced Livestock Selection.  
(5-0) Cr. 5. S.  
Prerequisite 305, Mr. Kiser.  
Beef cattle, hogs, horses and sheep. Trips to  
shows and stock farms.

409. Market Livestock and Marketing  
Procedures.  
(2-0) Cr. 2. F.S.  
Prerequisite 270, Mr. Warner.  
Classifying, grading, and evaluating cattle,  
hogs and sheep for market. Kinds of markets  
and marketing procedures. Field trips.

418. Animal Nutrition I.  
(3-0) Cr. 3. W.  
Prerequisite: Students in Veterinary Medicine.  
Mr. Haynes.  
Nutrition requirements for maintenance,  
growth, fattening, reproduction and lactation  
of ruminant and non-ruminant animals in  
cluding small animals.

419. Animal Nutrition II.  
(2-2) Cr. 3. S.  
Prerequisite: 418. Mr. Foreman.  
Essential nutrient requirements of livestock  
and poultry. Sources and composition of nutri-  
ets; ration formulation and feeding practices.

425. Swine Production and Marketing.  
(3-0) Cr. 3. W.S.  
Prerequisite 319. 350 recommended Mr.  
Taylor.

(3-0) Cr. 3. F.S. SS166.  
Prerequisite 319, Mr. Hunsley.

429. Sheep Production and Marketing.  
(2-2) Cr. 3. W.  
Prerequisite: 319, Mr. Warner.

(3-0) Cr. 3. F.S.  
Prerequisite 1. Phys 264, Mr. Melampy.  
Physiology of reproduction in farm animals.

434. Milk Production and Herd Management.  
(3-0) Cr. 3. F.W.  
Prerequisite 319, Mr. Foreman.  
Ration preparation and computations. Evaluation  
of feed sources, feed additives and herd  
management systems.

435. Advanced Dairy Cattle Selection.  
(3-0) Cr. 2. S.  
Prerequisite 335, permission of instructor.  
Mr. Sims.  
Specialized training in selection of dairy cattle  
in giving oral reasons. Trips to dairy  
farms and shows. Evaluating herd management  
practices and breeding programs. Written  
report required.

(3-0) Cr. 3. W.  
Prerequisite: 319, 350, 334, Mr. Porter.  
Seminar and discussion of current problems  
for the dairyman.

437. Milk Secretion.  
(3-0) Cr. 3. F.  
Prerequisite: 319, V. Phys. 264, Mr. Jacobson.  
Development, structure and functional proce- 
ses of the mammary gland.

450. Animal Breeding II.  
(3-0) Cr. 3. W.S.  
Prerequisite: 350 and Stat. 201 or 201A.  
Messrs. Freeman and Hazel.  
Gene frequency, genetic variation and covaria- 
tion in productive traits of livestock. Adjust- 
ing for environmental differences. Mass,  
pedigree family selection and progeny testing.  
Construction of selection indexes. Breeding  
plans for maximizing rates of improvement.

(3-3) Cr. 4. W.  
Prerequisite: 370, Bact. 304, Chem. 231 or  
335, Mr. Goll.  
Structure and composition of skeletal muscle  
and connective tissue. Microbiology of meat.  
Post-mortem changes affecting meat and meat  
quality. Fundamentals involved in meat pro- 
cessing and preservation. One-day field trip.

475. Intercollegiate Judging Training and Com- 
petition.  
Arr. A Cr 2.5 F.W.; B. Cr. 1.4, F.W.;  
C Cr 2.4 F.W.S.; D. Cr. 1.3 F.W.S.  
Prerequisite. Permission of instructor. Messrs.  
Kiser, Kline, Sims, Warner.  
A. Meat animals and horses.  
B. Dairy cattle.  
C. Meats.  
D. Wool.  
Specialized training in evaluating and grading  
live animals, carcasses and wool. Field trips  
to farm, meat packing firms, wool marketing  
warehouses and livestock exhibitions.

490. Special Problems.  
Cr. 1 to 3. F.W.S.  
Prerequisite Permission of instructor.  
Open to junior and senior students in animal  
sciences, dairy science and home economics.  
Shows satisfactory preparation for problems  
chosen and quality point average of 2.5 or  
above for two preceding quarters. Individual  
topic, conferences and preparation of report.  
A. Animal Science.  
B. Dairy Science.  
C. Meat Science.  
H. Honors Program.
COURSES PRIMARY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

518. Advanced Non-Ruminant Nutrition, (4-0) Cr. 4. W
Prerequisite: 391, B. and B. 304 Messrs Hayes, Speer.
Nutrition requirements for maintenance, growth, fattening, reproduction and lactation in the non-ruminant animal.

519. Advanced Ruminant Nutrition I, (3-0) Cr. 3. S
Prerequisite: 319, B. and B. 304. Mr Burroughs.
Digestion, absorption and metabolism of nutrients as related to maintenance, growth, lactation and reproduction in ruminants.

520. Advanced Ruminant Nutrition II, (2-3) Cr. 3. Alt. F. Offered 1966
Prerequisite: V. Phys. 462 or Zool. 552. Mr. McGil1ard.
Survey of outstanding literature on methodology as applied to the study of the physiological aspects of ruminant nutrition. Laboratory to illustrate principles, methods, and special procedures.

Prerequisite: B and B 305 or 503 or permission of instructor. 470 recommended. Mr. Goll.
Microstructure, physical and chemical composition of muscle tissue. Chemistry of muscle proteins. Chemical and physical aspects of muscle contraction and rigor mortis.

571. Advanced Meat Science, (D.F.I.571) (3-0) Cr. 3. Alt. W. Offered 1967
Prerequisite: 570 or permission of instructor. 570 recommended Messrs Goll and Snyder. Role of the chemical components of muscle in some fundamental properties of meat. Effect of enzymes on meat quality. Discussion of recent research topics.

572. Microbiology of Meats, (D.F.I. 572) (3-0) Cr. 3. Alt. S. Offered 1967
Prerequisite: 570 or permission of instructor. Messrs Ayres and Walker.
Microbiological considerations in the handling of meats. Sanitation and technology of processed meats. Packaging materials and storage life of meat.

590. Special Topics, Cr. 1 to 3. F.W.S.
Special topics in the animal sciences, offered on demand and often conducted by guest professors.
F. Endocrine Aspects of Animal Reproduction
Prerequisite: 431 or Zool 553. Mr. Melampy.

COURSES FOR GRADUATE STUDENTS, major or minor

603. Seminar in Animal Nutrition and Meats, (Po S. 603) (1-0) Cr. 1. F.W.S.
Prerequisite: Permission of instructor Messrs. Balloun, Burroughs, Jacobson, Speer.
Discussion of current literature; preparation and submission of abstracts.

605. Methods and Techniques in Animal Nutrition Experimentation, (Po S 605) (2-3) Cr. 3. F.
Methods and techniques in planning and conducting nutrition experiments with poultry, swine, cattle and sheep. Includes visits to experimental facilities.

654. Genetics of Breed Improvement, (Gen. 654) (3-0) Cr. 3. W
Prerequisite: Gen 301, Stat. 401. Messrs Hazel, Lush.
Genetic structure of breeds or other populations. Effects of gene number, degrees of dominance, gene interaction, linkage, mutations, non-genetic factors. Conditions of equilibrium. Rates of change in population mean or variability. Effects of mass selection

655. Breeding Systems and Plans, (Gen 655) (3-0) Cr. 3 S.
Prerequisite 654. Messrs Hazel, Lush.
Inbreeding and outbreeding, assortive mating, progeny testing, selection on family basis, selection indices, records of performance, methods of estimating heritability, comparison of various breeding plans.

A seminar presenting current concepts in nutrition and related fields. Required for all graduate students in nutrition.

690. Research.
C. Meat Animal Production. Messrs Burroughs, Self
E. Meats. Messrs Goll, Klme, Topel.
APPLIED ART

Marjorie S Garfield, M.F A., Head of Department

PROFESSORS: Harriet Adams, M.A.; Mabel C Fisher; Mary L. Meixner, M.A.; Janet L. Navin, M.S.; Edna O’Bryan, B.A.

ASSOCIATE PROFESSORS: Alice Davis, M.A.; Gladys E. Hamlin, M.A.; Shirley E. Held, M.S.; Neva M. Petersen, M.S.


Opportunities for Undergraduate Study

For undergraduate curriculum in applied art leading to the degree Bachelor of Science, see Home Economics, Curricula.

Four majors are offered for men and women in the Applied Art Department: general applied art and crafts, interior design, advertising design, and art education.

I. General applied art and crafts. This major is planned for the art student who may prefer a balanced art program along with a strong emphasis in the area of crafts. A broad background in design, drawing, and art history, and varied crafts media would permit men or women to have shops and market quality crafts in weaving, metal, jewelry, and wood, or to teach in community and welfare workshops or in adult education.

II. Interior design. This major is planned for art students who plan to enter the field of interior design and decoration professionally.

III. Advertising design. This major prepares students for positions in small or large advertising agencies; for work requiring precision skills such as layout and advertising design, poster art, greeting card and gift wrap designing, television art, packaging, store display, and fashion illustration.

IV. Art education. The major in art education is planned for students interested in preparation for teaching art in grades seven through fourteen. Students may enroll in this major as sophomores but must apply to and be accepted by the departmental committee on selection and the University Committee on Teacher Education in order to advance to the teacher education program. For the teacher education program, including requirements for teaching certification see Teacher Education.

Students applying for advanced credit must submit representative work.

Opportunities for Graduate Study

The department offers major work for the degree Master of Science and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of undergraduate work in applied art substantially equivalent to that required in the undergraduate curriculum in applied art at this institution.

Open to graduate students for minor only: 406, 424, 434, 435, 445, 446, 464, 465, 484, 485, 486, 490.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

103. Design I. (2-6) Cr. 4. F.W.S.S.S.I.
Creative problems in design and color with emphasis on art elements and principles.

104. Design II. (0-9) Cr. 3. F.W.S.
Prerequisite: 103
Two- and three-dimensional forms in design; varied materials and techniques.

200. General Crafts. (0-9) Cr. 3. F.S.
Designing craft objects suitable for home, school, or recreation.

206. Lettering. (0-9) Cr. 3. F.W.S.
Prerequisite: 103
Study of direct lettering; build-up letters and cut letters for display.

213. Fashion Illustration I. (0-9) Cr. 3. W.S.
Prerequisite: 230
Illustration of the fashion figure, costume rendering, layout.

214. Fashion Illustration II. (0-9) Cr. 3. F.
Prerequisite: 213.
Advanced work in rendering the costumed figure, accessories, layout.

230. Drawing and Composition
(19) Cr. 4 F.W.S.SSI
Prerequisite 103
Freehand drawing and perspective in various media. A.A. majors should enroll by the fall quarter of the sophomore year.

233. Watercolor.
(0-9) Cr. 3 F.SSSI
Prerequisite 230
Experimentation with watercolor techniques as applied to still life and landscape

241. Television Art Techniques.
(1-6) Cr. 3 F
Prerequisite Arch. 214, TCA 206
Creative problems in techniques and art essentials.

261. Interior House Design I
(1-6) Cr. 3 F.W.S.SSI.
Prerequisite 103
Principles of design and color applied to the exterior, interior and furnishings of the house.

262. Interior House Design II
(0-9) Cr. 3 W
Prerequisite: 261
Problems in design and color in the interior; analysis of home furnishings and housing design

306. Advertising Design I.
(0-12) Cr. 4 F.W.
Prerequisite: 206; for non-majors, 103.
Introductory work in advertising design.

324 Life Drawing.
(0-9) Cr. 3 W
Prerequisite 233.
Figure drawing in different media.

344 Craft Design I.
(0-9) Cr. 3 F.W.S.SSI, II
Prerequisite 103.
Weaving

345 Craft Design II.
(0-12) Cr. 4 F.W.S.SSI, II.
Prerequisite 103
Metal and wood

361 History of Furniture.
(3-0) Cr. 3 F.W.
A study of the history of furniture styles and interior architectural backgrounds

384. Survey of Art.
(3-0) Cr. 3 F.W.S.SSI
Survey of the art of all ages, emphasizing art as an expression of cultures

393 Craft Design III.
(0-9) Cr. 3 F.W.S.
Prerequisite 103
Ceramics.

401 Senior Study Tour.
Cr 8 S
Prerequisites A.A. senior classification, visit professional studios, retail establishments, art museums.

404 Seminar.
Cr 1 or arr
Prerequisite 12 Cr in A.A.
Art discussion

406. Advertising Design II.
(0-9) Cr. 3 W.S.
Prerequisite 104, 306
Advanced work in advertising design.

(3-0) Cr. 3 W.S.
Prerequisite A.A. classification, Ed 305
Development of a basic philosophy of art education and study of methods and media for teaching art in the high school

417. Supervised Teaching in Art.
Cr 9 F.S.
Prerequisite A.A. classification.
Supervised teaching in public schools. Advance reservation required.

424. Oil Painting.
(0-9) Cr. 3 F.S
Prerequisite 230
Introduction to oil painting and new media.

434. Textile Design I.
(19) Cr. 4 F.W.S.SSI, II.
Prerequisite 104; for non-majors, 103.
Creative design in block print, stencil, stitchery, batik, and silk-screen. Comparative analysis of designers and processes.

435. Textile Design II.
(0-9) Cr. 3 W.S.SSI
Prerequisite 434
Varied media in textile design.

445 Craft Design IV.
(0-9) Cr. 3 F.S.
Prerequisite 344, 345.
Weaving, furniture, wood, metal, and other media.

446. Craft Design V.
(0-9) Cr. 3 W.S.
Prerequisite. 345.
Jewelry design.

464. Interior Design I.
(1-6) Cr. 3 F.W.
Prerequisite: 233, 261
Media for the interior designer. Fabric selections, room planning, interior renderings.

465 Interior Design II.
(1-6) Cr. 3 W.S.
Prerequisite 464.
Interior design; planning of a professional nature; budgeting.

466. Apprenticeship.
Cr 9 S.SI, following the junior year.
Prerequisite 19 Cr in interior design.
Practical interior design shop experience.

484. History of Ornament.
(3-0) Cr. 3 W.
A study of historic ornament with emphasis on the arts of the past and their application to the present.

(3-0) Cr. 3 W.
History of European art from early Christian times to 1800; Oriental art.

486 Modern Art.
(3-0) Cr. 3 S
Architecture, painting, and sculpture from 1800 to the present.

490 Special Problems.
Cr 2-3 F.W.S.SSI
Prerequisite Existing course offerings, permission of instructor.
A. Painting and Composition
B. Textile Design
C. Craft Design
D. Ceramics
E. Interior Design
F. Advertising Design
G. Fashion Illustration
COURSES PRIMARILY FOR GRADUATE STUDENTS, for minor only, open to qualified undergraduates

535. Textile Design III. (0.9) Cr. 3. S.SSI. Prerequisite: 435. Advanced textile design

546. Craft Design VI. (0.9) Cr. 3. W.S.

565. Interior Design III. (1-6) Cr. 3-5. Prerequisite: 465. Advanced interior design.

COURSES FOR GRADUATE STUDENTS, major or minor

590. Advanced Design. Cr. arr. F.W.S.SSI. Prerequisite: B.S in A.A. or satisfactory evidence of ability.
   A. Painting and Composition. Misses Adams, Meixner
   B. Textile Design Miss Navin.
   C. Craft Design. Staff.
   D. Ceramics. Staff.

605. Seminar. Cr. arr. F.W.S. Miss Garfield.

614 Research. F.W.S SSI, II. Miss Garfield.

ARCHITECTURE

Raymond D. Reed, M.Arch., Head of Department

PROFESSORS: Karol J. Kocimski, M.Arch.; Roscoe O. Lorenz, M.S.; Lawton M. Patten, B.Arch.; Vernon F. Stone, B.Arch.; Clair B. Watson, M.F.A.

ASSOCIATE PROFESSORS: Arthur E. Burton, M.S.; Thomas C. Jellinger, M.S.; Donald I McKown, M.S.; Bernard J. Slater, M.S.

ASSISTANT PROFESSORS: Charles W. DeKovic, B.Arch.; Walter A. Hotchkiss, B.Arch.; James K McKie, B.Arch.E.; Norman H Rudi, B.Arch.

INSTRUCTORS: Bruce H. Green, B.Arch.; Wesley I. Shank, M.Arch.

Opportunities for Undergraduate Study

The architect seeks to create an environment that encourages the growth of meaningful human values. The basic curriculum in architecture with concentrations in construction, delineation, planning, and structures leads to the degree Bachelor of Architecture, and provides the academic foundation for a professional career of architecture in accordance with registration laws of the various states. Practical experience in approved architectural or construction firms is required prior to graduation.

Courses listed under Architectural Engineering are provided for students completing work for the degree Bachelor of Architectural Engineering. This degree is currently being terminated and will not be available to students matriculating subsequent to Fall Quarter 1965.

In cooperation with the Department of Industrial Administration, a program of study is provided for those interested in the business of building and related industries. This program leads to the degree of Bachelor of Science with a major in industrial administration and a minor in architecture. For information, consult the head of either department.

In cooperation with the Department of Industrial Engineering, the engineering operations curriculum is provided for students interested in building construction. This program leads to the degree of Bachelor of Science. For information, consult the head of the Department of Architecture or Industrial Engineering.

Opportunities for Graduate Study

The department offers major work for the degree Master of Architecture to those candidates interested in research and/or design and analysis. Satisfactory completion of a curriculum equivalent to the undergraduate architecture program of this institution is prerequisite to major graduate work. Minor work is offered to students majoring in other disciplines. A minimum of 36 credits must be taken while in residence. A minimum of 45 credits including a graduate thesis or 54 credits not including a thesis is required for graduation.
The modern language requirement for the degree Master of Architecture may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: Arch. 344, 345, 346, 449, 471, 472, 473, 543, 572, 573.

Courses in Architecture

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. 102, 104. Seminar. (1-0) Cr. 1 each Yr SS.
Synthesis, orientation, seminar discussions and lectures, field trips, visiting critics, projects of timely interest.

111. Design Fundamentals I. (0-9) Cr. 3. F.SS.
Creative individual and group projects in the perception of the elements of design.

112. Design Fundamentals II. (0-9) Cr. 3. W.
Prerequisite: 111.
Studies in visual perception psychology are extended to relative time, motion, and spatial sequences and relationships.

113. Architectural Design and Analysis I. (0-9) Cr. 3. S.SS.
Prerequisite: 112.
The elements of design are related to human requirements and reactions. Problem approach techniques and design methodology are stressed.

121, 122, 123. History of Architecture and the Related Arts I. (3-0) Cr 3 each Yr SS.
A survey of architecture and the related arts from early western civilization to the modern movement. Architecture as an expression of environment and of social conditions and values is stressed.

133. Architectural Graphics. (1-6) Cr. 3. S.SS.
Prerequisite: E.Gr. 132A or E.Gr. 132.
Introduction to architectural presentation, perspective and shades and shadows.

204. 205, 206. Seminar. (1-0) Cr. 1 each. Yr SS.
Prerequisite: Second year classification
Synthesis, professional orientation, seminar discussions and lectures, field trips, visiting critics, special projects of timely interest.

210. Architectural Design and Analysis II. (0-9) Cr 3 each time taken. F W S.SS.
Prerequisite: 113 or L.A. 113; 133.
Elementary projects in architectural design. Introduction and functional integration of structural concepts, planning and circulation. Recognition and synthesis of objective and subjective values. Problem methodology is stressed. A minimum of 9 credits is required to meet graduation requirements.

224. 225, 226. History of Architecture and the Related Arts II. (3-0) Cr 3 each. Yr SS
Prerequisite 123
A study of architecture and the related arts since the development of the modern movement.

231. Freehand Drawing I. (0-6) Cr. 2 F.W S.SS
Beginning drawing and sketching in pencil and charcoal. Study of proportion, perspective and form.

232. Freehand Drawing II. (0-6) Cr. 2 W.S.S.
Prerequisite: 231.
Freehand drawing extended to color theory and water color.

233. Freehand Drawing III. (0-6) Cr. 2. S.SS.
Prerequisite: 232.
Freehand drawing. Various media.

301, 302, 303. Seminar. (0-1) Cr. 1 each. Yr SS.
Prerequisite Third year classification.
Synthesis, professional orientation, discussions and lectures, field trips, visiting critics, projects of timely interest.

310. Architectural Design and Analysis III. (0-12) Cr. 4 each time taken. F W S.SS.
Prerequisite: Credit or classification in E.M. 324 and 9 Cr in 210
Individual and group projects of intermediate scope. Sensory and functional requirements, construction techniques and economics, regional and somatometric variables. Field trips. A minimum of 12 credits is required to meet graduation requirements.

319. Summer Work. Cr R S.S.
Ten weeks of practical experience with an approved architectural or construction firm.

331, 332, 333. Architectural Delineation. (0-9) Cr. 3 each. Yr SS.
Prerequisite 4 credits in freehand drawing
Methods, techniques of visual communication. Drawings and models

342, 343. Materials and Methods of Architectural Construction. (0-9) Cr. 3 each. 342 W. 343 S
Prerequisite: 342: E.M. 337, E.M. 354; 343. 342.
Properties of materials used in architectural construction. Manufactured, site-assembled or built-in-place assemblies. Techniques of architectural construction Coordination of construction trades. Preparation of construction and contract drawings

344. Analysis of Materials and Methods of Construction. (3-0) Cr. 3 F
Prerequisite: Third year classification or approval of the Head of the Department of Architecture.
Systems of building construction including wood frame, wall bearing, skeleton frame, and the building materials used in these systems

345. Specifications. (2-0) Cr 2 W.
Prerequisite 343 or 344.
Preparation and interpretation of architectural specifications and other contract documents.

346. Construction Cost Estimating. (2-3) Cr. 3. S.
Prerequisite: 343 or 344.
Estimating building construction costs, quantity surveys, production rates, local cost factors. Approximate and detailed methods.
361. Residential Architecture.  
(3.0) Cr. 3. F.  
Principles of planning and design of houses with consideration given to site selection, financing, planning, equipment, materials and methods of construction.

(3.0) Cr. 3. W.  
Principles of planning and design of individual unit housing with consideration given to the social, economic, political factors.

363. Housing.  
(3.0) Cr. 3. S.  
Principles of planning and design of group or multiple housing with consideration given to the social, economic, political factors.

401. 402. 403. Seminar.  
(1.0) Cr. 1 each. Yr. S.S.  
Prerequisite: Fourth year classification.  
Synthesis, professional orientation, seminar discussion and lectures. Field trips, visiting critics, projects of timely interest.

410. Architectural Design and Analysis IV.  
(0.15) Cr. 5 each term taken. F.W. S.S.S.  
Prerequisite: Credit or classification in C.E. 433A and 12 credits in 310.  
Problems in architectural design of a complex nature. Field trips. A minimum of 15 credits is required to satisfy graduation requirements.

419. Summer Work.  
Cr. R. S.S.  
Ten weeks practical experience with an approved architectural or construction firm.

430. Advanced Freehand Drawing.  
(0.6) Cr. 2 each term taken. F.W. S.S.S.  
Prerequisite: 4 credits in freehand drawing.  
A. Charcoal and crayon.  
B. Pencil.  
C. Color.  
D. Pen and ink.

449. Real Estate Finance.  
(1. Ad 449) (3.0) Cr. 3. F Mr. Shadle.  
Prerequisite: 343 or 344 or 1. Ad 350.  
An analysis of real estate problems and practices from the standpoint of the business man and the property owner. The financial, economic and social aspects of real estate investment decisions are emphasized, with attention to impact upon the construction industry.

(1.3) Cr. 2 each term taken. F.W. S.S.S.  
Prerequisite: C.E. 434A, 12 credits in 310.  
Design and comparative analysis of architectural structural systems.

460. Special Problems in Architecture.  
(0.6 to 27) Cr. 2 to 9. F.W. S.S.S.  
Prerequisite: Fourth or fifth year classification, permission of department head.  
Investigation of problems of special interest to the student.

471. Building Contractors Organization.  
(3.0) Cr. 3. F.  
Prerequisite: 346, credit or classification in I.E. 351.  
Construction contracting business management: planning, organization, staffing, directing, controlling.

472. Construction Progress Scheduling I.  
(0.9) Cr. 3. W.  
Prerequisite: 471.  
Types of progress schedules used in construction work. Applications and advantages of types of schedules.

473. Site Organization and Inspection of Construction.  
(1.0) Cr. 3. S.  
Prerequisite: 471.  
Principles of planning construction site layouts.

(1.0) Cr. 1 each. Yr. S.S.  
Prerequisite: Fifth year classification.  
Synthesis, professional orientation, seminar discussion and lectures. Field trips, visiting critics, projects of timely interest.

510. Architectural Design and Analysis V.  
(0.18) Cr. 6 each term taken. F.W. S.S.S.  
Individual and group solutions to large scale architectural problems of complex, multiple or specialized requirements. Primary elements of urban design are introduced. Student competitions and field trips. 18 credits are required to meet graduation requirements.

531. Advanced Graphic Techniques.  
(0.6) Cr. 2 each term taken. F.W. S.S.S.  
Prerequisite: 6 credits in freehand drawing.  
Air brush, silk screen, block printing, etching, or other approved media.

532. Two-Dimensional Design.  
(0.6) Cr. 2 each term taken. F.W. S.S.S.  
Prerequisite: 6 credits in freehand drawing.

533. Three-Dimensional Design.  
(0.6) Cr. 2 each term taken. F.W. S.S.S.  
Prerequisite: 6 credits in freehand drawing.

543. Contracts and Administration.  
(2.0) Cr. 2. S.  
Prerequisite: 345.  
Contract documents, office procedure and administration.

572. Construction Progress Scheduling II.  
(0.9) Cr. 3. W.  
Prerequisite: 472.  
Analysis and application of advanced scheduling techniques with emphasis on critical path method (CPM) and program evaluation and review (PERT).

573. Construction Progress Scheduling III.  
(0.9) Cr. 3. S.  
Prerequisite: 572.  
A study of computer methods and applications of advanced techniques of construction scheduling with work in man-power leveling, equipment allocation, and time cost relationships.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

580. Special Problems in Building Construction.  
Cr. 2 to 5 each term taken.  
Prerequisite: 345, 473, permission of department head.  
Advanced problems in building construction with emphasis in the field of construction operations and in the field of engineering and technology.

590. Special Topics.  
Cr. 2 to 5 each term taken. F.W. S.S.S.  
Prerequisite: Permission of department head.  
The solution of theoretical and practical problems in architecture and related design areas.
Courses in Architectural Engineering

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

313, 314, 315. Design and Analysis of Architectural Structures I. (0.9) Cr 3 each Yr. Prerequisite 313 210; 314 313, 315 314. Architectural projects in the design of structures and analysis of construction techniques. Properties of materials with emphasis on site engineering, codes, masonry systems and wood systems.

413, 414, 415. Design and Analysis of Architectural Structures II. (0.9) Cr 3 each Yr. Prerequisite 413 315 and credit or classification in C E 434; 414 413; 415 414. Architectural projects in the design of concrete, steel and special systems. Field trip.

425 Special Problems in Architectural Engineering. (0.9 to 27) Cr 2 to 9 F.W.S. Prerequisite Senior or graduate classification permission of department head. Investigation of problems of special interest to the student.

513, 514, 515 Design and Analysis of Architectural Structures III. 513 (1-15) Cr 6 F; 514 (1-12) Cr 5 W; 515 (19) Cr 4 S. Prerequisite 513 415; C E 434; credit or classification in M E 408; 514 513; 515 514. Architectural projects in the design of engineering systems for buildings. Cost estimating, working drawings and specifications. Field trip.

BACTERIOLOGY

William R Lockhart, Ph.D., Chairman of Department

PROFESSORS: John C Ayres, Ph D ; R F. Buchanan, Ph D ; Lloyd R Frederick, Ph D ; Paul A Hartman, Ph D ; Max Levine, Ph D., (Emeritus); Loyd Y Quinn, Ph.D

ASSOCIATE PROFESSORS: Russell J. Beers, Ph.D.; Peter A Pattee, Ph D ; George W. Reinbold, Ph D ; Homer W. Walker, Ph.D.

ASSISTANT PROFESSORS John G Holt, Ph D ; Fred D Williams, Ph D

Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in bacteriology, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

In this department, principal emphasis is placed on understanding the interrelationships of bacteria in nature, the application of bacteriology in agriculture and industry, and the study of fundamental life processes using bacteria as primitive examples of living things. A variety of careers are open to qualified graduates: in hospital and clinical laboratories, in federal, state or local government organization, in research and development and quality control laboratories maintained by the dairy and food processing, pharmaceutical and fermentation industries, among others. Some fields of bacteriology, especially advanced research, may require further training. Undergraduate work in the department is designed to provide sound preparation for graduate study.

Undergraduate programs usually include the following basic courses. 200, 300, 325, 350, 375, 436. The following courses are desirable as supporting work: Chem 101, 102, 103, 211, 334, 335; Phys 211, 212, 213; Math 110; Zool 101, 102; Bot 101, 102. These lists of courses are neither fixed requirements nor complete outlines of the work necessary for the major but are intended as a guide to students and advisers in planning individual programs.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in soil microbiology, pathogenic bacteriology and immunology, food, dairy and sanitary bacteriology, agricultural and industrial microbiology, physiology and genetics of
bacteria, virology, and systematic bacteriology. Major graduate study in veterinary bacteriology, soil bacteriology and dairy bacteriology is offered in the Departments of Veterinary Hygiene, Agronomy, and Dairy and Food Industry, respectively.

Specific prerequisite to major work in bacteriology is the completion of thorough courses in general bacteriology, biology, organic chemistry and physics. Biochemistry, physical chemistry and mathematics are advised. Minor study usually is selected from chemistry, biochemistry and biophysics, botany, zoology, genetics, mathematics and statistics.

Major and minor work in the area of cell biology is offered under a cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics, and Zoology and Entomology. See Cell Biology.

Open to graduate students for minor only: 350, 375, 436, 450, 485.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>200.</td>
<td>Introductory Bacteriology I.</td>
<td>(3-0) Cr 3 F W S</td>
<td>Description of bacteria, scope of bacteriology; relationships of bacteriology to personal and community health, industry, agriculture; role of bacteria in everyday life.</td>
</tr>
<tr>
<td>250.</td>
<td>Introduction to Sanitary Bacteriology.</td>
<td>(2-3) Cr 3 S</td>
<td>Staff</td>
</tr>
<tr>
<td>300.</td>
<td>Introductory Bacteriology II.</td>
<td>(2-4) Cr 3 W S</td>
<td>Prerequisite: 200; Chem 231 or 334 Staff</td>
</tr>
<tr>
<td>304.</td>
<td>General Bacteriology</td>
<td>(3-6) Cr 5 F W S</td>
<td>Prerequisite: Chem 231 or 334 Staff</td>
</tr>
<tr>
<td>325.</td>
<td>Advanced General Bacteriology.</td>
<td>(3-6) Cr 5 S</td>
<td>Prerequisite: 300 or 304</td>
</tr>
</tbody>
</table>

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Prerequisites</th>
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</tr>
</thead>
<tbody>
<tr>
<td>501.</td>
<td>Bacteriological Techniques.</td>
<td>(3-6) Cr 5 F</td>
<td>Prerequisite: 325 Study of function and structure of bacteria; research methods, literature survey and professional orientation in bacteriology.</td>
</tr>
<tr>
<td>510.</td>
<td>Microbial Food Infections and Toxins.</td>
<td>(D F I 510) See Dairy and Food Industry</td>
<td></td>
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<tr>
<td>511.</td>
<td>Milk Cultures and Fermentations.</td>
<td>(D F I 511) See Dairy and Food Industry</td>
<td></td>
</tr>
<tr>
<td>525.</td>
<td>Industrial Microbiology</td>
<td>(3-0) Cr 3 F</td>
<td>Prerequisite: 300 or 304, one course in biochemistry. Mr. Hartman. Utilization of microorganisms in industrial processes; history, principles, economics and control of microbiological fermentations</td>
</tr>
<tr>
<td>531.</td>
<td>Bacterial Viruses.</td>
<td>(3-6) Cr 5 S</td>
<td>Prerequisite: 509 Mr. Pattee. Function and structure of bacterial viruses; host-virus interactions.</td>
</tr>
<tr>
<td>534.</td>
<td>Sanitary Bacteriology.</td>
<td>(2-6) Cr 4 W</td>
<td>Prerequisite: 250, 300 or 304, Mr. Beers. Microorganisms in water supplies; bacteriology of sewage; disinfection and disinfectants.</td>
</tr>
<tr>
<td>535.</td>
<td>Food Bacteriology.</td>
<td>(2-6) Cr 4 W</td>
<td>Prerequisite: 300 or 304 Mr. Hartman. Bacteria, yeasts and molds in food products; food processing and its bacteriological control.</td>
</tr>
<tr>
<td>559.</td>
<td>Advanced Dairy Microbiology.</td>
<td>(D F I 559) See Dairy and Food Industry</td>
<td></td>
</tr>
<tr>
<td>560.</td>
<td>Systematic Bacteriology.</td>
<td>(3-0 or 6) Cr 3 or 5</td>
<td>Mr. Offered 1966 Prerequisite: 300 or 304 Mr. Buchanan. History of bacterial classification. International rules of nomenclature as applied to bacteria, development of classification of bacteria based upon relationships. Critical survey of characteristics of bacterial groups.</td>
</tr>
</tbody>
</table>
234/Description of Courses

561. Seminar.
Cr. 1. F W.S.
Required of all students taking major work in bacteriology.

575. Immunology.
(3-6) Cr. 4 S.
Prerequisite 375 Mr. Quinn
Theories of immunity and immunization, preparation of vaccines and antiserum; antigen antibody reactions.

585. Soil Microbiology and Biochemistry.
(Agron. 585) See Agronomy.

596. Special Topics.
Cr. 2 to 4 F W.S
Prerequisite: Permission of instructor.

COURSES FOR GRADUATE STUDENTS, major or minor

631, 632, 633. Physiology of Bacteria.
(3-0 or 6) Cr. 3 or 5. Yr Messrs. Lockhart, Beers.
631: Influence of chemical and physical environment on bacteria; bacterial nutrition.
632: Bacterial Metabolism; functions of intermediary catalysts. 633: Selected topics of current interest.

656. Systematic Dairy Microbiology.

690. Research.
Staff

698. Seminar in Cell Biology.

BIOCHEMISTRY AND BIOPHYSICS

Dexter French, Ph.D., Chairman of Department


Assistant Professor: Carl L. Tipton, Ph.D.

Instructors: Robert A. Jenkins, Ph.D.; Deane R. Clark, M.S.

Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities with a major in biochemistry or biophysics leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

Biochemists and biophysicists seek to understand life processes in terms of chemical and physical principles. They are employed wherever a better understanding of living organisms is sought, whether it be in the production of antibiotics or vitamins in a fermentation industry, in investigation of nutritional requirements of plants or animals, or in the study of the functions of the human body in health and disease. While there are many opportunities in universities and medical schools, government laboratories, and industry for both men and women well trained in biochemistry or biophysics, students with the necessary high scholastic standards usually continue their studies in a graduate college. The undergraduate programs in biochemistry and biophysics are designed to provide sound preparation for work at the Ph.D. level.

Undergraduate biochemists usually have the following basic courses or their equivalents in their programs: B. and B. 461, 490X. (or 501, 502, 503), 511; Chem. 101, 102, 103, 214, 215, 224, 237, 316, 325, 326, 327, 330, 331, 332, 333; Math. 101, 102, 110, 211, 212, 213; Phys. 221, 222, 223; Zool. 101, 102, 355 or Bot. 101, 102, 310; Bact. 304; Gen. 301

Biophysicists usually include the following basic courses in their programs: B and B 461; Phys. 221, 222, 223, 311, 325, 354, 355, 421, 422, 423; Math. 101, 102, 110, 211, 212, 213, 321, 322, 323; Chem. 101, 102, 103, 211, 321, 322, 323, 334, 335; Zool. 101, 102, 355, or Bot. 101, 202, 310; Gen. 301.

These lists of courses should not be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic study which may be needed.
Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in biochemistry and biophysics and minor work to students taking major work in other departments.

Major and minor work in the area of cell biology is offered under a cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics, and Zoology and Entomology. See Cell Biology.

Prerequisite to graduate work is completion of sufficient undergraduate work in chemistry, mathematics and physics, and if possible, biology. Some students may find it necessary to acquire additional training at the intermediate level before undertaking graduate work.

Open to graduate students for minor only: 304, 305, 315, 347, 348, 349, 461, 490X.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

301. Biochemistry. (3-0) Cr 3 F.W.S. Preerequisite: Chem. 231 Mr. Hearn. Chemical composition and reactions of living matter. Not accepted for credit toward a chemistry, biochemistry or biophysics major.

304. 305. Physiological Chemistry. (3-0) Cr 3 each. 304. F.; 305. W. Preerequisite: Chem. 235. Mr. Allen. Must be accompanied by 311 and 315 for veterinary students. Not accepted for credit toward a chemistry, biochemistry or biophysics major. 304. Chemistry of the animal body, digestion; absorption. 305: Metabolism of carbohydrates, lipids, proteins, and minerals.

311. Laboratory in Biochemistry. (0-6) Cr 2 F.S. To accompany 301 and 304. Not accepted for credit toward a chemistry, biochemistry or biophysics major.

315. Laboratory in Physiological Chemistry. (0-6) Cr 2 W. Prequisite: 311. To accompany 305. Introduction to quantitative biochemical procedures. Not accepted for credit toward a chemistry, biochemistry or biophysics major.


349. Food Chemistry (D.F.I 349) (3-0) Cr 5 S. Prequisite: Chem. 211, 335. Mr. Snyder. Application of proximate and physicochemical methods of analysis to the general composition of common food types and to determination of coloring materials, preservatives and metals in foods.

461. Introduction to Biophysics. (3-0) Cr 3. F.S. Prequisite: Chem. 103, Gen. 301, Phys. 113, 223 or 233. Mr. Rougvie. An introduction to the ideas and methods used in biophysics to attack fundamental biological problems. A study of several currently active research areas such as molecular genetics, contractility, nerve conduction and vision.


495. Undergraduate Research. Cr 2-5 each term. Prequisite: Permission of staff member with whom student proposes to work. B average in all previous courses. Literature survey and research under senior staff guidance.

*Courses not marked by an asterisk are offered by the College of Sciences and Humanities.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

(3-0) Cr 3 each. F.W.S. Messrs. Graves, Hearn, Horowitz, Metzler, Tipton. Prequisite: Courses in analytical chemistry, organic chemistry (Chem. 322, 325 or 484; Concurrent enrollment in physical chemistry may be permitted with consent of instructor.) Chemical composition of living matter and the chemistry of life processes. Designed for graduate students in biochemistry and biophysics, and advanced undergraduates in chemistry and for other qualified students desiring a rigorous course.

511. 512. Laboratory in General Biochemistry. (1-6) Cr 3 each. 511: F.W.; 512: S. Taken in conjunction with 501, 502, 503.

521. Radiobiology. (1-6) Cr 3 S. Prequisite: Chem. 426, permission of instructor. Mr. Aronoff. The use of radiotopes in biochemistry: dilution techniques, isolation of metabolites, elucidation of reaction mechanisms and metabolic pathways.


571. 572. Laboratory in Biophysics. (6-0) Cr. 2 each. W.S. Prequisite: Permission of instructor. Messrs. Foss, Rougvi. To accompany 561, 562.

574. Microscopy. (3-0) Cr. 3. F. Prequisite: Math. 211, Phys. 113 or 223.
Mr Roth
Optical microscopy including phase and interference techniques. Principles of electron optics. Methods and applications of electron microscopy.

575 Laboratory in Microscopy.
(0-6) Cr 2 F W S
Prerequisite 574 Mr Roth

578 Biological Fine Structure.
(3-0) Cr 3 W.
Prerequisite 501 or 501 and Bot 504 or Zool 528 or Vet Anat 103 and consent of instructor Mr Roth
An advanced study of the cell as a functional unit and of related information obtained by numerous techniques applied at the near-chemical level of structure. In addition to a general treatment, a selected topic of current interest will be developed each year

581, 582 Seminar.
(1-0) Cr 1 each F W
Prerequisite Permission of instructor
Short talks and discussion by students on assigned topics. Designed especially for entering graduate students and qualified seniors.

590 Special Topics.
Cr. arr.

COURSES FOR GRADUATE STUDENTS, major or minor

601 Advanced Biochemistry.
(2-0) Cr 2 each time elected F W S.
Prerequisite 501, permission of instructor Staff
A series of one-term courses covering such topics as enzymes, hormones, lipids, nucleic acids, proteins, vitamins, biochemistry of diseases, immunohemistry, and biochemical methods.

*622 Carbohydrate Chemistry.
(3-0) Cr 3 SS Mr French
Prerequisite Permission of instructor
Chemical behavior and enzymic relationships of sugars and polysaccharides.

*623 Lipid Chemistry
(D F I 623) (3-0) Cr 3. Alt F. Offered 1966
Prerequisite 501 Mr Hammond.
The chemistry of fatty acids, glycerides, complex lipids, waxes, sterols, and minor lipids.

661 Advanced Biophysics
(3-0) Cr 3 each time elected. P
Prerequisite Permission of instructor.
Intensive study of selected areas of biophysical research chosen from such topics as molecular genetics, muscle contraction and motility, nerve conduction, vision, hearing, photosynthesis, fine structure of biological systems, radiation biology, new or advanced techniques.

*680 Modern Views of Nutrition.
(An S 680, F and N 680, Po S 680) See Animal Science

681 Advanced Seminar.
(1-0) Cr 0 Yr

695 Research
Prerequisite Permission of staff member concerned

698 Seminar in Cell Biology.
(Bact 698, Bot 698E, Gen 698, Zool 698) See Zoology

*Biology

Biology encompasses a number of departments at Iowa State University. Basic undergraduate and graduate courses, and research opportunities in the biological sciences, are offered in the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics and Zoology and Entomology. Proper selection of courses from these departments, and appropriate choices in mathematics, physics, and chemistry, provide an excellent foundation for an understanding of biological phenomena, concepts, and methods of investigation. In addition, the Departments of Agronomy, Animal Science, Child Development, Dairy and Food Industry, Food and Nutrition, Forestry, Horticulture, Poultry Science, Psychology; departments within the College of Veterinary Medicine; and majors in biomedical engineering, dairy science, farm crops, and fisheries and wildlife biology provide undergraduate and graduate instruction and research programs in applied and specialized phases of the biological sciences.

An interdepartmental graduate program in Cell Biology is also available.

BIOMEDICAL ENGINEERING

Neal R. Cholvin, D.V.M., Ph.D., Chairman

ADMINISTRATIVE COMMITTEE

PROFESSORS
William C. McCormack, M.D.; Phillip T. Pearson, D.V.M., Ph.D.; Donald F. Young, Ph.D.
The Biomedical Engineering Program is interdisciplinary in scope, and is sponsored jointly by the Colleges of Engineering and Veterinary Medicine. The primary objectives are: (1) design of instruments for biomedical measurements, (2) instrumental methods for solving biomedical research problems, (3) applications of feedback theory to the study of physiological functions, (4) applications of information theory to the study of anatomical structures and functions, and (5) applications of biological concepts to the design of self-organizing data systems.

Opportunities for Undergraduate Study

Undergraduate students are encouraged to elect additional courses in physics, mathematics, engineering, anatomy, physiology, chemistry and biology to supplement their basic training in their chosen fields of study.

Opportunities for Graduate Study

A minor is offered in biomedical engineering. Courses of instruction are provided by the Departments of Veterinary Anatomy, Veterinary Physiology and Pharmacology, and Electrical Engineering. Courses are designed for the training of (a) engineering graduate students in advanced methods of designing instruments and in applying engineering principles to biomedical problems, (b) veterinary medicine graduate students in advanced research methods using modern instruments, and (c) qualified graduate students from other physical and life sciences interested in biomedical instrumentation. Laboratory facilities are available in the Instrumentation Research Laboratory.

For the degree Master of Science with a minor in biomedical engineering, the minimum requirement for related course work shall include E.E. 515. For graduate students in veterinary medicine this involves preliminary course work in mathematics, physics and electrical engineering. For graduate students in electrical engineering this involves preliminary course work in chemistry, anatomy and physiology. For other graduate students equivalent preliminary course work in these areas is required.

For the degree of Doctor of Philosophy with a minor in biomedical engineering, the requirements for related course work will be formulated by the student's graduate committee in cooperation with the Biomedical Engineering Program Committee.

The following courses bearing on advanced study in biomedical engineering are available in the offerings of the departments named:

Botany and Plant Pathology

Frederick G. Smith, Ph.D., Head of Department

Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in botany leading to the degree Bachelor of Science, see College of Sciences and Humanities, Curriculum.

For undergraduate curriculum in plant pathology leading to the degree Bachelor of Science, see College of Agriculture, Curriculum.

The department offers a liberal science training in many basic and applied aspects of plant study. The undergraduate programs are adapted to students of varied interests and prepare them for a wide range of opportunities in science and science-related occupations. Botany majors secure employment as science teachers, conservationists, seedsmen, representatives in sales and development for commercial organizations, recreation specialists, science writers and consultants, technicians in nurseries, canneries, tropical plantations, seed laboratories, and as inspectors in plant disease control and quarantine. Students in the upper half of their graduating class are well prepared for graduate training leading to the professional degrees, Master of Science and Doctor of Philosophy. Many receive scholarships and assistantships which provide opportunities to work with nationally known research scientists and teachers. Upon completion of graduate work they secure positions on the teaching and research staffs of leading educational institutions in the United States and foreign countries, as research scientists in the United States Department of Agriculture, and in research and development sections of food processing and chemical companies. The master's and doctor's degrees are definitely worth the additional time and effort required.

The Iowa State University Seed Laboratory offers unusual opportunities for securing formal course work in seed science and technology and at the same time provides practical experience through hourly employment.

Undergraduate programs in the department include the following basic courses: 101 or 210, 105, 202, 203, 306, 310, 404, 407, and 424, supplemented with others from the following: 216, 301, 304, 305, 338, 356, 438, 500, 501, 502, 504, 506, 564, 599. Undergraduate minor programs and supporting courses usually include: Bact 304; Chem. 101, 102, 103, 211, 314, 335; Gen. 301; Geol. 100; Math. 101, 102, 110; Phys. 111, 112, 113; Zool. 101, 102, 211, 224, 274, 355. Additional courses may be taken in agronomy, horticulture, forestry, mathematics, geology and zoology. Botany majors are urged to register for courses at the Iowa Lakeside Laboratory on Lake Okoboji one or more summer sessions. These courses are neither fixed requirements, nor are they all the courses required for graduation. They are merely a guide to the student and his adviser for planning a curriculum to fit the student's individual needs.

Staff members of the department serve as advisers for small groups of students to explain the basic requirements of the sciences and humanities curriculum and help students plan programs suited to their needs. Arrangements are made frequently for part-time employment in the research laboratories and greenhouses so students can learn first hand about the nature and importance of work done by botanists and plant pathologists.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in cytology and cytogenetics, plant ecology, morphology, mycology, pathology, physiology, and systematic and economic botany and minor work to students taking major work in other departments.

Major and minor work in the area of cell biology is offered under a cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics, and Zoology and Entomology. The department is also a cooperating department in the water resources program. See Water Resources.

Prerequisite to major graduate work is the completion of thirty undergraduate credit hours.
in botany, together with supporting work in basic and applied science. Undergraduate courses in bacteriology, zoology, farm crops, or horticulture may be substituted in part for botany upon recommendation of the department head. Students desiring to take major work in plant physiology should present undergraduate credits in inorganic and organic chemistry; courses in physics and mathematics are desirable. Students wishing to major in plant pathology should present undergraduate credits in bacteriology and organic chemistry; courses in horticulture or farm crops are desirable. Students desiring to do major work in systematic botany should have prerequisites in general morphology.

Students majoring in botany usually will select minors from bacteriology, biochemistry and biophysics, chemistry, farm crops, forestry, genetics, geology, horticulture, physics, soils or zoology and entomology.

Open to graduate students for minor only: 404, 407, 410, 416, 417, 424, 438.

Courses in Botany

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. General Botany.  
(0-6) Cr. 3. F.W.SSI, II. Mr. Knaphus. Introduction to the science of botany. Food production; structure, growth and reproduction of seed plants. 105 may be elected concurrently.

(1-0) Cr. 1. F.W.S  
Prerequisite: Concurrent classification in 101 or 210. Appraisals of major concepts and ideas influencing the development of plant science. Topics to be considered will include cell theory, evolution, mechanisms of inheritance, gene-enzyme hypothesis, alternation of generations, binomial system of nomenclature, environmental cycles, plant societies, photosynthesis, plant growth substances, parasitism.

*110. Technical Lecture.  
(1-0) Cr. R. S. Required of students in the plant pathology curriculum. Requirements and opportunities for work in the field of plant pathology.

155. Local Flora.  
(0-6) Cr. 3 S Identification of common trees, shrubs, and herbaceous plants. Field trips. Not recommended for students with professional interests in plant science. Credits toward graduation not allowed if credits for 203 or 306 are recorded.

202. The Plant Kingdom.  
(2-2) Cr. 3. W.SSI, II. Prerequisite: 101. Mr. Dodd. Nature and possible evolutionary relationships of the major groups of plants.

203. Field Botany.  
(0-6) Cr. 3. S.SSI.  
Prerequisite: 210 or credit or classification in 202. Field and laboratory study of plants in various local habitats. Introduction to use of keys and basic ecological concepts. Field trips. Required of majors.

210. Introduction to Plant Science.  
(3-4) Cr 5 S Messrs. Dodd and Knaphus. A synthesis of 101 and 202 in which representatives of major groups are used to illustrate the structure, growth, reproduction, and evolutionary relationships of plants. 105 may be elected concurrently. Credit toward graduation not allowed for both 101 and 210.

216 Weed Identification and Control.  
(2-6) Cr 4. F  
Prerequisite: 101 or 210. Mr. Isely


301. Field Biology.  
Cr 4 SSSI (Lakeside Lab)  
A study of plants in natural environments; includes methods of identification, collection, and preservation as well as basic ecological concepts. Field trips. May be taken at Iowa Lakeside Laboratory concurrently with Zool 302.

(2-2) C. 3. Alt. W. Offered 1966. Prerequisite: 101 or 210. Chem 101, junior classification. Mr. Isely. Food and beverage plants. Plants and plant products used as food for man and livestock; emphasis on those grown or used in the United States. Grains, forage crops, fruits, vegetables, condiments, beverages, nuts, sugars.

305. Botany of Economic Plants.  
(2-2) Cr. 3. Alt. W. Offered 1967. Prerequisite: 101 or 210. Chem. 101, junior classification. Mr. Isely. Plants and plant products used in industry and technology: fibers, rubber, wood and wood products, tobacco, medicinal plants, gums, waxes, oils.

(2-6) Cr. 4. S.SSI. Prerequisite: 101 or 210. Mr. Pohl. Principles of classification of seed plants; survey of major plant families, identification and habit study of local plants. Field trips. May be taken for 7 or 8 credits at Iowa Lakeside Laboratory.

310. Elementary Plant Physiology.  
A: (2-4) Cr. 4. F.W.SSI.  
B: (2-6) Cr. 5 S. Prerequisite: 101 or 210. Chem. 102 Messrs. Chasson, Loomis. Principles of absorption, conduction, transpiration, photosynthesis, respiration, growth, and reproduction. B sections are required for majors and available to other students desiring more extensive laboratory work.

338. Seed Analysis.  
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

(2-3) Cr 3 F
(For 356) (2-6) Cr 4 F
Prerequisite 15 credits in biological science
Mr Dodd
Identification and morphological study of algae
Field trips

(2-3) Cr 3 Alt W
Offered 1967
Prerequisite 15 credits in biological science
Mr Dodd
Morphological features and possible relationships of mosses and liverworts.
Field trips

(2-3) Cr 3 S
Prerequisite 15 credits in biological science
Mr Mickel
Morphological features and possible relationships of psilophytes, club-mosses, horsetails, and ferns.
Field trips

(2-6) Cr 4 Alt W
Offered 1966
Prerequisite 15 credits in biological science
Mr Lørensen
Morphological features, primarily those associated with reproduction, of gymnosperms and angiosperms.
Nature of cones and flowers in relation to phylogeny.
Possible origin of angiosperms.

504. Plant Cytology.
(2-4) Cr 3 F
Prerequisite 6 credits in biological science
Gen 301; Chem 335 recommended Mr Bowen
The anatomy and physiology of cyttoplasm and nucleus.
Cell division and the role of the cell in reproduction.

(2-3) Cr 3 F
Prerequisite 15 credits in biological science
Mrs Tiffany
Morphology, cytology and physiology of fungi; their relation to agriculture and industry

509. General Virology.
(see Bact. 509)
518. Enzymes in Plant Metabolism.
(3-0) Cr. 3. S
Pre-requisite: Permission of instructor. Mr. F. G. Smith.
Nature of enzyme action, role of enzymes in metabolism, and methods of investigation.

535. Disease Control.
(2-3) Cr. 3. Alt. S. Offered 1966.
Pre-requisite: 571. Mr. Buchholts.
Exclusion, eradication, protection and disease resistance as means of control or prevention of plant disease.

536. Methods of Research in Plant Pathology.
(2-6) Cr. 4. Alt. F. Offered 1966.
Pre-requisite: 571 or 572 or 573. Mr. Foley.
Introduction to the theory and practice of research in plant pathology.

555. Botanical Microtechniques.
(1-6) Cr. 3. F. Alt. SSI166.
Pre-requisite: 310. Mr. Sass.
Methods of killing, embedding, sectioning, and staining plant material. Methods of studying and recording microscopic preparations; microscopy, micrometry, projection, photomicrography.

556. Advanced Plant Anatomy.
(2-4) Cr. 4. W.
Pre-requisite: 310, 404. Mr. Sass.
Origin, development and structure of tissue systems of vegetative and reproductive organs of vascular plants.

558. Paleobotany.
(2-3) Cr. 3. Alt. W. Offered 1966, and SSI1.
Pre-requisite: Permission of instructor. Mr. Michel.
Introduction to the morphology, relationships, and identification of fossil plants. Field trips.

564. Aquatic Plants.
(2-3 or 2-6) Cr. 3 or 4. F.SSI166.
Pre-requisite: 306, permission of instructor. Mr. S. G. Smith.
Taxonomy, ecology and morphological specializations of aquatic plants, with emphasis on vascular plants. Field trips. May be taken for 7 or 8 Cr. at Iowa Lakeside Laboratory.

565. Advanced Field Botany.
(2-12) Cr. 5. SSI1.
Pre-requisite: 306. Mr. Pohl.
Field study, collection, preservation and identification of local flora. Field trips to localities of outstanding floristic interest in Iowa.

566. Native Range Plants.
(1-6) Cr. 3. W.
Pre-requisite: 306. Mr. Pohl.
Not open to students with credit in 595. Geographic distribution, identification and use of native grassland and forest forage plants.

571. Advanced Plant Pathology.
(2-3) Cr. 3. F.
Pre-requisite: 407 or 416 or 417. Mr. Buchholts.
Diseases of field and horticultural crops caused by phycomycetes and ascomycetes.

572. Advanced Plant Pathology.
(2-3) Cr. 3. W.
Pre-requisite: 407 or 416 or 417. Mr. Dunleavy.
Diseases of field and horticultural crops caused by bacteria.

573. Advanced Plant Pathology.
(2-3) Cr. 3. F.
Pre-requisite: 571. Gen. 301. Mr. Browning.
Diseases of field and horticultural crops caused by smut and rust fungi.

574. Plant Diseases Caused by Nematodes.
(3-3) Cr. 4. F
Pre-requisite: 407 or 416 or 417. Mr. Norton.
Symptoms of plant diseases caused by nematodes, host-parasite relationships, interactions, etiology and disease control.

575. Field Mycology.
(2-12) Cr. 4. SSI107, (SSI166. Lakeside Lab.)
Pre-requisite: 9 credits in Bot. Mrs. Tiffany.
Collection and taxonomy of fungi and relation of their occurrence to environmental factors. Preparation and utilization of mycological exsiccata. Field trips. May be taken for 7 or 8 credits at Iowa Lakeside Laboratory.

576. Field Plant Pathology.
(2-9) Cr. 3. Alt. SSI. Offered 1966.
Pre-requisite: 407 or 416 or 417. Mr. Buchholts.
Techniques and interpretation of field plots; plant disease surveys and estimates of prevalence and severity. Field trips.

577. Advanced Forest Pathology.
(For. 577) (1-6) Cr. 3. Alt. F. Offered 1966.
Pre-requisite: 416. Mr. McNabb.
Principles of pathology in forest practice illustrated by specific forest tree disease problems. Four day field trip to a forest pathology research center.

579. Special Topics.
Cr. 2 to 5 each time elected. F.W.S.
Pre-requisite: 15 credits in Bot., permission of instructor.
F. Plant Ecology. Mr. Landers.
J. Cytology. Mr. Bowen.

584 Advanced Plant Ecology.
(2-3) Cr. 3. F.
Pre-requisite: 424. Mr. Landers.
Origin, development and reactions of vegetation; classification of vegetation units; plant indicators. Field trips.

585. Experimental Field Ecology.
(1-6) Cr. 3. W.
Pre-requisite: 424. Mr. Landers.
Quantitative investigation of vegetation and environment; methods and instruments used: problems. Field trips.

590. Advanced Plant Taxonomy.
(2-6) Cr. 3. S
Pre-requisite: 306. Mr. Pohl.
Principles of plant classification; bibliographic tools of systematic botany; methods of collection, preservation and study of vascular plants.

595. Agrostology.
(1-6) Cr. 3. W.
Pre-requisite: 306. Mr. Pohl.
Morphology, classification and identification of grasses; utilization of grasses in agriculture and grazing. Not open to students with credit in 566.

596. Systematics of the Legumes.
(1-6) Cr. 3. S
Pre-requisite: 306. Mr. Isely.
Classification, evolution and identification of legumes. Emphasis on major taxonomic groups and those of economic significance.

599. History of Botany.
(3-0) Cr. 3. S
Pre-requisite: 15 credits in Bot.

*Administered by the College of Agriculture. Courses not marked by an asterisk are administered by the College of Science and Humanities.
COURSES FOR GRADUATE STUDENTS, major or minor

605. Cytogenetics. (Gen. 605) (3-0) Cr. 3. W
Prerequisite: 504 or Zool. 528, Gen 401 Mr. Bowen.
A continuation of 504 dealing with those aspects of the cell which directly affect inheritance and evolution.

624. Physiology of Fungi. (3-0) Cr. 3. Alt. W Offered 1966.
Prerequisite: 506. Mr. F. G. Smith.
Special physiology of fungi; nutrition, metabolism, growth and toxicology.

Prerequisite: 9 graduate course credits in pathology or mycology. Mr. Buchholtz.
Phenomena of infection and response in plants parasitized by fungi, bacteria and viruses.

641. 642, 643. General Mycology. (2-0) Cr 4 each yr
Prerequisite: 407 or 416 or 417. Mrs. Tiffany.
Taxonomy, morphology and phylogeny of slime molds and fungi (phycomycetes, ascomycetes, fungi imperfecti, and basidiomycetes).

Prerequisite: 506. Mrs. Tiffany.
Morphology, cytology, and physiology of fungi causing animal mycoses; includes superficial mycoses, dermatomycoses, and systemic mycoses.

680. Laboratory in Electron Microscopy. (0-6) Cr. 2 SSJ Mr. Bowen.
Prerequisite B and B 574.
This course is parallel to B and B 575, but deals primarily with preparation and observations of plant materials.

695. Research.
C. Plant Pathology. Messrs. Browning, Buchholtz, Dunleavy, McNabb, Norton, Simons, F. G. Smith, Mrs. Tiffany, Mr. Wallin.
D. Mycology. Mrs. Tiffany.
F. Plant Ecology. Mr. Landers.
G. Economic Botany. Mr. Isely.
J. Cytology. Mr. Bowen.

698. Seminar.
F.W.S.
Meetings of botanical staff and students to discuss recent literature and problems under investigation.
For students taking major work in morphology and taxonomy.
B. Cr. 1. Messrs. Chasson, Landers, Looms, F. G. Smith, Stanforth.
For students taking major work in physiology and ecology.
C. Cr 1. Messrs. Browning, Buchholtz, Dunleavy, McNabb, Norton, Simons, F. G. Smith, Mrs. Tiffany, Mr. Wallin.
For students taking major work in plant pathology.
D. Cr. R.
For staff and students in botany.

*Administered by the College of Agriculture. Courses not marked by an asterisk are administered by the College of Sciences and Humanities.

BUILDING CONSTRUCTION

Professor in Charge: Thomas C. Jellinger, M.S.

Opportunities for Undergraduate Study

Within the Engineering Operations curriculum an option is provided for those students who are interested in Building Construction. This is an area requiring specialists with a strong fundamental knowledge of engineering, plus management ability and familiarity with business, economics and human behavior. The graduate of this program may be engaged in supervising the craftsmen and laborers on the job, ordering materials and equipment, making estimates, insuring the most rapid progress of the project, and keeping cost records. The program in Building Construction offers much of the background that contractors need. It blends engineering, architecture, management and business administration to achieve this.

Total credits required for graduation is 209. In addition to the required courses for all Engineering Operations students, the following are required in the Building Construction program:

- C.E.—331, 432, 433, 434
- E.E.—355
- E.M.—327, 354
- I.E.—351, 494 or 581
- M.E.—406
- Soc.—380

See the course descriptions under the respective departments.
CELL BIOLOGY

Advisory Committee: John H. D. Bryan, Ph.D., Chairman, Charles C Bowen, Ph.D.; William R. Lockhart, Ph.D.; L. Evans Roth, Ph.D.

Opportunities for Undergraduate Study

A special curriculum in cell biology is not offered for the baccalaureate degree. Undergraduates wishing to prepare for graduate study in cell biology should elect laboratory courses in bacteriology, botany and zoology; an introductory course in genetics; mathematics through calculus; chemistry through organic; and one year of physics. Bot. 504 or Zool. 528 and B. and B 578 are recommended to qualified undergraduates desiring an introduction to this area.

Opportunities for Graduate Study

Major work in cell biology is offered for the degrees Master of Science and Doctor of Philosophy under a cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics, and Zoology and Entomology; minor work is offered to students taking major work in other areas. Facilities exist in the several departments for fundamental research in such areas as electron microscopy of cells, their chemistry and physiology particularly in relation to molecular architecture, cellular mechanisms in heredity and radiation response, and the special cytology of bacteria, algae, fungi, protozoa and higher organisms.

A student majoring in cell biology will choose a major professor from the graduate faculty membership of the cooperating departments and will develop his program of study under the guidance of a committee nominated by the coordinating committee and appointed by the Dean of the Graduate College. This program will include a number of the following courses as appropriate:

Agnrn. 623.
Bot. 500, 504, 511, 512, 513, 555, 556, 605, 624, 641, 642, 643, 698E.
Gen. 560, 630, 635, 640, 645, 646, 698.
Zool. 511, 512, 527, 528, 529, 538, 550, 551, 552, 553, 554, 555, 698.

CERAMIC ENGINEERING

David R. Wilder, Ph.D., Head of Department

Professors: Charles M. Dodd, Cer.E.; Thomas D. McGee, Ph.D.
Assistant Professor: Elmer A. Rosauer, Dr. Rer. Nat
Instructors: Michael F. Berard, M.S.; W. Raymond McMahon, M.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in ceramic engineering, leading to the degree Bachelor of Science, see College of Engineering, Curricula.

Ceramic engineering deals with those products formed from natural and synthetic minerals which are rendered durable by a process of heat treatment at high temperatures. This includes most of the non-metallic inorganic substances manufactured into electronic components, glass of all types, porcelain enamels, abrasives, cements, ultra-high temperature resistant refractories, many materials of construction and other similar products.

The ceramic engineer is concerned with the technical problems encountered in the research, development, control, production and use of these products and materials. He must also be well-versed in the methods employed for forming, drying and firing of ceramic raw materials. The ceramic engineer receives a well-rounded education to fit him for research,
production, equipment and plant design or sales engineering depending upon the capabilities and inclination of the individual.

Opportunities for Graduate Study
The department offers major work leading to the degree Master of Science and Doctor of Philosophy in ceramics and ceramic engineering and minor work to students taking major work in other departments. Minor work will be selected in related fields. Prerequisite to major graduate work is the completion of a curriculum in ceramic engineering, ceramic technology, engineering or physical science equivalent to that required of undergraduate students at this institution.

Open to graduate students for minor only: 415, 416, 417

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Orientation. (1-0) Cr. R. S.
201, 202, 203. Seminar. (1-0) Yr.
213. Ceramic Raw Materials. (4-0) Cr. 4. F. Prerequisite: Chem. 103. Geological formation; occurrence; behavior; chemical and physical properties of the more important ceramic raw materials.
301. 302, 303. Seminar. (1-0) Cr. R Yr
311. Ceramic Colloids and Phase Equilibria. (4-0) Cr. 4. F. Prerequisite 213. Fundamental phenomena found in ceramic and related colloids. Phase equilibria in ceramic compositions.
323. Ceramic Engineering Operations II. (4-0) Cr. 4. S. Prerequisite 214. Drying, firing, diffusion processes occurring in ceramic industries. Fuels and combustion in ceramic kilns and driers.
400. Inspection Trip. Cr. R. S. Prerequisite: Junior ceramic engineering classification. One week trip inspecting ceramic plants and studying industrial methods of production.
401. 402, 403. Seminar. (1-0) Cr. R Yr
415. Ceramic Industries I. (3-0) Cr. 3. F. Prerequisite: 312.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

511. Ceramic Technology. (3-0) Cr. 3. Prerequisite: Permission of instructor. Mr. McGee. Compositions, applications and nature of various ceramic bodies and glazes. General structure of the whiteware industries.
416. Ceramic Industries II. (3-0) Cr. 3. W. Prerequisite: 217 or permission of instructor. Manufacture, properties, uses, performance and testing of basic, neutral and acid refractories.
417. Ceramic Industries III. (3-0) Cr. 3. S. Prerequisite: 312. Plant layout, design, economic aspects and industrial structure of the vitreous industries, enamel and glass. Inspection trip to porcelain enamel plant.
427. Ceramic Engineering Design. (2-9) Cr. 5. W. Prerequisite: E M. 324. Introduction to design of steel and concrete structural components of ceramic equipment and ceramic plant structures.
428. Ceramic Engineering Design. (1-9) Cr. 4. S. Prerequisite: 427. Engineering design of kilns, driers and associated equipment.
430. Ceramic Development and Control. (0-12) Cr. 4. F. Prerequisite: 323. Development and control techniques as applied to the ceramic processes.
435. Ceramic Development and Control. (0-9) Cr. 3. S. Prerequisite: 323, 430. Development and control techniques as applied to the ceramic processes.
441. Electronic Ceramics. (3-0) Cr. 3. W. Prerequisite: 312, E E. 445. Relationship of composition, crystal structure and variables of fabrication techniques to the electrical properties of ceramic electronic components.
490. Special Problems. (0-3 to 15) Cr. 1 to 5. Yr. Introduction to research methods, investigation, and continuation of research problems for the undergraduate student.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

511. Ceramic Technology. (3-0) Cr. 3. Prerequisite: Permission of instructor. Mr. McGee.

Chemistry and technology of high temperature refractories, for the student not majoring in ceramic engineering.
CHEMICAL ENGINEERING

George Burnet, Jr., Ph.D., Head of Department

PROFESSORS: Lionel K. Arnold, Ph.D.; David R. Boylan, Jr., Ph.D.; Lawrence E. Burkhart, Ph.D.; Maurice A. Larson, Ph.D.; Morton Smutz, Ph.D.; Henry A. Webber, Ph.D.; Thomas D. Wheelock, Ph.D.

ASSOCIATE PROFESSORS: William H. Abraham, Ph.D.; John B. Sheeler, Ph.D.

ASSISTANT PROFESSORS: Edgar V. Collins, Jr., M.S.; Albert C. Miller, B.S.; E. H. Olson, B.S.; Allen H. Pulsifer, Ph.D.; Robert W. Shearer, B.S.; Frank O. Shuck, Ph.D.; John D. Stevens, Ph.D.; F. Dee Stevenson, Ph.D.

INSTRUCTORS: R. W. Hankinson, M.S.; H. A. Johnson, M.S.

Opportunities for Undergraduate Study

For undergraduate curricula in chemical engineering leading to the degree Bachelor of Science see College of Engineering, Curricula

The chemical engineer is concerned with the processes and equipment for bringing about changes in the state of matter and for transforming energy. He makes use of chemical and nuclear reactions and many physical operations such as mixing, distillation, crystallization, vaporization and filtration. He is trained in the fundamentals of science and mathematics as

512. Ceramic Technology. (3-0) Cr. 3.
Prerequisite: Permission of instructor.
Chemistry and technology of glassy ceramics—glasses, enamels and glazes.

513. Ceramic Technology. (3-0) Cr. 3. S.
Prerequisite: 441 or permission of instructor.
Theory and technology involved in the manufacture of ceramic solid state devices for electrical and electronic utilization. Correlation of electronic and crystal structure with the electrical properties of such devices.

Prerequisite: Math. 321, Phys. 223 or permission of instructor.

515. Special Topics in Electron Microscopy. Cr. 3 to 5.
Prerequisite: 514 or permission of instructor.
Special topics with emphasis given to an electron microscopic analysis of ceramic and other raw material systems. Advanced techniques in electron microscopy.

532. 533. Theory and Properties of Colloidal and Related Ceramic Materials. (3-0) Cr. 3.
Prerequisite: Permission of instructor.
Fundamentals of colloidal phenomena as applied to ceramic systems, including theory of deflocculation, rheology and measurements.

535. 536. Ceramic Colloids Laboratory. (0-6) Cr. 2 each.
Prerequisite: Concurrent with 532, 533.

550. Special Topics.
Cr. arr.
Prerequisite: Permission of instructor.

COURSES FOR GRADUATE STUDENTS, major or minor

611. Mechanical Properties of Ceramic Materials. (3-0) Cr. 3. F.
Fundamentals of the elastic, anelastic, and plastic properties of ionic and covalent solids. Visco-elastic behavior of vitreous and vitreous-solid systems. Point defect, dislocation, grain boundary, and polyphase contributions to mechanical properties.

612. Kinetics of Ceramic Processes. (3-0) Cr. 3. W.
Fundamentals of solid reactions occurring at elevated temperatures. Sintering, vitrification, diffusional mechanisms and effects, reaction rate theory.

613. Measurements in High Temperature Systems. (3-0) Cr. 3. S.
Theory, limitation, and problems of analysis of measurements at elevated temperatures. Furnaces and techniques for determination of mechanical, physical, structural, and chemical properties of ceramic materials at elevated temperatures.

618. Crystal Chemistry of Ceramic Materials. (3-0) Cr. 3.
Prerequisite: Permission of instructor.
Fundamentals of crystal chemistry and the systematic study of the structures of the ceramic materials.

619. Phase Equilibria of Ceramic Systems. (3-0) Cr. 3. S.
Prerequisite: 618 or permission of instructor.
Phase equilibria of the ceramic and closely related systems.

621, 622, 623. Advanced Ceramic Engineering Design. (2-6) Cr. 4 each.
Prerequisite: 428.
Specialized ceramic machinery, driers, kilns and plant structures.

690. Research.
Description of Courses

well as in the principles of fluid flow, heat and mass transfer, and in thermodynamics. He is usually employed by the chemical and allied industries but he frequently makes contributions in the electronic, nuclear, metallurgical and aircraft industries as well as in private and governmental research and educational institutions. He is helping to solve important problems arising in rocketry and space exploration. His field has developed so rapidly and has become so broad that it has become necessary to offer specialized training in the two areas described below.

A five-year cooperative work-study program is available in the Chemical Engineering Department. See College of Engineering, Cooperative Programs.

Design and Production Option

The Design and Production Option is for students who are interested in the design, construction, operation and management of manufacturing plants in which raw materials are processed to produce chemical, petroleum, plastic, fertilizer, pesticide, soap, paint, drug, food, paper and other products. This option provides a broad training in chemistry and engineering and emphasizes the application of basic principles to the solution of industrial problems.

Research and Development Option

The Research and Development Option is for students who are interested in basic or applied research and development or graduate training. It stresses mathematics, science and engineering fundamentals and it places great importance on developing the power to solve the new and untried problems of tomorrow.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science, Master of Engineering and Doctor of Philosophy in chemical engineering and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum substantially equivalent to that offered in chemical engineering at this institution.

Minor work usually will be selected from chemistry, mechanical engineering, mathematics, physics, statistics or nuclear science.


Courses Primarily for Undergraduate Students

100. Technical Lecture.
   (1-0) Cr R S
   A discussion of the chemical engineering profession.

161, 162, 163. Chemical Engineering Laboratory.
   (0.3 to 9) Cr. 1 to 3 each time elected Yr
   An approved assignment as laboratoryman on special problems.

201. Introduction to Chemical Engineering.
   (3-0) Cr. 3 F
   Prerequisite: Credit or classification in Chem. 103.
   The application of stoichiometric principles to industrial problems.

   (3-0) Cr 3 W
   Prerequisite 201
   Application of material and energy balance calculations to chemical engineering processes.

203. Elementary Chemical Engineering Unit Operations.
   (3-0) Cr. 3 S.
   Prerequisite 202
   Elementary chemical engineering operations such as crushing, grinding, size separation and filtration.

300. Junior Inspection Trip.
   Cr. R. S.
   Prerequisite: Junior classification in Chem. E
   Visits to chemical industries and plants in an industrial area for one week.

310. Engineering Unit Operations.
   (3-2) Cr 4 F S
   Prerequisite: Chem. 103, Math. 213, Phys. 222.
   Material and energy balances, fluid flow, heat and mass transfer, rate processes, stagewise operations, and system analogues.

315. Stoichiometry.
   (4-0) Cr. 4 F
   Prerequisite: Math. 213, Phys. 222.
   Material and energy balances. Introduction to rate processes.

341. Computer Applications in Chemical Engineering.
   (1-3) Cr. 2 S.
   Prerequisite: 361, 362, Math. 213.
   Applications of digital and analog computers to the solution of problems arising in transport processes, chemical reactions, process dynamics, and equipment design.
361. 362. 363. Chemical Engineering Unit Operations. (3-0) Cr. 3 each. Yr. 
Prerequisite: 203. Chemical engineering operations common to many industrial processes such as fluid flow, extraction, distillation, heat transfer and mass transfer.

401. 402. 403. Technical Seminar. (1-0) Cr. R. Yr. Discussion of current problems of importance to chemical engineers.

411. Chemical Process Industries. (3-0) Cr. 3. S. 
Prerequisite: Credit or classification in Chem. 334. Detailed studies of the history, raw materials, manufacturing methods, economics and chemistry of industrial chemical processes; coordination of unit operations and processes employed.

421. 422. Chemical Engineering Laboratory. (0-6) Cr. 2 each. F.S. 
Prerequisite: Credit or classification in 361, 362, 363. Laboratory application of the theory studied in 361, 362, and 363 to the testing and use of unit operation and process equipment; computation of experimental data; application of results to process design; writing of reports.

431. 432. 433. Transport Phenomena. (3-0) Cr. 3 each yr. 
Prerequisite: Phys. 222, Math. 213. The transport of momentum, energy and mass; determination of transport properties; the partial differential equations of change; turbulent gradients; correlation of transfer coefficients; macroscopic balances.

435. Process Control. (4-0) Cr. 4. F. 
Prerequisite: 363, Math 213. Mechanisms used to control industrial processes, their applications and limitations. Dynamics of chemical process components and process control systems. Analog simulation of process systems.

450. 451. Rate Processes Laboratory. (0-6) Cr. 2 each. W.S. 

461. 462. Chemical Engineering Thermodynamics. (3, 0 and 2, 0) Cr. 3, 2. F.W. 
Prerequisites: Math. 212, Phys. 222. Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of fluids, phase equilibria, chemical-reaction equilibria.

463. Chemical Reactor Design. (3-0) Cr. 3. S. 
Prerequisite: 462. Kinetics of chemical reactions, design of homogeneous and catalytic flow and batch reactors.

465. 466, 467. Special Problems. (0-3 to 18) Cr. 1 to 6 each. Yr. Introduction to research methods; investigation of an approved topic. H. Honors Students.

471. 472, 473. Chemical Engineering Design. (1-0) Cr. 3 each yr. 
Prerequisite: 361, 362, 363. Principles of process development and plant design.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

504. Plastics Technology. (3-0) Cr. 3. S. 
Prerequisite: Chem. 335. Chemistry and technology of plastic resins; production and use of finished plastic products.


514. Materials of Construction for the Chemical Industries. (3-0) Cr. 3. W. 
Prerequisite: Permission of instructor. Properties of materials in the presence of corrosive media; selection of materials of construction for chemical processes.

515. Organic Chemical Industries. (3-0) Cr. 3. SS. 
Prerequisite: 411. Chemical engineering aspects of manufacture of the principal organic chemicals.

516. Heavy Inorganic Chemical and Fertilizer Industries. (3-0) Cr. 3. SS. 
Prerequisite: 411. Manufacture of commercial fertilizers and related heavy inorganic chemicals.

517. Utilization of Agricultural Products and By-Products. (3-0) Cr. 3. W. 
Prerequisite: Chem. 336. Occurrence and chemical composition of agricultural products and by-products and their present and possible future utilization in manufactured products.

518. Oil and Fat Industries. (3-0) Cr. 3. F. 
Prerequisite: Chem. 335. Occurrence and composition of vegetable and animal oils and fat-bearing materials; methods of oil separation, refining, and bleaching; utilization in products such as foods, paints, and soaps.

535. Process Dynamics. (3-0) Cr. 3. S. 
Prerequisite: 435. Applications of dynamic analysis techniques in the study of non-steady state chemical processes.

541. 542, 543. Advanced Calculation Methods for Chemical Engineers. (3-0) Cr. 3 each. Yr. 
Prerequisite: 541: 363 or 433, credit or classification in Math. 322; 542: 541, credit or classification in Math. 323; 543: 542. 541: Analysis and design of equipment and processes and the solution of the resulting differential equations by operational, series and analog computer techniques. 542: Advanced analysis and design of equipment and
processes by digital computer simulation and solution. 543: Advanced analysis and design of equipment and processes requiring specialized mathematical techniques.

554, 555, 556. Advanced Unit Operations.
(3-0) Cr. 1 each. Yr.
Prerequisite: 363
Equilibrium phase relationships, multi-stage operations, applied heat and mass transfer, analysis and design of process equipment.

565. Distillation.
(3-0) Cr. 3. SS.
Prerequisite: 363.
Binary and multicomponent distillation. Azeotropic and extractive distillation.

566. Solvent Extraction.
(3-0) Cr. 3. SS.
Prerequisite: 363.
Theory and application of solvent extraction to industrial processing.

574. Advanced Plant Design.
(1-6) Cr. 3. F.
Prerequisite: 473.
Special problems in plant design.

(3-0) Cr. 3. W.
Prerequisite: 461.
Application of thermodynamic laws and fundamental relations to single component systems. Properties of non-ideal fluids.

582. Thermodynamics of Multicomponent Systems.
(3-0) Cr. 3. S
Prerequisite: 581.
Thermodynamic properties of solutions. Phase equilibria and chemical reaction equilibria.

(3-0) Cr. 3. S.
Prerequisite: 411.
Primary cells and storage batteries; electrolytic processes of chemical manufacture; electro-refining and electro-winning; electric furnaces and electric furnace products.

585. Chemical Engineering Kinetics.
(3-0) Cr. 3. SS.
Prerequisite: 463.
Theory of absolute reaction rates; mass and heat transfer in catalytic beds; treatment of differential and integral conversion data.

599. Special Topics.
Cr. 2 to 5 each time elected. F.W.S.
A series of one-term courses chosen from such topics as catalytic reactor design, chemical engineering of nuclear processes, liquid-liquid extraction, cost estimation and special topics in thermodynamics.

COURSES FOR GRADUATE STUDENTS, major or minor

600. Chemical Engineering Research.

601, 602, 603. Seminar.
(1-0) Cr. 1 each. Yr.

631, 632, 633. Advanced Transport Phenomena
(3-0) Cr. 3 each Alt Yr.
Prerequisite: 433, 541, Math. 322, 323

Chemistry
Charles A. Goetz, Ph.D., Head of Department


ASSOCIATE PROFESSORS: Rachel H Edgar, Ph.D.; Donald R. Fitzwater, Ph.D.; Robert A. Jacobson, Ph.D.; Robert E. McCarley, Ph.D.


INSTRUCTORS: Charles A. Kingsbury, Ph.D.; Thomas H. Kinstle, Ph.D.; Gene F. Morris, Ph.D.; Walter S. Trahanovsky, Ph.D.

Opportunities for Undergraduate Study
For undergraduate curriculum in sciences and humanities or curriculum in chemistry, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum and Chemistry, Curriculum.

Graduates in chemistry qualify in many fields: as teachers of chemistry, as analytical or control chemists, as supervisors in industry, as technical sales personnel and as research chemists in federal, state, municipal, academic or industrial laboratories.
Undergraduate chemistry students take not only studies in chemistry but also courses in mathematics, physics, German and in cultural subjects. Students with the necessary high scholastic standing usually continue with graduate work where they can explore more thoroughly the specialized areas of chemistry in which they are interested.

To meet the different needs of students of chemistry, Iowa State University has two curricula, both of which lead to the Bachelor of Science degree. Both the curriculum in chemistry and the curriculum in sciences and humanities, with a major in chemistry, prepare the student for graduate study and for industrial work at the Bachelor of Science level.

Undergraduate students of chemistry in the curriculum in chemistry or in the curriculum in sciences and humanities usually have the following basic courses or their equivalents in their programs: 100, 102, 103, 203, 214, 215, 224, 237, 316, 325, 326, 327, 330, 331, 332, 333, 401 and 6 credits advanced chemistry. As supporting work undergraduate majors have found the following courses desirable: Math. 101, 102, 110, 211, 212, 213; Physics 221, 222, 223. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in inorganic, analytical, physical, organic chemistry and combinations and specializations within these general areas. Minor work is offered to students taking major work in other departments.

In cooperation with the Institute for Atomic Research, special facilities are offered to graduate students in other departments of the University who wish to use radioactive isotopes in their research. Analytical chemistry, calculus and physics are required for this phase of chemistry.

The Department of Chemistry requires all graduate students majoring in chemistry to teach as part of their training for an advanced degree. Prerequisite to major graduate work is the completion of undergraduate work in chemistry, mathematics and physics, substantially equivalent to that required of undergraduate students at this institution in the curriculum in chemistry.

Open to graduate students for minor graduate credit only: 319, 320, 321, 322, 323, 329, 334, 335, 336, 339, 401, 408, 426, 466, 483, 484.

Index to field work is given by the second and third figures of course numbers:

- (a) Systematic Inorganic Chemistry 00 to 09
- (b) Analytical Chemistry 10 to 19
- (c) Physical Chemistry 20 to 29
- (d) Organic Chemistry 30 to 39
- (e) Open 40 to 49
- (f) Household (including Textile) Chemistry 60 to 69
- (g) Open 70 to 79
- (h) Physical Chemistry 80 to 89
- (i) Research 90 to 99

For courses in biochemistry, biophysics and metallurgy, see index.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

*30. Fundamentals of Inorganic Chemistry. (2-6) Cr. 4 each. 30: F; 31: W.
Some chemical principles.

*32. Fundamentals of Organic Chemistry. (2-6) Cr. 4. S.
Organic chemistry; aliphatic compounds, functional groups, polymers.

*60. Quantitative Chemical Analysis. (2-6) Cr. 4. F.
Principles of quantitative chemical analysis. Gravimetric, volumetric methods of analysis.

*61. Instrumental Quantitative Analysis. (2-6) Cr. 4. W.
The use of instruments in quantitative chemical analysis.

*70. Industrial Chemistry. (3-3) Cr. 4. S.
Some chemical principles for engineering technology students applied to the manufacture, properties and uses of engineering materials.

100. Orientation. (1-0) Cr. 1. F.W.S.
An introduction to the various fields of chemistry to assist chemistry majors in electing areas of concentration.

*Accepted for credit in the Technical Institute only.
101. 102. General Chemistry.
(3-4) Cr 4 each. 101: F.W.S.S.; 102: W.S.S.S.
Prerequisites: Principles of chemistry; properties of non-metallic and metallic elements. Only students who have not had high school chemistry will be classified in 101 during the fall quarter. 101 is not acceptable for credit toward graduation for students majoring in chemistry.

101A, 102A. General Chemistry.
(3-4) Cr 4 each. F.
Prerequisites: Principles of chemistry; properties of metallic and non-metallic elements. Students with one unit of high school chemistry will be classified in either 101A or 102A during the fall quarter; classification in 102A will be based on high school rank and test scores. 102A provides a recognition in the form of college credit for high school training in chemistry. Students enrolled in 102A may receive credit in both 101A and 102A. 103 is offered winter quarter and 203, 211, and 214 are offered spring quarter so that students may take full advantage of the accelerated program. 101A is not acceptable for credit toward graduation for students majoring in chemistry.

103. Systematic Inorganic Chemistry.
(3-4) Cr. 4. W.S.S.S.
Prerequisite: 102, grade of A or B in 106. Extension of General Chemistry; introduction to the reactions of individual elements and to group reaction as used in the determination of the composition of matter.

105, 106. General Chemistry.
(2-4) Cr 3 each. 105: F.W.; 106: W.S.
Prerequisites: Assignment by class ranking and test scores. 102A provides a recognition in the form of college credit for high school training in chemistry. Students enrolled in 102A may receive credit in both 101A and 102A. 103 is offered winter quarter and 203, 211, and 214 are offered spring quarter so that students may take full advantage of the accelerated program. 101A is not acceptable for credit toward graduation for students majoring in chemistry.

211. Quantitative Analysis.
(3-6) Cr 5 W
Prerequisite: 214. Theory and practice of quantitative separations, titration curves, and electroanalytical methods. Only for students majoring in chemistry or biochemistry.

(3-6) Cr 5 W
Prerequisite: 214. Theory and practice of quantitative separations, titration curves, and electroanalytical methods. Only for students majoring in chemistry or biochemistry.

224. Physical Chemistry.
(3-0) Cr 3 S
Prerequisite: 214, Math 212, Phys 112 or 222. Elementary thermodynamics and theory of the gaseous state. Homogeneous equilibria. Only for students majoring in chemistry or biochemistry.

(3-3 or 6) Cr. 4 or 5. F.W.S.S.S.
Prerequisite: 102 or 106. Fundamentals of organic chemistry for students in Home Economics and Agriculture. Students automatically will elect this course for 5 credits. Home Economics students automatically will elect for 4 credits.

237. Introduction to Organic Chemistry.
(2-0) Cr 2 W
Prerequisite: 214. A survey of classical organic chemistry; aliphatic, aromatic series; functional groups; reactions of derivatives of hydrocarbons; heterocyclic compounds. Only for students majoring in chemistry or biochemistry.

309. Inorganic Chemistry Review.
(3-0) Cr 3 F.
Prerequisite. Permission of instructor. A review of advanced, undergraduate inorganic chemistry and the reactions of acids and bases to prepare for graduate courses in inorganic chemistry.

316. Quantitative Analysis.
(3-6) Cr. 5. S.
Prerequisite: 213, 326. Gas analysis. Physicochemical methods of analysis. Designed for students who have already completed at least two quarters of analytical courses and who wish to review in preparation for graduate courses.

330. Laboratory in Physical Chemistry.
(0-3) Cr 1 each time taken. F.W.S.
To accompany 321, 322, 323.

321, 322, 323. Physical Chemistry.
(3-0) Cr 3 each. Yr.
Prerequisites: 211 or 214, Phys 223, Math 212 or 212 preferred. Properties of gases, liquids and solids, solutions, spectroscopy, and nuclear magnetic and molecular structure. Students majoring in chemistry ordinarily will elect 224, 325, 326, 327.

325. Physical Chemistry.
(3-0) Cr. 3. S.
Prerequisite: 224. Heterogeneous equilibria. Electrochemistry. Only for students majoring in chemistry or biochemistry.
326. Physical Chemistry.  
(3-0) Cr. 3. W.  
Prerequisite: 325  

327. Experimental Physical Chemistry.  
(0-6) Cr. 1 each time taken. F W.  
Prerequisite: 215  
To accompany 325 and 326. Only for students majoring in chemistry or biochemistry.

329. Physical Chemistry Review.  
(3-0) Cr. 3. W.  
Prerequisite: Permission of instructor.  
A review of the principles and applications of physical chemistry. Designed especially for students who have completed a year of undergraduate physical chemistry and who wish to review before attempting graduate courses in physical chemistry.

330. Laboratory in Organic Chemistry.  
(0-6) Cr. 2 each time taken. F W S.  
Prerequisite: 215  
To accompany 331, 332, 333. Only for students majoring in chemistry or biochemistry.

331. 332, 333 Organic Chemistry.  
331 332 (3-0) Cr. 3 each; 332- (2-0) Cr. 2. Yr.  
Prerequisite: 214.  
331, 332. Chemistry of aliphatic and aromatic compounds. Polyfunctional and heterocyclic chemistry. Only for students majoring in chemistry or biochemistry.

334. Organic Chemistry.  
(4-0) Cr. 4. F W.  
Prerequisite: 103  
During the sequence 334, 335, 336 the chemistry of carbohydrates, lipids, proteins, purines and pyrimidines will be covered. Premedical students must elect 334, 335, 336 with laboratory the last two quarters. For students majoring in biological or applied sciences. Students majoring in chemistry ordinarily will elect 331, 332, 333.

335. Organic Chemistry.  
(2-0 or 6) Cr. 2 or 4. W. S.  
Prerequisite: 334  
A continuation of 334 and an introduction to laboratory work in organic chemistry. The sequence 334, 335 will satisfy the requirements for admission to the curriculum in Veterinary Medicine. A course in quantitative analysis is advised.

(3-0 or 3) Cr. 3 or 4. S.  
A course for students needing additional organic chemistry beyond 335. Principally polyfunctional and heterocyclic chemistry.

(3-0) Cr. 3. W.  
Prerequisite: Permission of instructor.  
A review of undergraduate organic chemistry. Designed especially for students who have completed a year of organic chemistry and wish to review before attempting graduate courses in organic chemistry.

(4-0) Cr. 4. S.  
Prerequisite: 103, and M E 321 or equivalent.  
Organic materials such as fuels, refrigerants, lubricants and plastics; phase equilibria and the free energy concept; equilibrium constants for gas systems; kinetics of gas phase reactions; crystal structure. Not accepted for credit in science curriculum.

395. Special Topics in Chemistry.  
A. Undergraduate Research. Cr. var.  
F W S S S  
Prerequisite: Permission of staff member with whom the student proposes to work.  
A. Introduction to Chemical Research. (2-0) Cr. 2. F W. S.  
Prerequisite: Enrollment in University Honors Program and major in chemistry.  
Introduction to research methods in chemistry.

401. Advanced Inorganic Chemistry.  
(4-0) Cr. 4. F.  
Prerequisite: 326.  
The nature of bonding in inorganic systems; the application of thermodynamics, kinetics and structure to the study of inorganic systems. For students majoring in chemistry and biochemistry.

408. Radiochemistry.  
(2-6) Cr. 4. F.  
For students in engineering. Fundamental principles of radioactivity; theory, operation and uses of radiation measuring instruments; principles of radiochemistry.

426. Radiotracer Methods.  
(2-0) Cr. 2. F.  
Prerequisite: 323 or 326 or 483; Physics 112.  
For students in biology and Agriculture. Fundamental principles of radiotracer techniques and their applications to problems in biology and allied sciences.

466. Textile Chemistry.  
(2-0 or 6) Cr. 2 or 4.  
F S  
Prerequisite: 231.  
Reaction of fibers during modification and finishing.

483. 484. Biophysical Chemistry.  
3 Cr. 3 each. F W.  
Prerequisite: Math. 212  
Chem. 320 may be elected concurrently by those desiring laboratory. Introduction to the fundamentals of physical chemistry with application to biological systems. Not accepted for credit toward a degree in chemistry or chemical engineering.

495. Senior Thesis Research.  
(0-6 or 9) Cr. 2 or 3 each time taken.  
Prerequisite: Permission of staff member with whom student proposes to work. Average in all chemistry, physics and mathematics courses. Staff.  
Research in chosen area of chemistry, with final written report as senior thesis. This course should be elected for three consecutive quarters just preceding graduation. Only for students majoring in chemistry.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates:

500. The History of Chemistry.  
(2-0) Cr. 2. S.  
Prerequisite: 322 or 325, 332 or 335. Mr. Diehl.  
The historical development of chemistry.

501. Inorganic Preparation.  
(0-6 or more) Cr. 2 or more each time elected.  
Prerequisite: 203, 323, permission of instructor.  
Preparation of inorganic compounds providing
experience in two or three general areas such as high vacuum techniques, non-aqueous solvents, high temperature reactions, coordination compounds, electrochemistry.

505. Theoretical Inorganic Chemistry. (3-0) Cr. 3. F.S.
Prerequisite: 303 and 323 or 326. Messrs Corbett, Martin
Theoretical approach for the systematization of inorganic chemistry.

506. Systematic Inorganic Chemistry. (2-0) Cr. 2 each. 506 - W; 507 - S.
Prerequisite: 505 Messrs Corbett, Martin
506: Non-metallic elements. 507: Metallic elements.

511. 512. 513. Advanced Quantitative Analysis. 511: (3-0) Cr. 3. F.S; 512: (2-6) Cr. 4. W; 513: (0-6) Cr. 4. F.W.S.
Prerequisite: 316, 323 or 326, 333 or 336 Messrs Banks, Diehl, Fassel, Fritz, Goets, Marple.
511, 513: Emphasis on general methods, descriptive inorganic analysis, and current literature. 512: Physical and instrumental methods of analysis.

514. 515. Analytical Emission Spectroscopy. 514: (2-0); 515: (0-6) Cr. 2 each S
Prerequisite: 323 or 326. Phys. 223. Mr. Fassel
514: Principles and methods of analytical emission spectroscopy. Qualitative detection and quantitative determination of many elements in various materials. 515: Laboratory in analytical emission spectroscopy to accompany or follow 514.

516. Quantitative Organic Analysis. (1-3 to 9) Cr. 2 to 4. W
Prerequisite: 333 or 336 Mr. Fritz
Chemical analysis via functional groups, kinetic methods, spectrophotometric and physical methods, analytical separations. Optional laboratory work on a special analytical problem.

Prerequisite: 316, 323 or 326, or 336. Mr. Fritz
Microtechniques of organic analysis.

521. 522. 523. Chemical Thermodynamics. (2-0) Cr. 2 each. F
Prerequisite: 323 or 326
Advanced discussion of the principles of classical thermodynamics.

524. Surface Chemistry. (3-0) Cr. 3. Alt W Offered 1967
Prerequisite 323 or 326. Mr. Hansen
Basic principles and applications.

COURSES FOR GRADUATE STUDENTS, major or minor

600. Seminar in Inorganic Chemistry. (1-0) Cr. 1 each time elected. F.W.S.
Prerequisite: Permission of instructor Inorganic staff.

601. Selected Topics in Inorganic Chemistry. (2-0) Cr 2 each time elected F.W.S.
Prerequisite: 203, 323 Messrs Corbett, Martin
A series of one-term courses chosen from such topics as structure of matter, valency, catalysis, radiations, hybrids, and chemical reactions.

611. Seminar in Analytical Chemistry. (1-0) Cr 1 each time elected. F.W.S
Prerequisite: Permission of instructor Messrs Banks, Diehl, Fassel, Fritz, Goets, Marple.

526. 527. Radiochemistry. (2-0) Cr. 2 each. Alt. W.S. Offered 1966
Prerequisite: 323 or 326. Messrs Martin, Vogt.

529. Laboratory in Radiotracer Techniques. (0-6) Cr. 2. W.S
Prerequisite: 426 Mr Vogt
Training in measuring of radioactive substances and in their handling through chemical and biological experiments.

531. 532. Mechanistic Theory of Organic Chemistry. (3-0) Cr. 3 each. 531: W; 532: S.
Prerequisite: 323 or 326, 333 or 336. Messrs Chapman, Rusell.
Organic reaction mechanisms, organic syntheses, stereochemistry of organic processes.

535. Advanced Organic Laboratory. (0-3 or more) Cr. 1 or more each time elected. F.W.S.
Prerequisite: 333 or 336; permission of staff member with whom work is to be done
Preliminary research work in synthesis and study of reactions of compounds of theoretical and industrial importance.

536. Introduction to Organic Chemistry Research. (2-3) Cr. 3.
Prerequisite: 323 or 326; 333 or 336, permission of instructor.
Principles of infrared, ultraviolet, nuclear magnetic resonance and electron spin resonance spectroscopy as applied to organic chemistry. Physical methods of purification, separation and characterization of organic materials.

539. Advanced Organic Chemistry. (3-0) Cr. 3. F.S.S.
Prerequisite: 323 or 326, 333 or 336.
Advanced descriptive organic chemistry with emphasis on synthesis and stereochemistry.

557 Soil Chemistry. (Agron. 557) See Agronomy.

581. 582. Introduction to Molecular Structure. 581 (3-0) Cr. 3 F; 582. (2-0) Cr 2. S.
Prerequisite: 581. 323 or 326; 582 581.
Introduction to wave mechanics; electronic states of atoms and molecules; directed valence; polyatomic molecules. 582: Time dependent wave equation; molecular spectroscopy; experimental molecular structure; recent developments in structural research.
Discussion of the Schrödinger equation, solutions in simple cases, perturbation and variation methods. Slater's treatment of complex atoms and molecules, valence bond and molecular orbital methods; applications.

625. Special Topics in Physical Chemistry.
(0-2) Cr 2 each time elected. F.W.S. Prerequisite: 521 or 581
A series of one-term courses chosen from such topics as atomic, molecular and nuclear structure, surface chemistry, photochemistry, chemical kinetics, electrochemistry, phase rule.

626. X-Ray Crystal Structure.
(2-0) Cr. 2 each time taken. F.W.S. Offered on request. Must be started in fall. Prerequisite: Permission of instructor.
Lattice and symmetry properties of crystals; diffraction of X-rays by crystals; intensities of diffracted beams; application of Fourier method; examples of structures deduced from X-ray investigations.

(1-0) Cr. 1 each time elected. F.W.S.S. Prerequisite: Permission of instructor. Organic staff.

633. Special Topics in Organometallic Chemistry.
(2-0) Cr 2 Alt. S. Offered 1967. Prerequisite: 530, reading knowledge of German. Mr. Gilman.

(2-0) Cr. 2 each. W.S. Prerequisite: 531, 532, permission of instructor. Mr. Russell.
Selected topics in the fields of reaction mechanisms, kinetics and structural theory as applied to organic molecules.

638. 639. Chemistry of Organic Natural Products.
(2-0) Cr. 2 each. F.S. Prerequisite 531, 532, permission of instructor. Messrs. Chapman, Wildman.
Discussion of selected topics in the chemistry of naturally occurring substances; degradation and synthesis of alkaloids, terpenes, steroids, antibiotics, photochemistry; and the chemistry of heterocyclic and troponoid substances.

695. Research.
Prerequisite: Permission of staff member concerned.

CHILD DEVELOPMENT
Glenn R. Hawkes, Ph.D., Head of Department

PROFESSORS: D. Bruce Gardner, Ph.D.; Dorothy Lee, Ph.D.; Damaris Pease, Ph.D.; Edith M. Sunderlin, M.A.

ASSOCIATE PROFESSOR: Charlyce King, Ed.D.


INSTRUCTORS: Re Jean Bowar, MS.; Helen H. Coe, M.S.; Marlene Ellis, M.S.; Irma Galejs, M.S.; Kathryn Madera, M.S.; Frances Ralston, M.S.; Josephine K. Rosauer, M.S.; David A. Weltha, M.A.

Opportunities for Undergraduate Study
For undergraduate curricula in child development leading to the degree Bachelor of Science, see Home Economics, Curricula.

The curricula in child development provides specialized training for professional work with children and families in connection with nursery schools, elementary schools, hospital recreation programs, settlement houses, welfare agencies, programs for handicapped children or emotionally disturbed children and in recreational programs for older children, such as Girl Scouts, Campfire Girls or youth programs of the Extension Service. Opportunities to observe and work with infants, preschool and school age children are offered.

Three areas of preparation are offered: child development, child development-elementary education, child development and related science.

Students may enroll in the child development-elementary education curriculum as sophomores but must apply to and be accepted by the departmental committee on selection and the University Committee on Teacher Education in order to advance to the teacher education program.

Further information for students wishing to combine preparation for work in radio or television with this curriculum is found under Home Economics, Radio and Television, and under Telecommunicative Arts.
Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in child development and minor work to students taking major work in other departments.

It is recommended that the student have a general background in home economics, child development or other behavioral sciences.

The modern language requirements for the degree Master of Science may be waived upon recommendation of the department head. For the language requirement for the degree Doctor of Philosophy, see the Graduate College.

Open to graduate students for minor only: 434, 444, 460, 461.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

236. Principles of Child Development.
   Prerequisite: (3.2) Cr 3 F.W.S.SSI.
   Description of courses.

240. Literature for Children.
   Prerequisite: 236 Mrs. Lillie.
   Description of courses.

270. The Individual and His Family I.
   Prerequisite: Psych. 101, Soc 134, 218 Mrs Duran, King.
   Description of courses.

   Prerequisite: 236 Mr. Gardner.
   Description of courses.

337. Development and Guidance in Later Childhood.
   Prerequisite: Psych. 230. Mrs. Lillie, Miss Smith.
   Description of courses.

366. Activities and Materials.
   Prerequisite: 336, 337. Miss Navaux.
   Description of courses.

368. Study Tour.
   Prerequisite: Junior classification.
   Description of courses.

375. The Teaching of Reading (Ed. 375).
   Prerequisite: Ed. 204, Psych 333, C.D. 336.
   Description of courses.

434 Development in Infancy.
   Prerequisite: 6 credits in C.D. and Psych Mrs Duran.
   Description of courses.

   Prerequisite: 2 F.W.S.SSI.
   Description of courses.

445. Elementary Education Methods I.
   Prerequisite: 444 Miss Coe, Mr. Shea.
   Description of courses.

446. Elementary Education Methods II.
   Prerequisite: 444 Mr. Frost.
   Description of courses.

460. Guidance of Children.
   Prerequisite: 366, Miss Smith.
   Description of courses.

   Prerequisite: 460 Miss Sunderland.
   Description of courses.

465. Seminar.
   Prerequisite: 366, senior classification.
   Description of courses.

467A. Supervised Teaching in Nursery School.
   Prerequisite: 461 classification in 467B.
   Description of courses.

467B. Home-school Relations.
   Prerequisite: 467A Miss Sunderland.
   Description of courses.

467C. Student Teaching in the Primary Grades.
   Prerequisite: 445, 446, 460, cumulative point average of 2.3. Mrs. Frost, Miss Coe.
   Description of courses.

467D. Student Teaching in the Intermediate Grades.
   Prerequisite: 455, 446, 460, cumulative point average of 2.3. Mrs. Frost, Miss Coe.
Experience in teaching in the intermediate grades. Advance reservation required.

468. Administration of Programs for Young Children.
(2-3) Cr. 3 F W S.
Prerequisite: Credit or classification in 460
Essential procedures in programming for young children, including housing, equipment, health protection and supervision. Field trips to selected children's centers.

481. Group Work with Children.
(0-24) Cr 8 F W SSSI.
Prerequisite 460. Mr. Hawkes, Mrs. Rosauer. Observation and participation in group activities of children of various ages. Advance reservation required.

490. Special Problems.
Cr. Arr. F.W.S.SSI, II.
Prerequisite: 12 credits in C.D., permission of department head.
A. Child Development. Messrs. Gardner, Hawkes, Misses Pease, Sunderlin
B. Family Relationships. Messrs. Gardner, Hawkes, Mrs. Durian, King
C. Nursery Education. Messrs. Smith, Sunderlin
D. Elementary Education. Messrs. Frost, Hawkes, Shea. Miss Cor.

COURSES PRIMARILY FOR GRADUATE UNDERGRADUATES, major or minor, open to qualified undergraduates

519. Research Methods in Child Development I.
(2-0) Cr. 2. W.
Prerequisite: Credit or classification in Stat. 401. Mr. Gardner.
Research and problems in methodology.

520. Research Methods in Child Development II.
(2-0) Cr 2 S.
Prerequisite 519. Mr. Gardner.
Advanced study of research design and methodology in child development. Emphasis on the laboratory-experimental study of the child.

537. Theories and Principles of Child Development.
(3-0) Cr 3 F
Prerequisite: 336, 337. 9 credits in Psych. Miss Pease
Analysis of the developmental approach to the study of child behavior. Emphasis upon principles of development.

545. The Community Program of Elementary Education (Ed. 545).
(2 to 4.0) Cr. 2 to 4. SSI
Prerequisite: Ed. 426.

570. The Individual and His Family II.
(3-0) Cr 3. S
Prerequisite: 270 or equivalent. Mr. Hawkes, Mrs. King
Analysis of human behavior, as it relates to family development, from the biological, psychological and sociological fields.

572. Parent Education.
(3-0) Cr 3 F
Prerequisite 270, 336, 337
Principles and procedures of instruction and evaluation in parent education

COURSES FOR GRADUATE STUDENTS, major or minor

600. History and Philosophy of Child Development.
(3-0) Cr 3 W SSSI.
Prerequisite Permission of department head. Miss Sunderlin
History of child development; research centers; theories of early childhood education.

614 Research.
F.W.S.SSI, II
Messrs. Gardner, Hawkes, Miss Pease.

(3-0) Cr 3 S
Prerequisite Psych 440 Mr. Gardner
Analysis of methods in the clinical and experimental appraisal of children.

Prerequisite: 537. Miss Pease

575. Cultural Foundations of Family Life.
(2 or 3.0) Cr 2 or 3. F SSI
Prerequisite: 9 hours of behavioral sciences. Mrs. Lee.
Cultural influences on the individual and family, on child-rearing practices and personality development; roles of family members; values, customs, taboos and rituals related to family life.

(2-3) Cr 3. F
Prerequisite 460. Miss Sunderlin.
Theories, objectives and recent research used in nursery education; role of nursery education in the total educational system; observation of a variety of programs for young children.

581. Supervised Programming for Children.
Cr. Arr. F.W.S
Prerequisite: 12 credits in C.D. and reservation. Mr. Hawkes, Miss Sunderlin.
Supervised programming for children in a variety of settings.

590. Special Topics.
F.W.S.SSI, II.
Prerequisite: 12 credits in C.D. permission of department head.
A. Child Development. Messrs. Gardner, Hawkes, Misses Pease, Sunderlin
C. Nursery Education. Miss Sunderlin

Theories and concepts of development, maturation and growth related to body functioning in children. Body functioning and personal-social development.

(2-0) Cr. 2. Alt. S. Offered 1967.
Prerequisite: 537. Mr. Gardner
Analysis of cognitive development in children.

(2-0) Cr. 2. Alt. S. Offered 1966.
Prerequisite: 537. Mr. Hawkes
Analysis of personality formation in children.

(2-0) Cr. 2. Alt. W. Offered 1967.
Prerequisite: 537.
Analysis of social development in children.
655. Planning College Courses in Child Development.

(3-0) Cr. 3. S.
Prerequisite: 600. Miss Pease.
Selection, organization, presentation of subject matter.

665. Seminar.
Cr. arr. F.W.S.


(2-0) Cr. 2 W.
Prerequisite: 15 credits in C.D. and Psych.
Mr. Hawkes.
Theories of parent-child relations.

CIVIL ENGINEERING

Carl E. Ekberg, Jr., Ph.D., Head of Department


Associate Professors: Turgut Demirel, Ph.D.; Hon-Pong Fung, Ph.D.; Wilfred T. Hosmer, M.S.; Rudolph J. Lubsen, M.S.; Jack L. Mickle, Ph.D.; Robert M. Nady, M.S.; Wallace W. Sanders, Ph.D.; John B. Sheeler, Ph.D.; Owen Sletten, Ph.D.

Assistant Professors: Robert L. Carstens, M.S.; Merwin D. Dougal, M.S.; James M. Hoover, M.S.; Dah-yinn Lee, Ph.D.; Ti-Ta Lee, Ph.D.; Robert A. Lohnes, Ph.D.; Charles S. Oulman, Ph.D.

Instructors: Claude D. Johnson, M.S.; Richard E. Montag, B.S.; James O. Shearman, B.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in civil engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula

Civil engineering consists of the economic application of the laws, forces and materials of nature to the planning, design, construction, maintenance and operation of public and private facilities, including research, testing, sales, management and other functions that are related. The facilities commonly include transportation; bridges and buildings; water supply, sewerage, irrigation, and drainage systems; river and harbor improvements; dams and reservoirs; surveys and maps.

Work on the campus is supplemented by a six-week summer program which follows the freshman year and by inspection trips which furnish an opportunity for first-hand study of engineering work and industrial plants.

Opportunities for Graduate Study

The department offers work for the degree Master of Science and Master of Engineering in sanitary, structural, municipal, highway, soil and transportation engineering and major work for the degree of Doctor of Philosophy in structural, sanitary, soil and transportation engineering and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in civil engineering at this institution, and including undergraduate courses necessary for the particular field chosen.

Students who major in civil engineering usually will select minor work from the Departments of Mathematics, Physics, Chemistry, Bacteriology, Geology, Economics, Statistics, or other engineering departments.


Courses Primarily for Undergraduate Students

100. Technical Lecture.

(1-0) Cr. R. S.
Discussion of various phases of civil engineering. Lectures by staff members and practicing civil engineers.

111. Fundamentals of Surveying.

(0-9) Cr. 3. S
Prerequisite: Math. 102.
Theory and practice in the use of tape, compass, level and transit for surveying problems.
Sources of error, map plotting, error of closure, areas of land and triangulation. For engineering students only.

112. Advanced Surveying I.
Cr. 6. SS.
Prerequisite: 111.
Theory and practice in route surveying, including location, curves and earthwork. Theory and field practice in surveying astronomy. 112 and 113 constitute a six-week, full-time summer term. The student pays his own living expenses and regular registration fee.

113. Advanced Surveying II.
Cr. 6. SS.
Prerequisite: 111.
Theory and practice in topographic mapping, land surveying and precise surveying measurements.

210. Surveying.
(2-9) Cr. 5 F
Prerequisite: Math. 102.
Surveying for resource development including principles of surveying measurements, topography, traversing, plane table mapping, field astronomy, and staking of buildings, curves and earthwork.

211. Elementary Surveying.
(0-9) Cr. 3. F
Prerequisite: Math. 102.
Principles of surveying measurements, simple topography, site layout, and traversing.

214. Mapping, Computations and Land Surveying.
(1-6) Cr. 3. W.
Prerequisite: 210 or 211.
Mapping and computations related to stadia, simple horizontal and vertical curves, earthwork; elementary public land surveys and boundaries.

(2-3) Cr. 3. S.
Prerequisite: 113, Stat. 201B, credit or classification in Math. 211, Phys. 225.
Theory of macro measurements, errors, and adjustments, photo, optical and electronic applications by direct and indirect methods.

291. 292. Civil Engineering Development.
Cr. R. F.W.
Lectures and visual presentation of material relevant to civil engineering, by staff members and eminent civil engineers.

304. Hydrology.
(2-2) Cr. 3. F.W.
Prerequisite: Credit or classification in E.M. 378.
Elements of hydrology, precipitation, water losses and stream flow and ground water hydraulics.

331. 331A. Analysis of Statically Determinate Structures.
331: (3-4) Cr. 5. F.S. 331A: (3-0) Cr. 3. F.W.
Prerequisite: E.M. 274.

350. Collaborative Transportation Development.
(2-2) Cr. 3. F.
Prerequisite: Credit or classification in 214 or Stat. 201, 201A or 201B.
History, legal requirements, organizations, and coordination in national, state, and local development of transport modes. The planning, regulation, safety, operation, and circulation patterns of air, rail, water, pipeline, street, and road systems. Population, land use, economic, social, and other source data for use in the location of transportation routes, parking, and terminal facilities.

352. Planning of Transportation Facilities.
(3-2) Cr. 4. F.S.
Prerequisite: 215
Comprehensive transportation development, organization, economics, and finance; trends, forecasts, and programs. Interrelation of engineering technology, human behavior, safety, time, vehicle, route, terminal, land and other factors in mathematical models of future traffic. Rating inventories, capacity, and divergence computations for transportation systems.

355. Design of Pavements.
(2-4) Cr. 4. S.
Prerequisite: 360, 361.
Theory and practice in design, construction, and maintenance of low cost, intermediate, and high type highway and airport pavements. Stabilization of bases and pavements. Laboratory tests of aggregates, bituminous materials and bituminous paving mixtures.

360. Soil Engineering.
(3-0) Cr. 3. W.S.S.S.
Prerequisite: Credit or classification in 361, E.M. 324, Geol. 374.
Introduction to soil engineering; identification and classification of soils for engineering purposes; water movement and seepage forces, stress distribution, settlement and shearing strength in soils; applications of soil mechanics to earth dams, retaining walls, foundations, piers and underground conduits.

361. Soil Engineering Laboratory.
(0-4) Cr. 2. W.S.S.S.
Prerequisite: Chem. 101 or equivalent, credit or classification in 360.
Elementary theory and techniques of soil mechanics measurement. Identification and classification of engineering soils, moisture-density relationships, shearing strength, permeability, capilarity and consolidation.

394. 395. Professional Development.
Cr. R. F.W.
Oral reports and discussions of prominent engineers, notable engineering projects and related topics.

404. Engineering in City Planning.
(1-0) Cr. 3. W.
Prerequisite: Credit or classification in L.A. 401 or senior engineering classification.
Relation of sanitary works, transportation, and other utilities to city planning; housing, building codes, real estate subdivision, land titles.

415. Advanced Methods of Precise Measurement I.
(2-3) Cr. 3. W.
Prerequisite: 215.
Theory and practice of optical tooling methods as applied to projects in research and industry. Use of mechanical and electrical strain gages for static and dynamic testing.

416. Advanced Methods of Precise Measurement II.
(2-3) Cr. 3. S.
Prerequisite: 215.
Theory and practice in the precise measurement of long distances using tape and radar equipment. Elements of geodesy as applied to measurement of the earth's shape and precise determination of geodetic positions.
258/Description of Courses

417. Land Surveying.
(1-6 or 3-9) Cr 3 or 6. F.
Prerequisite: 113.
A study of the methods used for the original government land surveys. Land subdivision and boundary retraction. Legal aspects of land surveying.

418. Aerial Photogrammetry.
(1-6) Cr 3 W.
Prerequisite 112, 113 or 310
Mapping by use of aerial photographs. Preparation of map and controlled mosaic from photographs of area near campus.

425. Introduction to Sanitary Engineering.
(3-2) Cr 4. F.S.
Prerequisite: Chem. 103, credit or classification in Bact. 250 or Bact 304
Introduction to those studies in which engineering knowledge is applied to problems concerning public health, including: water and waste water treatment, the prevention and control of air pollution, stream pollution and communicable diseases.

(2-2) Cr 3 W.
Prerequisite: 304, 425, E.M. 378
Engineering aspects of collection, pumping, storage and distribution of water for public, domestic and industrial uses. Design of water supply systems.

427. Sewerage.
(2-2) Cr 3. F.S.
Prerequisite: 304, 425, E.M. 378
Engineering aspects of collection of storm, sanitary and combined sewage. Design of storm and sanitary sewerage systems.

(3-0) Cr 3. W.
Prerequisite: 425.
The sanitary engineer's responsibility in public health and hygiene. Organization, administration and operation of public health agencies.

432. 432A. Analysis of Statical Indeterminate Structures.
432. (3-4) Cr 5 F.W. 432A: (4-0) Cr 4 W.S.
Prerequisite: 331, E.M. 324.

433. 433A. Structural Design in Steel.
433 (3-4) Cr 5 W.S 433A: (4-0) Cr 4. F.S.
Prerequisite: 432, E.M. 354, credit or classification in E.M. 327 or 337.
Design and behavior of the elements of steel structures, proportioning of members and connections, introduction to plastic design. 433A: Primarily for architectural students.

434. 434A. Reinforced Concrete Design.
434: (3-4) Cr 5 F.S 434A: (4-0) Cr 4. F.W.
Prerequisite 432, E.M. 354, credit or classification in E.M. 327 or 337.
Design and behavior of elements of reinforced concrete structures such as beams, columns, footings and slabs. Introduction to prestressed concrete. 434A: Primarily for architectural students.

448. Advanced Structures.
(3-0) Cr. 3. W.
Prerequisite: Credit or classification in 434
Selected topics from prestressed concrete, ultimate theory of reinforced concrete, limit design, space frames, model analysis, slope deflection, column analogy, etc. Design of rigid frame structure.

449. Structural Projects.
(3-0) Cr 3 S.
Prerequisite: Credit or classification in 433
Structural planning and designing of engineering projects, such as buildings and bridges.

450. Traffic Engineering.
(3-3) Cr 4 F
Prerequisite: Stat 201 or 201A or 201B.

453. Designing Transportation Facilities.
(3-3) Cr 4 W
Prerequisite: 304, 352, E.M. 378.
Location and safe geometric design of highway and railway facilities. Earthwork and drainage relative to highway, railway and airport design. Right of way acquisition and final plans and specifications.

460. Foundations.
(3-0) Cr. 3. S.
Prerequisite: 360, 361, 434.

(2-2) Cr 3. S.
Prerequisite: 304
Characteristics of flow in natural and artificial channels; hydraulic design of culverts, bridge waterway openings, spillways, stilling basins, hydraulic gates and gated structures, miscellaneous water control structures.

(3-2) Cr 4. F.S.
Prerequisite: Credit or classification in E.M. 354
Quantity surveys, cost keeping, letting procedures and contract documents, form design, construction methods and equipment. Relations between contractor, owner, and engineer.

486. Civil Engineering Specifications.
(3-0) Cr. 3 S.
Prerequisite: Stat 201B, credit or classification in I.A. 365A.
The preparation of specifications for structures, highway, and public works developments.

490. Advanced Civil Engineering.
By conference Cr 1 to 6 F.W. S.S.
Prerequisite: Permission of instructor.
Any phase of civil engineering in which the student has done exceptionally strong work.

496. 497. Professional Development.
Cr R F.W.
Oral reports and discussions on engineering organizations, technical and professional societies, governmental bureaus, ethics, and registration.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates*

505. Public Works Engineering. (3-0) Cr. 3 S
Prerequisite 427
Job classification and specification; construction contracts and specifications; unit costs, special assessments, building codes; fire protection; refuse collection and disposal; street and road maintenance, subdivision design and layout.

520. Water and Waste Water Analysis. (0-9) Cr. 3 to 6 W
Prerequisite 425, Chem 211 or 214.
Review of the principles of gravimetric, volumetric, and colorimetric methods of analysis. Application of these principles to the laboratory analysis of water and waste water samples.

521. Field Hydrology. (2-3) Cr. 3 F
Prerequisite 304
Collection and analysis of field data concerning precipitation, water losses and stream flow. Use of current hydrologic techniques in hydrologic studies.

522. Water Pollution Control Plant Design. (2-3) Cr. 3. W
Prerequisite 304, 425, EM 378.
Investigation and planning activities used to evaluate need for water pollution control facilities and design of such facilities.

523. Water Treatment Plant Design. (2-3) Cr. 3 S
Prerequisite 304, 425, EM 378.
Investigation and planning activities used to evaluate adequacy of existing municipal water supply and treatment facilities. Design of municipal water treatment facilities.

524. Multiple Use of Water Resources. (2-3 to 12) Cr. 3 to 6 W.
Prerequisite 304.
Social, economic and technical phases of governmental participation in public works programs in the field of water resources. Study of multi-purpose uses in water resources project planning.

526. Industrial Waste Treatment. (3-0) Cr. 3. Alt. S
Prerequisite 522
Investigation of industrial waste treatment problems and methods of treatment. Study of unit operations required in industrial waste treatment methods.

527. Radioactivity in Air, Water and Food. (2-3) Cr. 3 S
Prerequisite: Nuc.E. 510, Chem. 408.
Principles and methods of sampling, identifying and measuring radio-nuclides in air, water and food.

532. Structural Analysis by Numerical Procedures. (3-0) Cr. 3 F
Prerequisite 432
Analysis of structural problems by methods of successive approximations and numerical procedures. Moments and deflections of beams, influence lines, moments and deflections of beams under combined axial and bending loads, buckling strength of columns and frames, beams on elastic foundations.

534. Advanced Structural Analysis. (3-0) Cr. 3 F
Prerequisite 432
Rigid frame analysis based on energy concepts, consistent deformation, slope-deflection, moment distribution and column analogy.

535. Structural Testing. (2-1) Cr. 3 F
Prerequisite 424, credit or classification in EM 517 or 518.
Study and adjustment of errors inherent in optical, mechanical and electrical measurement equipment used in structural research projects that involve the determination of strains, deflections and rotations in test specimens subjected to static or dynamic loading.

536. Bridge Design. (3-0) Cr. 3 S
Prerequisite 433, 434
The bridge as a unit in a transportation system. Clearance requirements for traffic. Economic principles governing the design and relationship of trusses, girders, floors, and bracing. Advantages and limitations of continuous structures. Aesthetic features.

538. Model Analysis of Structures. (3-0) Cr. 3. W
Prerequisite Credit or classification in 433 or 434.
Theoretical and experimental model analysis of structures. Use of devices and mechanisms for measuring load effects on plane and space structures.

539. Prestressed Concrete Structures. (3-0) Cr. 3 F
Prerequisite 434
Principles of prestressed concrete with applications to structural design.

540. Behavior of Reinforced Concrete Members. Cr. 3 to 6 F
Prerequisite 434.
A study of the actual behavior and strength of reinforced concrete members by reviews of experimental and analytical investigations. Flexural members, combined flexure and shear, axially loaded columns, combined flexure and axially loaded members, bond.

544. Plastic Analysis and Design of Structures. (3-0) Cr. 3 W
Prerequisite Credit or classification in 433
Analysis and design of metal structures by plastic theory. Behavior of metal structures beyond elastic limit.

547. Analysis and Design of Plate and Shell Type Structures I. (3-0) Cr. 3 S
Prerequisite E.M 514
Analysis and design of plate and shell type structures with particular emphasis on those methods which yield practical solution to structural problems.

552. Bituminous Paving Materials. (3-0) Cr. 3 F
Prerequisite 355
Source, manufacture, processing, types, constituents, tests, chemical behavior, specifications, and uses of bituminous materials and aggregates in pavements.

553. Traffic Engineering Planning and Analysis. (3-3) Cr. 3 F
Prerequisite: 433.
Principles of highway and street traffic planning, traffic analysis by electronic computer methods, driver, vehicle and roadway characteristics, location, safety and capacity of traffic ways.
554. Traffic Engineering Design and Control.
   (3-3) Cr. 4. F. W. 
   Prerequisite: 552. 
   Principles of street and highway traffic design for safety and control, arterial ways, one-way streets, traffic signals, signs, markings and lighting, channelization, speed regulation and zoning.

556. Design of Aerospace Traffic and Transportation Facilities.
   (3-3) Cr 4. S. 
   Prerequisite: 453. 
   Historical development, legislation, finance, zoning and operation of aerospace transport facilities. The installation of lighting and electronic traffic aids for taxiways, runways, approaches and airways. The planning, location and design of heliports, airports and spaceports.

560. Advanced Soil Engineering.
   (3-3) Cr 4. F.S.S. 
   Prerequisite: 360, 361. 
   Advanced treatment of theories and principles of soil mechanics. Shearing strength, stress distribution, seepage, bearing capacity, retaining wall pressures, piles foundations, slope stability, consolidation and settlement analysis. Applications to design problems.

561. Soil Stabilization.
   (3-3) Cr 4. F. 
   Prerequisite: 360, 361. 
   Requirements for, and factors affecting, soil stability. Methods of soil stabilization. Design and testing of stabilized soils.

   (2-6) Cr 4. S. 
   Prerequisite: 360, Geol 202 or 374. 
   Recognition, identification, and mapping of engineering soils from airphotos. Unconsolidated deposits, rock types, orientations and drainage patterns; weathering and soil profiles; landslides, fractures and faults. Field checking of interpretations.

563. 564. Advanced Soil Engineering Laboratory. 
   (0-6 to 9) Cr. 2 to 3 each. F.W. 
   Prerequisite: 561. Permission of instructor. 
   564. Credit or classification in 560. 
   Advanced theory and techniques of soil engineering measurements. Analysis of soil and expansive clays by X-ray diffraction and differential thermal techniques. Triaxial shear, consolidation, permeability, capillarity testing and analyses; relation of hydrostatic excess pressures and compositional influences. Field bearing tests.

573. Ground Water Hydrology.
   (3-0) Cr 3. S. 
   Prerequisite: 304. 
   Study of ground water as a source of municipal, industrial, agricultural water supplies; location, occurrence, hydraulicsof flow; determination of aquifer and well characteristics; well discharge and pumping test analyses.

585 Highway Construction Methods.
   (2-2) Cr. 3. S. 
   Prerequisite: 355, credit or classification in 485. 
   Methods and equipment used in processing materials and constructing highways and their appurtenances; scheduling and controlling operations; compliance with specifications.

586. Heavy Construction Methods.
   (3-0) Cr. 3. W. 
   Prerequisite: Credit or classification in 485. 
   Methods and equipment employed in heavy construction including pile, caissons, heavy foundations, piers, coffer dams and river-works; heavy concrete structures, retaining walls, tunneling and dam projects.

590 Special Topics.
   Cr 1 to 5 each time elected F.W.S.S.S.

*An undergraduate student must have an academic standing in the upper one-half of his class in order to enroll in any 500 level Civil Engineering course.

COURSES FOR GRADUATE STUDENTS, major or minor

606. Municipal Management. 
   Cr 3 to 6. F. 
   Utility management, planning improvements, sources of funds, labor relations, public relations, coordination of departments.

622. Advanced Topics in Water Pollution Control. 
   Cr 3 to 6. F. 
   Prerequisite: 522. Messrs. Baumann, Cleasby. 
   Study of advanced concepts in water pollution control. Analysis and application of current developments to pollution control methods.

623. Advanced Topics in Water Treatment. 
   Cr. 3 to 6. Alt. F. 
   Prerequisite: 523. Messrs. Baumann, Cleasby. 
   Study of advanced concepts in water treatment. Analysis and application of current developments to water treatment methods.

634. Suspension Bridges. 
   (3-0) Cr 3. W. 
   Prerequisite: 534. Mr. Ekberg. 
   Comparison of analysis of elastic theory, conventional deflection theory, and difference equation method. Consideration of other types of suspended structures.

644. Space Frames. 
   Cr 3 to 6. F. 
   Prerequisite: 534. Mr. Ekberg. 
   Analysis of complete structures in three planes, including the continuous-frame and the truss-frame types. Interpretation of load strain and displacement measurements.

646. Dynamic Analysis of Structures. 
   Cr 3 to 6. F. 
   Prerequisite: 432. Mr. Umtrauer. 
   Theoretical and experimental studies of the dynamic effects upon structures caused by machines, vehicles, impact loads, wind and earthquake.

648. Analysis and Design of Plate and Shell Type Structures II. 
   (3-0) Cr 3. F. 
   Prerequisite: 547, Math. 322. Mr. Lee. 
   Advanced topics in the analysis and design of plate and shell type structures.

652. Bituminous Pavement Design. 
   (3-3) Cr 4. W. 
   Prerequisite: 552. Mr. Csanyi. 
   Theory and practice in design and manufacture of bituminous paving mixtures and construction of bituminous pavements. Laboratory tests for design and their correlation to service behavior.

653. Street and Urban Highway Design. 
   (3-3) Cr 4. W. 
   Prerequisite: 553. Mr. Csanyi. 
   Design of city streets, involving cross section, intersections, subsurface utilities, on-and-off-street parking, mass transportation, loading facilities, widening, channelization, drainage and the design of structures required for city streets.
654. Highway Location and Design.  
**Prerequisite:** 553, Mr. Csanyi.  
Route selection, geometric design, economic aspects, traffic capacity, and roadway appearances of non-urban roads and highways.

655. Highway Administration and Finance.  
**Prerequisite:** 5. F. Mr. Csanyi.  
Organization and function of highway department's administrative procedures; financial plans, revenues, budgets and controls; sources of revenue.

656. Planning Highway Transportation Systems.  
**Prerequisite:** 553, Mr. Csanyi.  
Fundamentals and coordination of transportation systems. Regional planning, planning surveys, designation of road and street systems. Mass transportation and location and type of urban facilities.

**Prerequisite:** 560, Mr. Sheeler.  
Advanced substructure analysis and design to meet various soil conditions: footings and rafts, shoring and underpinning, piles, retaining walls, cofferdams, caissons, breakwaters, wharves and piers, bridge piers and abutments; theory of loads and supporting strengths of sewers, water mains, gas lines, culverts and tunnels.

661. Highway Soil Engineering.  
**Prerequisite:** 560, Mr. Demirel.  
Stability, stress-strain characteristics and bearing capacity of subgrades; subsurface drainage, frost action and related phenomena. Principles of flexible and rigid pavement design.

663. Earth Dams.  
**Prerequisite:** 665. Cr. 3. W.  
Location, selection of material, design and construction of earth dams.

**Prerequisite:** 563. Messrs. Handy, Demirel.  

690. Research.  
Graduate faculty in C.B.

699. Seminar.  
**Cr. R.**

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**CLIMATOLOGY AND METEOROLOGY**

### Opportunities for Undergraduate Study

The following specific courses in climatology and meteorology are available to undergraduate students: Agron. 206 and 406, Geophysics 320, 341, 342, and 343. Related and supporting work is offered in the Departments of Physics, Agronomy, Statistics, Botany and Mathematics. A program of study in physics, mathematics and meteorology is available for those who wish to do graduate work at colleges which offer advanced degrees in meteorology. An undergraduate minor is available but not a major.

### Opportunities for Graduate Study

Graduate study in the field of meteorology is administered by the Department of Earth Science, whereas graduate study in agricultural climatology is administered by the Department of Agronomy.

Prerequisite to graduate work in geophysics (meteorology) is the satisfactory completion of a suitable undergraduate curriculum, including five quarters of college mathematics through differential and integral calculus; three quarters of college physics based upon a year of college mathematics; three quarters of chemistry; three quarters of meteorology, including physical meteorology with laboratory work in map and chart analysis, and dynamic meteorology (Geophysics 341, 342, 343). Also desirable are courses in statistics and differential equations and elementary courses in geology, climatology and hydrology.

The Master of Science degree is offered in agricultural climatology. Graduate students working toward the Doctor of Philosophy degree in agronomy may specialize in agricultural climatology. Supporting work usually will be taken in physics, statistics and botany.

Prerequisite to graduate work in the field of agricultural climatology is the completion of five quarters of college mathematics, through differential and integral calculus, two quarters of college physics, elementary courses in statistics, meteorology and botany and the following courses in agronomy: 114, 154, 354, 464.
Opportunity for Undergraduate Study

A curriculum in computer science is not offered for the baccalaureate degree. However, there are a number of undergraduate courses which are available in the various departments which offer training in this area. These include:

- Math. 109 (IE 109) Introduction to Digital Computers
- Math. 215 Introduction to Numerical Techniques for Computers
- Stat. 380 (Math 380) Introduction to High Speed Computing
- Math. 407 Finite Difference Calculus
- Math. 408 Introduction to Numerical Analysis
- Stat. 480 Processing of Data
- Stat. 481 Processing of Statistical Data
- EE 410 Introduction to Electronic Computers
- EE 426 Recurrent Transient and Digital Circuits

Undergraduates wishing to prepare for graduate study in computer science should develop a strong background in an area such as mathematics, statistics, physics or electrical engineering in addition to electing selections from the above list.

Opportunity for Graduate Study

Major work in computer science is offered for the degrees of Master of Science and Doctor of Philosophy under a cooperative arrangement with the Departments of Mathematics Statistics and Electrical Engineering. Minor work is offered to students taking major work in other areas.

Facilities exist in these departments for fundamental research in such areas as numerical solution of ordinary and partial differential equations, computational methods of linear algebra, linear programming, simulation, Monte Carlo calculations and statistical problems, the theory of approximation, logical design and programming systems.

A student majoring in computer science will choose a major professor from the graduate faculty membership of the cooperating departments, and will develop his program of study under the guidance of a committee nominated by the coordinating committee and appointed by the Dean of the Graduate College.

CROP SCIENCE

For description of courses, see Agronomy

DAIRY AND FOOD INDUSTRY

Verner H. Nielsen, Ph.D., Head of Department


Assistant Professors: Warren S. Clark, Ph.D.; William S. LaGrange, Ph.D.; Lothar E. Leistner, D.V.M.; Dorris A. Lillard, Ph.D.; F. C. Parrish, Ph.D.
Opportunities for Undergraduate Study

Dairy Industry

The various options of the dairy industry curriculum provide the student with opportunities for selecting an academic course of study which will prepare him best for that phase of the industry in which he intends to build a career. All the options are based on courses in the physical and biological sciences which, in other courses, are applied to the technology of processing, packaging and marketing of milk and milk products. In the business option this core is supplemented by courses emphasizing fiscal operations, marketing and organization. In the science option it is augmented by thorough training in mathematics, physics and chemistry. This option is excellent preparation for students interested in research careers or in graduate study.

Students who wish to combine training in chemistry, mechanical engineering or chemical engineering with dairy industry may arrange special 5-year programs which will lead to Bachelor of Science degrees in dairy industry plus one of the other selected fields.

Food Technology

Food technology is concerned with technological application of the sciences and engineering to the manufacture, transportation, storage, distribution and utilization of food products. It is based on the fundamentals of biology, chemistry, microbiology and physics and is applied through engineering operations. Opportunities for persons trained in food technology may be found in the following functional branches of this field:

1. Processing and manufacture of food products
2. Quality control in the procurement, processing, manufacture, distribution and utilization of food products.
3. Economics of food processing, distribution, and consumption.
4. Legal specifications relative to composition, quality and safety of food products.
6. Research and development in food products and their by-products.

Because of the complexity of the field of food technology, undergraduate training emphasizes the physical and biological sciences, although some work specifically applied to food technology is included. In addition, three months of practical work in a food industry is required.

Opportunities for Graduate Study

Dairy Industry

The department offers major work for the degree Master of Science in dairy industry, including dairy plant management, dairy bacteriology, dairy chemistry and the manufacture of dairy products and major work for the degree Doctor of Philosophy in dairy bacteriology and dairy chemistry in cooperation with basic science departments and minor work to students taking major work in other departments.

Courses open to graduate students for minor only: 304, 306, 347, 348, 349, 350, 404, 413, 414, 425, 458, 491, 492, 493, 494, 495.

Food Technology

Major work is offered for the degrees Master of Science and Doctor of Philosophy in food technology. Graduate study in meats is offered as a joint major in meat science and food technology.

Prerequisite to major graduate work is the satisfactory completion of a suitable undergraduate curriculum, including courses in mathematics through differential and integral calculus; a year of physics; chemistry (the equivalent of about eight quarters of chemistry, usually including inorganic, qualitative, quantitative and organic); one year in biology (botany and/or zoology) and one course in general bacteriology.

Ordinarily the candidate's graduate committee will require, in addition to training in statistics and chemical engineering, the following courses for the doctorate: Bact. 501, 535 and Chem. 323, or 484, 530, B. and B 501, or substitutions approved by the candidate's graduate committee.
COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Technical Lectures. (1-0) Cr. R. F.
Field of dairy and food industry, its opportunities, requirements, and organization.

114. Elements of Dairy and Food Industries. (3-3) Cr. 4. F.W.S. Mr. Rosenberger.
Development and organization of the dairy and food industries; methods of processing dairy and food products, and quality control of these products.

*152. 153. Dairy Technology. (3-3) Cr. 4 each. F.W. Mr. Mr. Rosenberger.

*156. Analysis of Milk and Milk Products. (2-6) Cr. 4. F.
Composition and analysis of milk and milk products

*157. Butter Manufacture. (3-3) Cr. 5. W Mr. Nielsen.
Quality of milk and cream, separation of milk, cream ripening, starters, churning, and preparing butter for market

*158. Ice Cream and Ices. (3-6) Cr. 5. W Mr. Caulfield.
Selection and preparation of materials, processing and merchandising of plain and fancy ice creams and related products.

*159. Cheese Manufacture. (3-3) Cr. 5. W Mr. Reinbold.
Principles of cheese manufacture. Soft cheese, cheddar, and other cured cheese; manufacture, curing, and marketing.

207. Judging Dairy Products. (0-3) Cr. 1 W Mr. Rosenberger
Systematic organoleptic evaluation of milk products.

216. Fundamentals of Dairy Technology. (3-0) Cr. 3 W
Prerequisite: 114. Math 101, Chem 231 or 334 or permission of instructor. Mr. Hammond
Composition of milk; chemical phenomena important in dairy products manufacturing.

256. Market Milk. (3-6) Cr. 5. F Mr. Rosenberger
Processing and marketing of fluid milk products.

*258. Condensed and Dried Milk Products. (3-3) Cr. 4 F Mr. Caulfield
Manufacture of condensed and dried milk products.

*260. Dairy Plant Management. (4-6) Cr. 6 W Mr. Caulfield
Principles of management of creameries and other dairy plants.

*265. Dairy Bacteriology. (3-9) Cr. 6. F. Mr. Clark
Importance of bacteria in dairy products. Determination of numbers and types of bacteria in dairy products and their significance.

*269. Dairy Equipment. (2-2) Cr. 3. F
Design, construction and functioning of processing equipment for the dairy industry.

304. Manufacture of Butter. (3-6) Cr. 5 W
Prerequisite: 216 or Chem. 211; 350 concurrently. Mr. Nielsen

*For students in Dairy Plant Operation.

Separation and preparation of cream for butter manufacture, churning theories and practice based on knowledge of the physical and chemical properties of milk fat. Application of chemistry and microbiology to the control of butter quality.

305. Market Milk. (3-6) Cr. 3 or 5. S
Prerequisite: 216 or Chem. 211; 350. Mr. Rosenberger.
The application of microbiology, chemistry and mechanics to the procurement, processing and distribution of market milk; sanitary standards, control of chemical and bacteriological defects.

306. Manufacture of Ice Cream and Related Products. (3-6) Cr. 5 S
Prerequisite: 216 or Chem. 211; 350. Mr. Caulfield.
Selection and processing of ingredients. Theory and practice of manufacturing procedures, based on fundamental chemical, microbiological and engineering information.

308. 309. Judging Dairy Products. (0-3) Cr. 1 each. W.S. Mr. Rosenberger.
Systematic organoleptic evaluation of milk products.

315. Domestic and Foreign Cheeses. (3-6) Cr. 5. S
Prerequisite: 216, 350. Mr. Reinbold.
Application of microbiological and chemical principles to the technology of manufacturing, ripening and marketing of domestic and foreign varieties of cheese.

347. 348. Dairy Chemistry. (B. and B. 347, 348) (3-0 or 6) Cr. 3 or 5 each. Alt. F.W. Offered 1966.
Prerequisite: 347 Chem 211, 335. Mr. Bird 347: Composition and changes in composition of milk in the light of milk secretion theory. The application of pH and of colloidal chemistry to dairy products manufacture. 348: Importance of milk salts, milk fat, milk fat emulsion, milk proteins and milk enzymes to the processing and keeping quality of dairy products.

349. Food Chemistry. (B and B 349) See Biochemistry and Biophysics

350. Dairy Microbiology. (Bact. 350) (3-6) Cr. 5 W
Prerequisite: Bact. 304 Mr. Clark

404. Condensed and Dried Milk Products. (3-3) Cr. 4. F.
Prerequisite: 216 or Chem. 211. Mr. Caulfield
Manufacture of condensed and dried milk products, casein and milk sugar.

407. Special Problems in Dairy and Food Technology. (0-6 or 9) Cr. 2 or 3. F.W. S.SSI. II.
Prerequisite: Junior classification, quality point average of 2.5 or more for preceding two quarters. Staff.
Advanced study related to the processing of dairy and other food products.
H. Honors Program.
413. Food Preservation. 
(3-6) Cr. 5. F. 
Prerequisite: Bact. 304. Mr. Ayres. 
Preservation, maintenance of quality of food products. Field trips.

414. Food Sanitation. 
(3-6) Cr. 5. S. 
Prerequisite: Bact 304 Mr Walker. 
Regulations governing foods, sanitation and safety of foods. Field trips.

450. Special Dairy Microbiology. 
(Bact. 450) Cr. 2 to 6 F W S. 
Prerequisite 350, junior classification, quality point average of 2.5 or more for preceding two quarters. Messrs. Clark, Reinbold. 
Laboratory investigations, assigned readings, and reports on microbiological problems of milk products.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Microbial Food Infections and Toxins. 
(Bact 510) (2-3) Cr. 3. S. 
Prerequisite: Bact 300 or 304, permission of instructor. Mr. Clark. 

511. Milk Cultures and Fermentations. 
(Bact 511) (2-3) Cr. 3 W. 
Prerequisite 350 Mr Reinbold. 
Function and utilization of microorganisms in the manufacture of cultured milk products. Relationship of metabolism, chemical and physical conditions to quality of product.

512. Food Technology. 
(3-0) Cr 3 Alt F Offered 1965. 
Prerequisite: Bact 304, permission of instructor. Messrs Ayres, Bird. 
Selected topics in food technology presented by staff members and industry leaders in research, manufacturing and marketing.

COURSES FOR GRADUATE STUDENTS, major or minor

623. Lipid Chemistry. 
(B. and B 623) See Biochemistry and Biophysics.

640. Food Proteins. 
(3-0) Cr 3 Alt F Offered 1965. 
Prerequisite B and B 501 or permission of instructor. 
Fundamental properties of protein systems found in milk, eggs, meat and cereal grains. Effect of processing on food proteins.

656. Systematic Dairy Microbiology. 
(Bact 656) (19) Cr. 4 W. 
Prerequisite 350 Mr Reinbold. 
Identification and classification of microorganisms commonly found in milk products.

458. Milk Sanitation. 
(2-6) Cr. 4 S. 
Prerequisite: Bact 350 Mr. Clark. 
Supervision of milk and ice cream supplies from the standpoint of sanitation requirements of milk ordinances. Field trips.

491. 492. 493. Food Processing Equipment. 
(3-3) Cr. 4 each Yr. 
Prerequisite: Math 110. Phys 111. 1 Ed. 154 or permission of instructor. 
Design and operation of food processing equipment considering materials handling, heat and mass transfer, fluid mechanics, steam, refrigeration and automation. Field trips.

494. 495. Management of Food Processing Plants. 
(3-0) Cr 3 each W S. 
Prerequisite: 304, 305, 306. Mr. Caulfield. 
Design, organization and operation of food manufacturing plants.

547. Food Technology. 
(2-0) Cr 2 Yr. 
A. Concentration; drying; thermal processing. F 1966. 
C. Packaging; flavors; flavor evaluation. S. 1967. 
E. Federal, state and local regulations; additives; toxicology S 1966.

559. Advanced Dairy Microbiology. 
(Bact 559) (3 or 6) Cr. 3 or 5 F. 
Prerequisite 350 Mr Reinbold. 
Intensive study of microorganisms in milk products. Importance of beneficial and defect-producing microorganisms in manufacturing, packaging and storing milk products.

570. 571. Molecular Biology of Muscle. 
(An S. 570, 571) See Animal Science.

572 Microbiology of Meats 
(An S 572) See Animal Science.

DAIRY SCIENCE
For description of courses, See Animal Science.
Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in geology, leading to the degree of Bachelor of Science, see Sciences and Humanities, Curriculum.

The department offers fundamental courses in geology and geophysics designed to give the student a knowledge of the composition of the earth, the processes which are at work upon it, and its history. For those who plan to engage in professional work in geology or geophysics a sequence of more advanced courses in the various subdivisions of the science is provided, continuing through the junior and senior years. In the senior year such students may take courses particularly applicable to specialized fields of geology. Graduate work is essential for those planning to engage in professional geological or geophysical work.

Undergraduate geology majors in this department usually have included the following basic courses in their programs: Geology 100, 253, 300, 354, 355, 356, 435, 460, 461 and 9 additional credits in courses numbered above 300. As supporting work the following courses are desirable: Zool. 101, 102; Chem 103; Engl 205, 414; Math. 213; Phys. 223; Geophys. 309, 440. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for graduation. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Minor work should be taken in two of the following: chemistry, chemical engineering, mathematics, statistics, physics, zoology, civil engineering.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in geology and minor work to students taking major work in other departments. Work may be taken for the degree of Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Students desiring to major in geology should have completed the equivalent of the following courses: Geology 300, 354, 355, 356; and 434, 435, or 454, 455, 460, 461; Geophysics 440.

Minor work usually is recommended in chemistry, mathematics, physics, soils, soils engineering, or zoology.

Open to graduate students for minor only are: Geology 355, 401, 402, 434, 435, 436, 454, 455, 460, 461; Geophysics 440.

GEOLOGY

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Introduction to Geology.
(0-6) Cr. 3. F.W.S.S.S. Staff.
The astronomical relationships of the earth; the nature and effects of internal and external earth processes and an introduction to the history of the earth and of life upon it. Occasional field trips will be included.

(3-0) Cr. 3. F65, S66, W67 (all yrs.) Prerequisite: 100 Messrs. Biggs, Hussey, Lemish.
Types of mineral resources; their geologic distribution in time, space, and environment; their manner of occurrence or origin; need and methods for conservation.

201. Life in the Geologic Past.
(3-0) Cr. 3. F66, W66, S67 (alt. yrs.) Prerequisite: 100. Mr. Vondra.
Significant events in the development of life upon earth. Principles by which fossils can be used for reconstructing environments of the past. The pattern and principles of development of life as they relate to modern fauna and flora.

253. Elementary Petrology.
(1-6) Cr. 3. S. Prerequisite: 100. Mr. Vondra.
The classification, identification and description of the common rocks and rock-forming minerals. Field trips.
300. Summer Field Work. 
Cr 8-12 SS Messrs. Hussey, Vondra. 
Eight weeks summer camp following sophomore year, required of all geology majors. A real mapping, structural and stratigraphic analyses, written report with appropriate illustration required.

304. World Geography. 
(3-0) Cr 3 F.W. 
Prerequisite 100 Mr. Hussey. 
World-wide consideration of the elements of geography, physical and cultural, and the interrelation between them and man. Not acceptable as credit toward a major in geology.

305. Economic Geography. 
(3-0) Cr 3 S. 
Prerequisite 100, Mr. Hussey. 
Geographic occurrence and distribution of natural resources; their relations to commercial and industrial enterprises. Not acceptable as credit toward a major in geography.

331. Geologic Interpretation of Aerial Photographs. 
(1-6) Cr. 3 S. 
Prerequisite 100, Mr. Hussey. 
Principles of aerial photography and the use of aerial photographs in the analysis and interpretation of landscapes and geologic structures.

354. Structural Geology. 
(3-3) Cr 4 W. 
Prerequisite: 100, permission of instructor Mr. Lemish. 
Structure of earth’s crust and interpretations of rock structures.

355. Mineralogy. 
(2-6) Cr. 4 F. 
Prerequisite: Chem. 102 Mr. Biggs. 
Geochmistry of silicates and other rock-forming minerals; determinative mineralogy.

356. Petrology. 
(2-6) Cr. 4 S. 
Prerequisite: 253, 355 Mr. Biggs. 
Physical, mineralogical, textural and structural characteristics of rocks, origin and distribution. Field trips.

374. Geology for Engineers. 
(2-3) Cr 3. F.S. Mr. Sendletn. 
Fundamentals of the science and engineering application. Field trips.

399. Special Problems. 
Cr 2 to 4 each time elected. F.W.S. 
Prerequisite: Elementary geology, permission of department head H. Honors Program.

(3-0) Cr 3 each W.S. 
Prerequisite 253, 354 Mr. Lemish. 

434 Economic Geology: Principles and Processes. 
(3-3) Cr 4 F. 
Prerequisite: 354, 356 Mr. Lemish. 
Nature and origin of mineral deposits.

435. Invertebrate Paleontology. 
(2-6) Cr. 4 F. 
Prerequisite 100 or 201, permission of instructor Mr. Vondra. 
Characteristics and relationships of invertebrates of fossil record; their use in historical geology. Field trips.

454. Optical Mineralogy. 
(2-6) Cr 4 W. 
Prerequisite 355 Mr. Biggs. 
Study of minerals with polarizing microscope; optical characteristics of principal rock-forming minerals.

455 Economic Geology. 
(3-0) Cr 3 W. 
Prerequisite: 434 Mr. Lemish. 
Geology applied to mining; significant deposits and districts.

460. Geomorphology. 
(3-3) Cr. 4. F. 
Prerequisite: 354, permission of instructor Mr. Hussey. 
Origin and distribution of land forms; principles involved in the interpretation of that portion of the geologic record related to landscape development; some economic aspects of geomorphology.

461. Stratigraphy. 
(3-3) Cr 4 S. 
Prerequisite: 356, permission of instructor Mr. Vondra. 
Principles of interpreting the geologic record. Significant events of the geologic past.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

554. Advanced Structural Geology. 
(3-2) Cr 3. W. 
Prerequisite: 354, permission of instructor Mr. Lemish. 
Review of current theories of rock deformation and advanced problems in metamorphic, igneous and sedimentary structures.

555. Clay Mineralogy. 
Prerequisite: 355 Mr. Biggs. 
Origin and occurrence of clay minerals; their chemical and physical properties, X-ray diffractiion, classification and identification.

557. 558. Advanced Petrology and Petrography. 
Prerequisite: 356, 454 Messrs Biggs, Roy. 

566. Seminar. 
Cr. 1 each time elected. P.W.S. Staff. 
Required of all graduate students and open to advanced graduate students with approval of the head of the department.

567. Invertebrate Paleontology. 
(2-6) Cr 4 W. 
Prerequisite: 435 Mr. Vondra. 
Application of paleontology to stratigraphic correlation and interpretation of Paleozoic earth history. Field trips.

569. Micropaleontology. 
(2-6) Cr. 4 F. 
Prerequisite: 435 Mr. Vondra. 
Fossil protozoa and other small organisms in relation to stratigraphic geology. Field trips.

572. World Structural Geology. 
(3-0) Cr. 3 Alt W. Offered 1966. 
Prerequisite: 354, 356 Messrs. Hussey, Roy. 
The distribution and dynamic history of sedimentary basins and mountain ranges of the world.
COURSES FOR GRADUATE STUDENTS, major or minor

664. Special Topics.
Cr. 1 to 3 each time taken.
A. Geomorphology. Mr. Hussey.
B. Stratigraphy. Mr. Vondra.
C. Paleontology Mr. Vondra.
F. Micropaleontology Mr. Vondra.
H. Geophysics. Mr. Sendlein.

665. Research.
Cr. 1 to 3 each time taken.
A. Geomorphology Mr. Hussey.
B. Stratigraphy. Mr. Vondra.
C. Paleontology Mr. Vondra.
F. Micropaleontology Mr. Vondra.
H. Geophysics. Mr. Sendlein.

GEOPHYSICS

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

206. Agricultural Meteorology.
(Agron. 206) See Agronomy.
309. Introduction to Geophysics.
(3-0) Cr. 3. S
Prerequisite: Geol 300, Phys 113 or 223.
Application of physical principles to the determination of subsurface rock structure and/or boundaries. Area of study includes seismology, gravimetry, magnetometry, and the techniques of electrical and radioactivity surveying.

320. Descriptive Meteorology.
(3-0) Cr. 3 F
Prerequisite: Phys. 112 or 113 or 222
Significant weather processes. Composition and structure of the atmosphere, condensation and precipitation, wind-pressure relations, air masses and fronts, cyclones and anti-cyclones.

341. 342, 343. General Meteorology.
(3-1) Cr. 4 each yr
Prerequisite Phys 223 or 232, Math 212
341: Composition and structure of the atmosphere; hydrostatics, thermodynamics, stability; radiation and heat balance; meteorological observations and instruments; weather maps, codes and charts. 342. Equations of motion; geostrophic gradient, thermal and isallobaric winds; air masses, fronts, cyclones and anticyclones. 343. General circulation, turbulence; condensation and precipitation, atmospheric electricity and optics; climatic fluctuations.

406. Climates of the Continents.
(Agron 406) See Agronomy.

440. Petrophysics.
(2-2) Cr. 4 W
Prerequisite Geol 300, 354, 356; Math. 213; Phys 223 or permission of instructor. Mr. Sendlein.
A study of the physical properties of rocks, including porosity, permeability, elastic properties, and heat and electrical conductivity. Rocks will be studied through laboratory investigations to establish their relationship to natural geologic materials and processes.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

508. Micrometeorology.
(3-0) Cr. 3. S
Prerequisite 242.
Fundamental meteorological processes occurring in the layer of air near the ground; heat exchange, radioactive transfer, water vapor transfer. Influence of topography, vegetation cover and soil conditions on the microlayer.

ECONOMICS AND SOCIOLOGY

Karl A. Fox, Ph.D., Head of Department


ECONOMICS

Opportunities for Undergraduate Study

Programs of study offered in both the College of Agriculture and the College of Sciences and Humanities are outlined in this section. Information for students who wish to specialize in the study of international affairs while majoring in economics may be found under the heading International Service Programs.

College of Agriculture

Agricultural business is a curriculum in the College of Agriculture. It prepares students for careers in farm credit and appraisal, agricultural marketing industries, commercial farm management, independent farming, research for business firms, agricultural extension, and government service. The curriculum offers options in Agricultural Economics, Farm Management, Marketing Management, and Public Service and Administration. For the curriculum and the options, see Agricultural Business, Curriculum.

A student preparing for the study of law may complete three years of study under the agricultural business curriculum, followed by one year in a recognized law college, after which the degree of Bachelor of Science will be awarded by Iowa State University.

College of Sciences and Humanities

For the curriculum in sciences and humanities with a major in economics, the basic sequence of courses is 241, 242, 307, 308 and 409.

A variety of programs can be developed within the economics major depending on the interests and career goals of the individual students. All of these programs are based on the required sequence with additional courses chosen to support the students’ objectives. Among the programs are labor and industrial relations, pre-law, general business, international trade and development, urban and regional economics, and government service and research. Many other programs are available. These programs have been designed to offer substantial flexibility while providing the student with the basic knowledge necessary to pursue his goals.

For information concerning group requirements see College of Sciences and Humanities, Curriculum.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in economic theory, applied general economics (including consumption and industrial economics), and in agricultural economics and minor work to students taking major work in other departments.

Prerequisite to major graduate work in the department is the completion of undergraduate work in economics, mathematics, statistics, sociology and other social science and technical subjects, substantially equivalent to that required of undergraduate students majoring in agricultural business or economics, consumption economics, general economics or industrial economics at this institution.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head.

Cooperative programs of study may be arranged with the State University of Iowa College of Law or with other recognized institutions.
Field of agricultural economics.

121. Agricultural Economics.  
(3-0) Cr. 3 F. Mr. Ball.  
Role of agriculture in the American economy. Introduction to the economics of agricultural production and marketing.

130. Elements of Farm Management.  
A student cannot count credit for both 130 and 330 toward a degree. Application of economic principles to organization and management of a farm. Budgeting, size of business, choice of enterprise; timing of production, farm labor utilization, farm layouts; leases and farm credit. One all-day field trip.

190. Supervised Practice.  
Cr. 1 to 12. F.S.  
Prerequisite: 9 credits in Econ. Messrs. Doak, James, Scott.  
Twelve to 24 weeks of full-time observation and supervised experience in the employ of selected agricultural businesses. Not more than six credits will apply toward a B.S. degree.

(3-0) Cr. 3 each. F.W.S SSI, II. Mr. Star leaf, staff.  

(3-2) Cr. 4. S.  
Prerequisite: 6 credits in Econ. Messrs Doak, Scott.  
Application of accounting and business management to the operation of agricultural marketing and purchasing plants. Use of plant records, forms and statements; merchandising, employee training and production plan. Visits to representative businesses.

304. Money and Banking.  
(3-0) Cr. 3. F.W.S.SSI.  
Prerequisite: 242 Messrs. Luckett, Star leaf. Principles of money and credit; principles of bank management, including the banker-customer relationship; non-bank financial institutions; central banking and monetary policy.

305. Labor Economics and Labor Relations.  
(3-0) Cr. 3. F.W.S SSI.  

(3-0) Cr. 3. W.  
Prerequisite: 242 Staff.  
Comparison of the economic theories of communism, democratic socialism, fascism, capitalism and relevant alternative forms of economic organization; operation and performance of Russian, American, British and other economies; choice of systems at different levels of economic and industrial growth.

(3-0) Cr. 3 each. 307: F.W.; 308: W.S.  
Prerequisite: 242; 243; 307: Mr. Meyer, staff.  
Theory of consumption and of the business firm; competitive and monopolistic markets; distribution of income; general equilibrium of the pricing system.

313. Consumption Economics.  
(3-0) Cr. 3. S.  
Prerequisite: Two quarters of economics. Messrs. Hoyt.  
Consumer's choice; consumption and the market; standards of living; measurement of consumption; effects of technological change.

329. Farm Accounting and Business Analysis.  
(2-2) Cr. 3. F.W.S.  
Prerequisite: 4 credits in Econ. Messrs Ball, James.  
Purpose and methods of keeping farm records, procedures in accounting; income and net worth statements; use of efficiency factors, analysis of the farm business; and use of accounts for tax purposes. Field trip.

330. Farm Management and Organization.  
(3-2) Cr. 4. F.S.SSI.  
Open to students with credit in 130 only by permission of instructor. Organization and management of a farm with emphasis on use of economic principles. Enterprise selection, size of business, budgeting, leases, layout and farm analysis.

334. Land Economics.  
(3-0) Cr. 3. F.S.  
Prerequisite 242 Mr. Timmons.  

335. Agricultural Marketing.  
(3-0) Cr. 3. F.S.SSI.  
Prerequisite: 242 Messrs. Doak, Scott.  
Estimating prospective demands for farm products in relation to supplies; improving the accuracy of the system that reflects consumers' demands to producers; reducing the costs and increasing the efficiency of marketing.

403. Marketing Livestock and Meat.  
(An S. 403) (3-0) Cr. 3. S.  
Prerequisite: 242 Mr. Kolmer.  
The demand, supply, and distribution of livestock and meat. Analysis of changes in marketing methods; grades, values, prices and costs. One all-day field trip.

(3-0) Cr. 3. F.S.  
Economic aspects of public expenditures, public borrowing and taxation with special attention to incidence of taxation, debt creation and federal-state-local fiscal interrelationships.

(3-0) Cr. 3. F.S.  
Business investment fluctuations and other determinants of national income and employment. Government spending, taxing and monetary policies for economic stabilization.

410. Competition in the American Economy.  
(3-0) Cr. 3. S.  
Prerequisite: 308. Messrs. Fletcher, Harl.  
Factors determining competitive behavior in representative American industries; economic aspects of social evaluation of competitive performance.

411. Economics of Underdeveloped Nations.  
(3-0) Cr. 3. F.  
Prerequisite: 307, 409; or 242 and permission of instructor. Mr. Scott.  
Analysis of inflation and capital allocation problems; relation of transportation, communications and resource availability to development; population and education problems as they relate to growth.

415. Consumers in the Market.  
(H.Mgt. 415) See Home Management.

*421. Agricultural Cooperation.  
(3-0) Cr. 3. F.  
Prerequisite: 242. Messrs. Doak, Scott.  
General survey of cooperative activities, with special reference to agriculture; kinds of cooperatives and operation; principles, legal requirements; economic possibilities and limitations of cooperation.

*430. Advanced Farm Organization and Management.  
(2-2) Cr. 3. F.S.  
Prerequisite: 242, 130 or 330. Mr. Beneke.  
Application of budgeting and linear programming to planning organizations for varying soil, market, capital, tenure and farm size situations.

*431. Economics of Regional Farm Production.  
(3-0) Cr. 3. W.  
Prerequisite: 242; 130 or 330. Mr. Ball.  
Theory of production location; regional production and adjustment problems in the Great Plains, Cotton Belt, Dairy Region, Corn Belt, and other regions; efficiency of resource use in the agricultural industry.

*432. Management of Tenant-Operated Farms.  
(2-0) Cr. 2. F.  
Prerequisite: Senior classification; 130 or 330. Mr. Wallace.  
Business techniques; application of economic principles to the operation of rented farms; working relationships with farm tenants. Two all-day field trips.

*435. Agricultural Finance.  
(3-0) Cr. 3. W.  
Prerequisite: 242 Mr. Murray.  
Financial requirements of individual farmers and of farm cooperative organizations. Farm credit policy. Farm Credit Administration and other lending institutions. Field trips.

*436. Agricultural Marketing Analysis.  
(3-0) Cr. 3. W.  
Prerequisite: 308, 335 Messrs Doak, Fletcher, Scott.  
Analysis of demands, costs and efficiency in agricultural marketing, processing and farm supply organizations. Analysis of the price making processes as related to agricultural commodities. Effects of industry organization and government programs.

*440. Appraisal of Farm Real Estate.  
(2-3) Cr. 3. S.  
Prerequisite: 242, Agron. 154. Mr. Murray.  
Land appraisal with emphasis on valuation procedure. Relationship of farm prices, taxes, and interest rates to value. Appraisal reports.

441. Manpower Economics.  
(3-0) Cr. 3. W.  
Prerequisite: 305. Mr. Jakubaukas.  
Wage theories and processes of wage determination; economic and institutional forces determining the level and composition of labor supply and demand; manpower implications of automation; labor mobility; governmental manpower policies.

444. Management, Theory and Practice.  
(3-0) Cr. 3. F.S.  
Prerequisite: 308 or 242; Math. 110. Messrs. Holdren, Van der Weering, Winkelmann.  
An empirical approach to business management and policy formulation in business firms. Business decision making with the aid of organization theory, linear programming, statistical techniques, and other elements of operations research.

445. Union-Management Relations.  
(3-0) Cr. 3. F.S.  
Prerequisite: 205. Mr. Davey.  

447. Introduction to Agricultural Policy.  
(3-0) Cr. 3. F.W. Alt. SSI. Offered 1967.  
Prerequisite: 242. Messrs. Ball, Kaldor.  
Introductory analysis of efficiency and income problems in American agriculture; description and appraisal of price support programs, conservation programs and programs to aid low-income families.

455. International Economics.  
(3-0) Cr. 3. P.S.SSI.  
Prerequisite: 242. Mr. Thorbecke.  
Principles of international trade, exchange rates and balance of payments adjustments. Commercial and foreign investment policies. Foreign trade and American agriculture and industry.

(3-0) Cr. 3. W.  
Prerequisite: 242, 304 or 455 recommended Mr. Luckett.  
Methods of financing international trade. The foreign exchange and the gold standard. International financial institutions, short- and long-term capital movements, and problems of international liquidity.

461. 462. Economics of Urban Form and City Planning.  
(3-0) Cr. 3 each. P.W.  
Prerequisite: 242; Math. 110. Messrs. Faden, Maki, Prescott.  
461: Theories of urban development; city typeology and measurement; land-use analysis; commuting and trade patterns; structure of the metropolitan community. 462: Cost-benefit analysis applied to urban problems—congestion, blight, pollution, discrimination, level of municipal services; financing; patterns developing from alternate planning strategies.
466. Retailing.  
(3-0) Cr 3 S.  
Prerequisite 242. Mr Holdren.  
Economic nature of retailing; retail market structure; store organization; merchandising and pricing policies; retail control.  

*470. Principles of Forestry Economics I.  
(For. 470) See Forestry  

*471. Principles of Forestry Economics II.  
(For. 471) See Forestry  

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates  

506. Intermediate Macroeconomic Analysis.  
(3-0) Cr 3 S  
Prerequisite. 409 Messrs. Brady, Starleaf  
Determination of the level of national income and employment; measurement, analysis, and control of aggregate economic activity. Examination of the postulates and policy implications of the classical, Wicksellian and Keynesian models.  

507. 508. Intermediate Microeconomic Analysis.  
(3) Cr 3 each F W SSI, II  
Prerequisite 308 Messrs. Fletcher, Winkelmann  
Analysis of production function, behavior of firms in perfect competition, theory of consumption, concepts of optimal allocation of resources, distribution of income. Behavior of firms in nonperfect competition  

510. Land Use and Conservation.  
(3-0) Cr 3 W  
Prerequisite 307 or 334 Mr Timmons  

512. Agrarian Reform and Economic Development.  
(3-0) Cr 3 S  
Prerequisite 307 or 334 Mr Timmons  

520. Food Economics.  
(H Mgt 520) See Home Management  

(3-0) Cr 3 F  
Prerequisite 507 Messrs Fletcher, Scott  
Critical review of the theory of industry organization and firm behavior; analysis of the structures and competitive processes in agricultural product and factor markets; evaluation of economic performance under alternative normative criteria; legal restraints and marketing control programs  

532. Quantitative Methods in Agricultural Marketing Research.  
(3-0) Cr 3 W  
Prerequisite 507, Stat 402 Mr Ladd  
Examination of models and theories from economics and other social sciences relevant to marketing and forecasting problems; use of these models and theories for hypothesis formulation; selection and use of quantitative techniques.  

533. Research Design in Agricultural Marketing.  
(3-0) Cr 3 S  
Prerequisite 507 Messrs Fletcher, Scott  
Current problems in agricultural markets and marketing; integration of theory, models, techniques and data in problem formulation; role of information in decision processes; research objectives, organization and financing—state, federal and industry; dissemination and application of research findings.  

(3-0) Cr 3 Alt W Offered 1966  
Prerequisite 507 Mr. Brady  
Relation of economic growth to factor prices and the technological and firm structure; firm behavior and aggregate response in product supply and factor demand; developmental needs for transformation of agriculture and resource mobility; supply and resource problems under different stages of development; policy needs for alternative problems in development.  

536. Business Fluctuations.  
(3-0) Cr 3 Alt F Offered 1967  
Prerequisite 409 or 506 Mr Brady  
General fluctuations in production, employment, prices, and incomes; their scale and importance; principal explanations suggested; proposed remedies.  

537. Linear Economic Models.  
(3-0) Cr 3 F  
Prerequisite 307, Math 102 or 104 Mr Ladd  
Selected applications of mathematics to economic problems; includes game theory, linear programming, and input-output analysis  

538. Elementary Econometric Statistics.  
(Stat. 538) See Statistics  

539 Operations Research Methods.  
(Math 539, Stat 539) See Statistics  

(Stat. 540, Math 540) See Statistics  

541. Agriculture in the World Economy.  
(3-0) Cr 3 S SSI  
Prerequisite 242 Mr Kaldor  
International comparison of development, adaptation, instability and income problems in agriculture; world agricultural specialization and trade; policies of food importing and exporting nations and role of national and international agencies in agricultural development.  

548. Quantitative Agricultural Price Analysis.  
(3-0) Cr 3 F  
Prerequisite: 307. Mr. Shepherd.  

488. Family Finance.  
(H.Mgt. 488) See Home Management.  

499. Special Problems.  
Cr 1 to 5 each time taken. F W S  
Prerequisite. 242, senior classification  
*A Agricultural Economics.  
B. Applied General Economics  
C. Economic Theory.  
H Honors Program.  

*Offered by the College of Agriculture. Courses not marked by an asterisk are offered by the College of Sciences and Humanities.
Measurement of arc and point elasticity and changes in demand and supply of farm products. Theory of price stabilization and discrimination. Technical analysis of parity and other price and income bases.

550. Industrial Structures and Competition. (3.0) Cr. 3 S
Prerequisite 508
Business concentration in the American economy; structures and competitive practices of particular industries; mergers, vertical and horizontal integration, measurement and evaluation of competition and monopoly; economic problems of public control of competition.

552. Advanced Money and Banking. (3.0) Cr 3 Alt. F Offered 1966
Prerequisite 506, Mr. Lueckett
Theory and structure of commercial banking, the money and capital markets, financial intermediaries, and the Treasury with respect to central banking and monetary policy.

554. The Public Economy. (3.0) Cr 3 Alt. W. Offered 1967
Prerequisite 507, Mr. M. Dehn
Determination of public expenditure and tax policies; tax structures and shifting and incidence of taxes; policies and methods of income redistribution; fiscal policies and economic stabilization.

555. Advanced International Economics. (3.0) Cr 3 S
Prerequisite 507, Mr. Thorbecke
Modern theory of international pricing and allocation; foreign trade multiplier and international monetary equilibrium; problems of international economic stability; multilateral trade and economic development.

556. Regional Economics. (3.0) Cr. 3. S
Prerequisite 508 Mr. Maki
Classification schemes for regional analysis; regional systems of social accounting; social and private goals and preference structures; linear programming and input-output analyses of intra- and inter-regional linkages in economic activity; econometric models for estimating regional behavioral and technical relationships; forecasts and projections of regional economic growth and development.

557. Advanced International Finance. (3.0) Cr. 3 S
Prerequisite 400; 506 and 555 recommended Messrs Cheng, Lueckett.
Theory of foreign exchange, mechanism of adjustments in the balance of payments, exchange speculation and the forward exchange market, selected topics in international monetary policy.

560. Welfare Economics. (3.0) Cr 3 F.
Prerequisite 508, Mr. Holdren
Pareto optimality and the various compensating principle approaches to the derivation of social welfare functions. The relation between ethics and welfare economics.

561. Agricultural Resource and Income Problems. (3.0) Cr 3 F
Prerequisite 308 Mr. Kaldor
Analysis of adjustment, instability and income problems and their interrelationships; forces of agricultural dis-equilibrium, adaptability of the farm industry; sources of short-run price and income instability; farm family income problems related to structural imbalance and inadequate resources.

562. Agricultural Price and Income Policy. (3.0) Cr. 3. W.
Prerequisite 561 Mr. Shepherd.
Short-run and long run objectives of farm price and income policy; analysis and appraisal of agricultural price and income programs.

563. Formulation of Farm Policies. (Soc. 563) (3.0) Cr. 3 S.
Prerequisite 561, Govt. 473, Soc 490, Messrs Bohlen, Hendy, Kaldor, Shepherd, Talbot
Interdisciplinary application of the principles and methods of economics, political science and sociology to problems of farm policy for mulation; economic, political and sociological analysis of farm policy proposals. This course may be used for minor graduate credit in government.

566. Urban Economics. (3.0) Cr. 3 W.
Prerequisite 507 Mr. Faden
History of world urban development; economic foundations of the city, agglomerating forces, linkage; theories of city growth—ring theories, sectoral theories, multiple nucleation; city system and urban hierarchies, coresuburban, hinterland relations and size distributions, commuting patterns, land use patterns, CBD functions; metropolitan problems, transportation, housing, congestion and neighborhood effects; city and metropolitan planning, design and renewal.

570. Economic Development and Growth. (3.0) Cr. 3 S
Prerequisite 508 Mr. Thorbecke.
Determinants of real income; resources and their productivity in developed and underdeveloped areas. Capital formation and allocation. Investment criteria; social marginal productivity; population absorption. Economic growth models. Population factors in economic development. Balance of payment problems of developing countries.


590. Collective Bargaining Problems. (3.0) Cr. 3 Alt. S. Offered 1967
Prerequisite 508 Mr. Davy
Advanced analysis of selected problems in the economics and politics of collective bargaining, such as wage-price profit relationships under collective bargaining and full employment policy, wage and employment relationships, and adaptation to technological change.

591. Comparative Trade Unionism. (3.0) Cr. 3 Alt. S. Offered 1966.
Prerequisite 508. Mr. Davy.
Analytical survey of contemporary trade unionism in the United States and selected Western European countries, with special emphasis on the transferability of objectives, procedures and techniques to free trade union movements in newly emerging nations and economically undeveloped areas.

592. Advanced Labor Market Analysis. (3.0) Cr. 3. S.
Prerequisite: 307, or consent of instructor. Mr. Jakabauskas.
Advanced research and analysis of current problems in wages and labor markets, unemployment and underemployment, and changes in the industrial and occupational composition of the labor force.

599. Special Topics. Cr 1 to 5 each time taken F W S.
*A. Agricultural Economics. Staff.
B. Applied General Economics. Staff
C. Economic Theory. Staff.

*Offered by the College of Agriculture. Courses not marked by an asterisk are offered by the College of Sciences and Humanities.
Principal figures in the development of economic ideas; contribution of each period of economic thought. 605: The Mercantilists to the Classical School, inclusive. 606: Critics of the Classical School to J. M. Keynes.

614, 615, 616. Advanced Theoretical Analysis.  (3-0) Cr. 3 each Yr.  Prerequisite. 506. Messrs. Brady, Sengupta, Starleaf, Van Moezeke.  
614: Axiomatic formulation of material scarcity. Stability of local equilibrium of consumer and firm. 615: General equilibrium: existence and Pareto optimality; activity-analytic approach; dynamic intersectoral balance; turnpike theories. Application to work trade. Extension to imperfect knowledge. 616: Macroeconomics; relations between monetary theory and general equilibrium theory.

630. Advanced Land Economics.  (3-0) Cr. 3. F.  Prerequisite. 307 or 334. Mr. Timmons.  

634. Land Valuation.  (3-0) Cr. 3. S.  Prerequisite. 307 Mr. Murray.  
Factors determining land value; fluctuation in land prices, critical evaluation of appraisal methods.

635. Farm Credit Theory.  (3-0) Cr. 3 W.  Prerequisite. 307, 308 recommended. Mr. Murray.  
Farm credit policies and methods of extending credit. Organization and operation of lending agencies, private and governmental. Evaluation of alternative agricultural credit systems.


641. Economics of Agricultural Production.  (3-0) Cr. 3. F.  Prerequisite. 507. Mr. Heady.  
Production principles applied to use of land, labor and capital. Static and dynamic firm theory; farm size; resource and product combinations; production location; timing of production and conservation; cost structure; leases and asset control; uncertainty and expectations.

642. Resource Efficiency and Allocation in Agriculture.  (3-0) Cr. 3. W.  Prerequisite. 641. Mr. Heady.  
Efficiency criteria; inter-industry productivity comparisons; technological change; resource mobility; firm-household interrelationships; returns to firm and society; causes of and means for eliminating production inefficiency.

Existence theorems of static and dynamic general equilibria. Social valuation. Linear and non-linear programming, goal programming, stochastic and dynamic formulations. Measurement and the theoretical model.


690. Graduate Workshop in Economic Policy.  Cr. 1 to 6 each time elected; maximum total 15 quarter hours. F.W.S.  Prerequisite. 508. Messrs. Fox, Thorbecke, Sengupta, Van de Wetering.  
A year's program, first half devoted to study of literature and theory; second half devoted to preparation and presentation of research papers. Fall quarter—self contained and may be taken as one course—prerequisite to W. and S. Students may repeat W. and S. but not F. for credit up to maximum total of 15 quarter hours, for all quarters including Fall. Theory of economic policy. Survey of existing theoretical and empirical bases for predicting effects of economic policies. Formulation of models for the evaluation of the effectiveness of agencies—at international, national, state and regional levels—in carrying out their economic objectives. Development of new research methods in these areas.

698. Advanced Top's.  (3-0) Cr. 3 each time elected. F.W.S.  Prerequisite: Permission of instructor. Graduate staff.

Current topics in economic theory and applied economics. Offerings each quarter will be selected from the following list:
A. Capital and Growth. Mr. Sengupta.
B. Theory of the Firm. Mr. Holdren.
C. Consumption. Mr. Holdren.
E. Regional Development Planning and Systems Analysis. Mr. Maki.
F. Standards of Living. Miss Hoyt.
G. Institutions and Industrial Structures. Mrs. Harl.
H. Economics of Housing. Staff.

699. Research.  
* A. Agricultural Economics. Staff.
B. Applied General Economics. Staff.
C. Economic Theory. Staff.

*Offered by the College of Agriculture. Courses not marked by an asterisk are offered by the College of Sciences and Humanities.

SOCIOLGY  
Administered by the Department of Economics and Sociology.

Opportunities for Undergraduate Study
Sociology is concerned with the nature and workings of group life. Courses are built around selected group functions, institutions, and problems with the objectives of providing (1) information gained through research about group life, (2) insight into the “why” of group behavior and (3) techniques for studying social situations and problems.
A major in sociology prepares a student for a variety of occupational fields among which are (1) position in private, public welfare, and group work agencies; (2) civil service appointments with government agencies; (3) college and university teaching, research and extension work; (4) positions with personnel departments in industry or farm organizations. The facilities of the University provide unusual opportunities for apprenticeship in social welfare and research in industrial relations, population, family, ethnic and inter-group relations, community, anthropology, social problems, etc. Qualified students are encouraged to pursue graduate study in sociology, rural sociology, anthropology or social work, since the more responsible positions require advanced degrees.

Undergraduate students with majors in sociology usually include the following courses in their programs: 134, 135, 201, 218, 401, 402, 445, and 21 additional hours in sociology courses. In addition to the basic courses for all majors in sociology, fields of specialization are represented by the following course offerings:

3. Industrial sociology. 380, 410, 480, 486, 570.

The minor in sociology is particularly suitable for students majoring in other social sciences or in technical and applied fields where principles and applications of group organization and group behavior are helpful.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in sociology and rural sociology and minor work for students majoring in other departments.

Prerequisite to major graduate work in the department is the completion of undergraduate work in economics, mathematics, statistics, sociology and other social science and technical subjects, substantially equivalent to that required of undergraduate students majoring in sociology or rural sociology at this institution.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head.

Courses open to graduate students for minor credit only: 401, 402, 410, 420, 421, 422, 425, 445, 464, 480, 485, 486, 488.

Courses in General Sociology

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

134. Introduction to Sociology. (3-0) Cr 3. F.W.S. SS111.
Analysis of the effects of group relations on human behavior; interrelations of personality, group, community and culture; major social processes, practical study of society.

135. Social Problems. (3-0) Cr. 3. F.W.S. SS1166, SS167.
Prequisite: 134.
Nature and meaning of social problems: incidence and characteristics of selected social problems of major public interest; analysis of proposed solutions. Field trips.

*200. Rural Institutions and Organizations. (4-0) Cr. 4. F.W.S.
Structure and problems of rural groups; field trips to farmer meetings; visiting lecturers; discussions by agricultural leaders.

201. Principles of Sociology. (3-0) Cr. 3. F.W.
Prequisite: 134 or 200.
Introduction to advanced principles; analysis of concepts and propositions.

218. Introduction to Cultural Anthropology. (3-0) Cr. 3. F.W.S. Messrs. Bartell, Gradwohl.
Anthropological concepts and techniques for understanding world cultural similarities and differences; universal aspects of human experience, including the family, economic, political, and religious systems examined in cross-cultural perspective.

220. Prehistoric Man. (3-0) Cr. 3. F. Mr. Gradwohl.
Survey of contributions of physical anthropology, linguistics, and prehistoric archeology to understanding of biological evolution, relation of race and culture, significance of language in shaping culture, and prehistoric development of cultures.

300. Race and Minority Group Relations. (3-0) Cr. 3. F.S.SI. Offered 1967.
Prequisite: 134 or 218. Mr. Coombs.
Minority groups and social structure; analysis of causes and consequences of group conflict with emphasis upon prejudice and discrimination in U.S.
305. Social Interaction.  
(3.0) Cr 3 F S SS1166, SS1167  
Prerequisite 134 Mr Kimmel  
Dynamics of social relations, analysis of human behavior in group situations

319. Courtship and Marriage.  
(3.0) Cr 3 F W S SS1166, SS1167  
Prerequisite Sophomore standing Mr Coombs  
A person-centered analysis of courtship and marriage relationships; contributions of the various fields of knowledge to the understanding of courtship and marital adjustment.

322. The American Indian.  
(3.0) Cr 3 W SS1.  
Prerequisite. 3 credits in anthropology Mr Gradwohl  
Origin and distribution of native populations in North and South America; survey of cultural patterns of various ethnic groups; problems of adaptation subsequent to European contact

323. The Peoples of Middle and South America.  
(3.0) Cr 3 F  
Prerequisite 3 credits in anthropology Mr Bartell  
Cultural backgrounds of middle and South American groups; historical and present economic, social, and religious systems of Indian and Mestizo groups in rural regions; processes of acculturation and current trend in cultural development

330. Social Stratification.  
(3.0) Cr 3 S SS1166, SS1167  
Prerequisite 134  
Social status and social class; analysis of stratification systems in the United States; social status and behavior differences; social mobility

335. Criminology.  
(3.0) Cr 3 F  
Prerequisite 134 Mr Lunden  
Extent and character of crime in rural and urban areas; treatment and care of offenders; programs for prevention. Field trips and interviews with public officials.

(3.0) Cr 3 W S  
Prerequisite 134 Mr Lunden  
Sociological nature and extent of delinquency, administration of juvenile courts; institutional treatment; probation and parole. Field trips and interviews.

337. Correctional Institutions.  
(3.0) Cr 3 S  
Prerequisite 335 Mr Lunden  
Analysis of organization and administration of correctional institutions. One-week field trip to an assigned institution

(3.0) Cr 3 W  
Prerequisite 134 Mr Bartell  
The function and forms of religious groups and institutions in primitive and contemporary societies.

364. Group Dynamics.  
(2.5) Cr 3 F W S  
Prerequisite 134 or 200 Mr Beal  
Planning and conducting group activities, relation of group dynamics and group techniques to group productivity; laboratory, group analysis, field practices.

380. Social Relations in Industry.  
(3.0) Cr 3 F S  
Prerequisite 134 Mr Cohen  
Formal and informal group aspects of business and industrial organizations; group aspects of personnel administration and worker adjustment

386. Sociology of Rural Life.  
(3.0) Cr 3 W  
Prerequisite 134 or 200 Mr Bohlen  
Changing characteristics of rural society; human relationships, values, institutions affected by changing population, technology and agricultural practices.

387. Farmers' Organizations.  
(3.0) Cr 3 W  
Prerequisite 134 or 200 Mr Bohlen  
Organized efforts of farmers to solve major problems. Development, policies and progress of Grange, Alliance, Farmers Union, Farm Bureau and of Extension Service and other governmental agencies. Field studies of farm organizations and meetings.

401. Contemporary Theories.  
(3.0) Cr 3 W  
Prerequisite 201  
Analysis of major contemporary sociological theories

(3.0) Cr 3 F  
Prerequisite 401  
Research design, field procedures and analysis of data.

403 Archaeological Field School and Laboratory Methods.  
Cr 1 to 5. May be taken for Cr 8 to 12 in Summer Field School, Summer and F W S.  
Prerequisite 3 credits in anthropology and consent of instructor Mr Gradwohl.  
Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence. Laboratory processing and analysis of materials; preparation of preliminary archaeological report

410 Sociology of City Life.  
(3.0) Cr 3 W, SS1166, SS1167  
Prerequisite 134 Mr Coombs  
Growth, structure, and functions of the city; urban-social relations

420. Archaeology of North America.  
(3.0) Cr 3 S  
Prerequisite 3 credits in anthropology Mr Gradwohl  
The prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; major cultural historical developments north of the Rio Grande

421 Kinship and the Family in Different Cultures.  
(3.0) Cr 3 S  
Prerequisite 3 credits in anthropology Messrs Bartell, Gradwohl  
Theories of kinship, marriage regulations, and divorce; significance of kinship systems in organization of social life; cross-cultural approach to study of the family.

422. Culture and Personality.  
(3.0) Cr 3 W  
Prerequisite 134, Psych 101 3 credits in anthropology Mr Bartell  
Relationship of cultural, social, and personality factors in human behavior; analysis of generational transmission of culture

425 Intercultural Relations.  
(3.0) Cr 3 F  
Prerequisite 3 credits in anthropology Mr Bartell  
Analysis of culture contact and change with special emphasis on the impact of Western peoples and civilization on economically undeveloped areas.
*(3-0) Cr. 3. W SS166, SS1167. 
Prerequisite: 201. Mr. Doerflinger. 
Composition and characteristics of changing population, birth rates, and mobility; introduction to population theory and policy.

450. Human Ecology.  
*(3-0) Cr. 3 Alt W Offered 1966. 
Prerequisite: 154. Mr. Doerflinger.  
Relationships among people growing out of their relationship to their natural and cultural environments.

454. Field Observation and Practice.  
Cr. 1 to 3 each time taken. F W S. 
Prerequisite: 9 hours in Soc. 
Supervised practice in established organizations and agencies.

A. Rural organizations and group work agencies. 
B. Industrial plants and related organizations. 
C. Welfare and professional group work agencies. 
D. Family life education and agencies.

*(3-0) Cr. 3 F.  
Prerequisite: 461. Mrs. Doerflinger. 
Survey of the fields of social welfare and social work; welfare programs and agencies.

462. Introduction to Social Casework.  
*(3-0) Cr. 3. W.  
Prerequisite: 461. Mrs. Doerflinger. 
Principles, concepts, and methods of social casework and their application in agencies and institutions.

*(3-0) Cr. 3 W SS1.  
Prerequisite: 201 Mr. Beal. 
Community analysis of mobilization and organization of community resources for social action; field studies.

480. Industrial Sociology.  
*(3-0) Cr. 3. F.  
Prerequisite: 201 or 380 Mr. Cohen. 
Social organization of industrial systems; social implications of bureaucracy and technological change.

485. Sociology of the Family.  
*(3-0) Cr. 3. S.  
Prerequisite: 201 Mr. Kenkel. 
Analysis of the family as a group; cultural influences, group processes and institutional aspects.

486. Leadership and Social Interaction.  
*(3-0) Cr. 3. W SS166, SS1167.  
Prerequisite: 201 or 305. 
Genetics of leadership; leader-follower roles and leader types in modern society; case studies of contemporary theories.

488. Family Legislation.  
*(3-0) Cr. 3 S.  
Prerequisite: 6 Cr. in Soc. Mr. Lundén. 
Analysis of welfare legislation relating to marriage, guardianship, adoption, divorce, and dependents; legal status of husband and wife, and children. Laws relative to social security.

490. Rural Social Organization.  
*(3-0) Cr. 3. W.  
Prerequisite: 9 Cr. in Soc. Mr. Bohlen. 
Theoretical analysis of the structure of rural society; emphasis on sociological aspects of rural life which influence value structure; factors involved in goal choices and decision making.

499. Special Problems.  
*(3-0) Cr. 1 to 5 each time taken. F W S.  
Prerequisite: 9 credits in Soc. 
A. General Sociology. 
B. Rural Sociology. 
C. Social Welfare. 
D. Industrial Sociology. 
E. Family Sociology. 
F. Anthropology. 
H. Honors Program. 

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates.

500. History of Sociological Thought.  
*(4-0) Cr. 4. F.  
Prerequisite: 9 credits in Soc. Mr. Lundén. 
Origin and development of sociological thought from earliest times to the twentieth century.

*(4-0) Cr. 4. W.S.  
Prerequisite: 401-400 or equivalents. 
Elements of systematic theory; analysis of important theoretical works; Use of theory in research.

505. Primary Relations.  
*(3-0) Cr. 3 Alt W Offered 1966.  
Prerequisite: 201; 305 or Psych. 380 Mr. Kimmel. 
Analytic treatment of diffuse, affective interpersonal relations; development of such primary relations in a variety of social situations; importance of primary relations in identity development and maintenance of social organizations.

563. Formulation of Farm Policies.  
*(Econ 563) See Economics. 
This course may be used for minor graduate credit in government.

570. Social Order and Social Conflict.  
*(Govt 570) *(3-0) Cr. 3. W.  
Prerequisite: 9 credits in Soc.; 9 credits in Govt or Hist Mr. Kimmel. 
Sociological analysis of power, power structure, mass society, and elite formation; conflict management within and between nations.

590. Social Organization.  
*(3-0) Cr. 3 Alt W. Offered 1967.  
Prerequisite: 9 credits in Soc. Mr. Lundén. 
Theories of social organization; group structure and process as frames of reference; Differentiating factors affecting the structure of society; classification of basic social forms.

599. Special Topics.  
Cr. 1 to 5. F W S.  
Prerequisite: 15 credits in Soc., senior or graduate classification. 
B. Rural Sociology Messrs. Beal, Bohlen. 
C. Social Welfare. Mr. Lunden. 
D. Industrial Sociology. Mr. Cohen. 

*Offered by the College of Agriculture. Courses not marked by an asterisk are offered by the College of Sciences and Humanities.

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COURSES FOR GRADUATE STUDENTS, major or minor

660. Seminars in Sociology. (3-0) Cr. 3 each.
1. General
   A. Social Theory F.
   B. Social Institutions Alt. S. Offered 1967
   D. Social Interaction and Communication. Alt. S. Offered 1966
   H. Research Methods, 1 and 2. W.S.
   I. Anthropology. F.W.
2. Family
   L. Current Emphases in Marriage and the Family. Alt. S. Offered 1967

699. Research.

*Offered by the College of Agriculture Sociology courses not marked by an asterisk are offered by the College of Sciences and Humanities.

EDUCATION

Ray J. Bryan, Ph D, Head of Department

PROFESSORS: Clarence E. Bundy, M S; Lowell L Carver, M S; James H Hilton, Ph D; Thomas A Hippaka, Ph D; Glenn Holmes, M A; Virgil S. Lagomarcino, Ph.D.; John W. Litherland, Ph.D; John B McClelland, Ph.D.; Vilas J. Morford, M.Sc; Barton Morgan, Ph.D


INSTRUCTORS: John Gabrielson, M A; Donald H. Martin, B.S.; Garry Weede, M.S.

Opportunities for Undergraduate Study

For undergraduate curricula in agricultural education and in industrial education leading to the degree Bachelor of Science, see College of Agriculture, Curricula.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science, Master of Education and Doctor of Philosophy in education and minor work to students taking major work in other departments. Areas of specialization are: adult education, agricultural education, education administration, evaluation, extension education, guidance and counseling, industrial education, and philosophy of education.

Prerequisite to major graduate work in education is preparation substantially equivalent to the completion of one of the undergraduate curricula in education offered at Iowa State University and adequate proof that the student ranks above average in scholastic ability and promise of vocational competency.

Open to graduate students for minor only: Ed. 426, Ag. Ed. 466, 467.
Courses in Education

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Freshman Problems. (1-0) Cr. R. F.
Opportunities in education; qualifications; personal development; how to study. Required of all students majoring in agricultural education and industrial education.

204. Foundations of American Education. (3-0) Cr. 3 F.W./S.SSI
Place of education in democracy; American public school system; modern objectives of education; legal, personal and professional qualifications for teaching.

305. Methods of Teaching. A: (3-0) Cr. 3 F.W./S.SSI, II. B: (0-2) Cr. 1 F.W./S.SSI.
Prerequisite: 204, classification in Psych. 333, enrollment in approved teacher education program, junior classification. Mr. Schloerke
A: Methods of realizing such teaching objectives as interests, ideals, understandings and abilities. Special emphasis on problem, project and unit teaching. B: Audio-visual laboratory.

375. The Teaching of Reading. (5-0) Cr. 5 F.W./S.SSI
Prerequisite: 204, Psych. 333, C.D 366.
A study of the developmental reading program in the elementary school. Historical development, reading skills, materials, ability levels, evaluation, reading in the content areas, current controversies.

417. Observation and Supervised Teaching. Cr. 12 F.W./S.
Prerequisite: 305, special methods
Observation and supervised teaching in public schools and junior colleges.

426. Principles of Secondary Education. (3-0) Cr. 3 F.W./S.SSI.
Prerequisite: 305 or equivalent. Mr. Manatt.
Problems of teacher relationships; pupil management and guidance; the curriculum; extracurricular activities; trends in education; secondary school population; community school; evaluation of pupil progress; codes of professional ethics.

490. Special Problems.
Cr. 1 to 5. F.W./S
Prerequisite: Junior classification, quality point average of 2.5 or more for preceding two quarters.
A. Agricultural Education.
B. Vocational and Educational Guidance.
C. Curriculum Construction.
D. Principles of Education.
E. Methods of Teaching.
H. Honors Program.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

515. Evaluation of Educational Outcomes. (0-2) Cr. 2. W.SSI Mr. Howe.
Prerequisite: 15 credits in Ed.
Methods of evaluating educational outcomes; types of tests and their construction; use and interpretation of educational measures in teaching.

530. Principles and Practices of Guidance. (2 or 3-0) Cr. 2 or 3. F.SSSI.
Principles and practices in the guidance services; individual inventory, informational services, counseling, placement, follow-up, assisting school staff, and coordination of school, home and community efforts.

531. Analysis of the Individual. (2 or 3-0) Cr. 2 or 3. W. and S.SSI.
Prerequisite: 530, Psych. 440 Messrs. Bryan, Ripley.
Collection, organization, and interpretation of data pertinent to the study of pupils in relation to problems of educational and vocational planning and personal adjustment. Includes techniques for identifying and utilizing sources of information, and for collecting, analyzing, recording and maintenance of data about individual pupils.

553. Counseling High School Students. (2-2) Cr. 3 S.SSI.
Prerequisite. 530, 531. Messrs. Bryan, Ripley
Use of individual and environmental information in the school counseling situation.

554. Administration of the Guidance Services. (2 or 3-0) Cr. 2 or 3. F. and S.SSI.
Prerequisite: 530. Messrs. Bryan, Ripley.
Administrative principles and practices in organizing and implementing the guidance services.

536. Adult Education. (1 or 2-3) Cr. 2 or 3. F.
Prerequisite: 15 credits in Ed. Messrs. McClendon, Holmes.
Survey of current trends and present activities in adult education. Special problems and practices in organizing adult education programs. Observation and evaluation of the community program of adult education.

541. Introduction to Education Administration. (2 to 4-0) Cr. 2 to 4. F.SSI.
Prerequisite: 15 credits in Ed. Messrs. Manatt, Lagomarcino.
Philosophy and purposes of education in a democratic society. Basic principles of school administration. Analysis of the nature and function of units of education at local, intermediate and state levels; principles and procedures for their reorganization.

542. The Community Program of Secondary Education. (2 or 3-0) Cr. 2 or 3. S.SSI.
Prerequisite: 426. Mr. Lagomarcino.
The academic and vocational program of community high schools; extra-class activities; education programs for post-high school youth and adults; local community resources as curriculum content; curriculum revision.

543. The Administration of School Personnel. (2 or 3-0) Cr. 2 or 3. W.SSI
Prerequisite: 15 credits in Ed. Messrs. Manatt, Lagomarcino.
Selection and organization of the teaching staff; personnel policies; stimulation of professional growth; management of non-professional employees. Nature of leadership.

544. Administration of Material Facilities in Education. (2 or 3-0) Cr. 2 or 3. S.SSI.
Prerequisite: 15 credits in Ed. Messrs. Boyles, Lagomarcino, Manatt.
545. The Community Program of Elementary Education.
(2 to 4-0) Cr. 2 to 4 SS1
Prerequisite 426 Mr Frost.
Problems of organization and administration of the elementary school program in relation to current theories and practices. Review of state courses of study; areas-of-living education; the fine arts; elementary school extra-class activities; community resources.

546. School Business Management.
(3-0) Cr. 3. SS1.
Prerequisite 541 Messrs. Boyles, Lagomarino, Manatt.
Fiscal administration of local school systems; budgeting; financial accounting; auditing school accounts.

547. Supervision of Instruction in Elementary and Secondary Schools.
(3-0) Cr 3 SS1.
Prerequisite 426.
Purposes of democratic educational supervision; review of modern elementary school and secondary school methods of teaching, common techniques of supervision; unique methods of teaching in arithmetic, the languages, arts, science and social studies; evaluation of teaching effectiveness.

548. Educational Policy-Making and Interpretation.
(3-0) Cr 3 WSS1.
Prerequisite 541 Messrs Lagomarino, Manatt.
Historical and legal bases of educational government in the United States, current issues in educational policy-making at the local, state, and national levels; problems of implementing policy and interpreting educational programs to the community.

549. School Buildings.
(3-0) Cr 3 SS1.
Prerequisite. Ed 541 Mr Boyles.
Assessment of need for new buildings; selection and acquisition of sites; selection of architect; educational specifications; construction of new buildings.

(2-0) Cr 3 WSS1.
Prerequisite 305.

551. Occupational Information.
(3-0) Cr 3 WSS1.
Prerequisite 15 credits in Ed and Psych Messrs Bryan, Canute, Riplcy.
Methods and techniques of occupational analysis, description and presentation of occupational information to high school pupils. Growth and development of important occupations, statistics and trends. For teachers and counselors. Field trips to industrial plants.

552. 553. Educational Statistics.
(3-0) Cr 3 each FW SS1, II
Prerequisite 15 credits in Ed Mr House.
Students without credit in college mathematics must either enroll in a required non-credit four-hour laboratory accompanying 552, or have concurrent enrollment in an approved college mathematics course before enrollment in 552. Statistical concepts and procedures for teachers, school administrators, and research workers.

555. Organization and Administration of the Junior High School.
(2-0) or (3-0) Cr. 2 or 3. WSS1
Prerequisite. Ed 426. Mr. Manatt.
Current practices and trends in the organization of the junior high school; including underlying psychological and educational theory. Responsibilities of the junior high school principal for scheduling, selection, and leadership of teaching personnel; records and reports; extra-curricular activities; discipline; and business administration.

561. Methods of College Teaching.
(2 or 3-0) Cr 2 or 3. W.
Messrs Lagomarino, Rich.
Basic principles of educational methods; abilities essential to effective teaching.

(3-0) Cr. 3. SS1.
Prerequisite 541, 543.
Fundamentals and principles of laws as related to the state and education, reorganization, liability, board procedures, pupil regulation, conditions of employment.

584. History of Education.
(3-0) Cr. 3.
Prerequisite: 15 credits in Ed Messrs. Morgan, Rich.
Historical foundations of education in Europe and the United States of America.

585. Comparative Education I: Europe and the English Speaking Countries.
(3-0) Cr 3 FWS1.
Prerequisite: 15 credits graduate work in Ed Social and cultural factors influencing the differentiated development of educational institutions. Recent trends and developments in curriculum and educational philosophy.

590. Special Topics.
Cr. 1 to 5 FWS1.
Prerequisite: 15 credits in Ed.
A. Agricultural Education. Messrs. Blake, Bundy, McClelland.
B. Adult Education. Messrs. Bundy, Holmes, McClelland.
E. Administration of Education Messrs Boyles, Bryan, Lagomarino, Manatt.
G. Techniques of Research in Education.
H. Science Education. Mr. House.
K. Classroom Utilization of Audio-Visual Aids, including Radio and Television.
M. Extension Education. Messrs. Holmes, Lawrence.
W. Administration and Supervision of Physical Education.

591. Supervised Field Experience.
(0.3 to 9) Cr 1 to 3. FWS1.
Prerequisite 15 credits graduate work in special area.
Supervised on-the-job field experience in special areas.
D. Guidance.
E. School Administration.

593. Workshop.
Cr 1 to 5. SS1, II
Prerequisite 15 credits in Ed.
A. Agricultural Education. Messrs. Blake, Bundy, McClelland.
B. Adult Education. Messrs. Holmes, McClelland.
C. Secondary Education Messrs. Lapomarisco and Manatt
D. Vocational Educational Guidance Mr. Bryan
E. Administration and Supervision of Education Messrs. Bryan, Lapomarisco, Morgan
F. Industrial Education Messrs. Carver, Tomlinson

COURSES FOR GRADUATE STUDENTS, major or minor

601. Philosophy of Education. (3-0) Cr. 3. F.S.S.S.
Prerequisite 15 credits of graduate work in Ed. Mr. Rich

602. Current Educational Movements. (2 or 30) Cr. 2 or 3 W.
Prerequisite 15 credits in Ed. Mr. Rich

603. Philosophical Ideas in American Education. (3-0) Cr. 3 S.S.S.
Prerequisite 601 Mr. Rich

615. Seminar. (0-1 to 30) Cr. 1 F.W.S. Mr. Howe.

624. Research Methods in Education. (2-0) Cr. 2 S.S.S.
Prerequisite 15 credits in Ed. Mr. Howe

644. Educational Finance. (24) Cr. 2 to 4 S.S.S.
Prerequisite 541 Messrs. Boyles, Manatt

596. Curriculum Construction. (3-0) Cr. 3 W.S.S.
Prerequisite 15 credits of graduate work in Ed. Messrs. Dilts, Rich

An analysis of curriculum theories and principles of curriculum construction. Survey of curriculum trends, promising practices and socio-cultural factors affecting the curriculum.

664. College Organization and Administration. (3-0) Cr. 3 F. Messrs. Hilton, Lapomarisco
Lectures and discussions relating to college and university administration for general information of graduate students expecting to enter teaching profession.

676. Duties of School Principals. (2 or 30) Cr. 2 or 3 S.S.
Prerequisite 541 Mr. Manatt
Elementary and secondary school organization, schedule making, management of pupil organizations, evaluation of pupil growth. Evaluation of the total program of the community school through surveys, check lists, scales and reports.

678. Administrative Theory in Education. (3-0) Cr. 3. S.S.S.
Prerequisite Master’s degree, permission of instructor Mr. Manatt
The historical background of current thinking in administration and organization; theoretical approaches to administration; analysis of functions and processes of administration as they apply to education. For experienced administrators.


Courses in Agricultural Education

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

211. Observation and Survey of Program of Education in Agriculture. (0-0) Cr. 1 each A. S.; B. F.S.
A. Agricultural Education. Visitation of high school departments of agriculture. Survey of day school, young and adult farmer programs. Field trips. B. Extension Education Visitation of central staff departments, county programs and special day activities; observation and discussion of extension education programs in agriculture and home economics. Field trips.

321. Planning and Evaluating the Program in Vocational Agriculture. (2-3) Cr. 3 F.S.
Prerequisite 305 Messrs. Blake, McClelland

423. Methods of Teaching Vocational Agriculture in High School. (3-3) Cr. 4 F.W.
Prerequisite 321 Mr. Bundy
Course organization, methods, farming programs, employment training and Future Farmers of America activities. Departments are visited to observe programs and results.

424. Young Farmer and Adult Education in Agriculture. (3-0) Cr. 4 F.W.
Prerequisite 321 Mr. Blake
Methods in organizing and teaching classes in vocational agriculture for young and adult farmers. Departments visited to determine best practices.

425. Observation and Supervised Teaching in Agriculture. Cr. 3 to 12 F.W.
Prerequisite 321. Messrs. Blake, Bundy, McClelland
Open only to Ag. Ed. Majors. Three to nine weeks of full time observation and supervised teaching in public schools. To be scheduled with “as arranged” courses and special sections.

466. Administration and Organization of Extension Education. (3-0) Cr. 3 F.W. Mr. Lawrence
History and philosophy of extension education in agriculture and home economics; plans
of organization; extension programs; relationships with other agencies; selection and training of extension personnel.

467. Methods of Extension Education. (3-0) Cr. 3. W.S.
Prerequisite: 466, permission of instructor. Mr. Lawrence

COURSES FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

537. Methods of Teaching Adults. 
(1 or 2-3) Cr 2 or 3. SSI.
Prerequisite: 426, 466, 467, or permission of department head. Messrs. Bundy, Holmes, McClelland.
Principles and practices; conducting forums; leading group discussions, using visual aids and teaching short unit courses. Observations of programs and methods

538. Young Farmer Education in Agriculture. 
(1 or 2-3) Cr 2 or 3 SSI. 1967.
Prerequisite: 424. Messrs. Blake, Bundy, McClelland.
Problems and needs of out-of-school farm youth; survey techniques, use of advisory councils, administrative relationship problems and evaluation of programs leading to establishment in farming. Departments are visited to observe programs and results.

539. Farming Programs and Employment Training in Vocational Agriculture. 
(3-0) Cr. 3 F.S Off-Campus.
Prerequisite: 423, 424. Messrs. Blake, Bundy.
Purposes of farming programs and employment training. Analysis of home farm and off-farm employment opportunities. Organizing and supervising farming program and off-farm agricultural occupation training programs. Integrating farming programs, employment training, F.F.A. activities and classroom instruction. Evaluation of individual and departmental programs.

540. Educational Implications of Occupational Adjustment in Agriculture. 
(3-0) Cr 3 F.S. Off-Campus.
Prerequisite: 423, 424. Messrs Blake, Bundy.
Analysis of farming and other occupational opportunities in agriculture in individual communities, state and nation. Methods in analyzing individual situations and in program planning.

590A. Special Topics in Agricultural Education.
Cr 1 to 5. F.W.S.
Prerequisite: 15 credits in Ed. Messrs. Blake, Bundy, McClelland.

593A. Workshop in Agricultural Education.
Cr 1 to 5. SSI.
Prerequisite: 15 credits in Ed. Messrs. Blake, Bundy, McClelland.

COURSES FOR GRADUATE STUDENTS, major or minor

604. The Community School Program of Agricultural Education.  
(2 or 3-0) Cr. 2 or 3 SSI.66. Messrs. Blake, Bundy, McClelland.
Organization of vocational agriculture in the community school; curricula; supervised farming programs, student activities, and evaluation of results.

690. Research.
F.W.S. Messrs. Blake, Bundy, McClelland.

Courses in Industrial Education

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

105. Technology and Application of Finishing Materials.  
(1-6) Cr 3 F.
Finishing materials and techniques used in wood finishing, bleaching, filling, staining, varnishing, lacquering, novelty finishes and furniture refinishing.

106. Exploration and Fundamental Fabrication of Wood.  
(1-6) Cr 3. W.
Care and use of hand tools; basic tool operations and their application to woodworking.

150. Introduction to Industrial Education.  
(3-0) Cr 3. S.
Qualifications, opportunities, preparation and duties of workers in industrial arts, vocational industrial education and industry.

154. Drafting for Agricultural Students.  
(0-6) Cr. 2 F.W.S.
Basic techniques and skills in drafting and their application to the problems of agricultural students.

204. Ornamental Metal Design and Processes.  
(1-6) Cr. 3. W SSI67
Principles and practices involved in the use of ferrous and non-ferrous metals for construction of ornamental projects and teaching aids. Such operations as spinning, rolling, etching, annealing and wrought iron work.

205. Advanced Techniques of Wood Fabrication.  
(1-6) Cr 3 SSSI66.
Prerequisite: 105, 106; 154 or Engr. Gr. 131. Basic principles and practices involved in the use of power woodworking machines and their application to furniture and cabinet making.

207. Crafts.  
(1-6) Cr 3. F.W.S. SSI67.
Craft materials and their application to industrial arts, shopwork; principles and techniques of crafts suitable for industrial art craft classes, such as plastics, leather, gem cutting, etc.

250. Industrial Arts Design.  
(3-0) Cr. 3. W.
Application of fundamental principles of design in planning of industrial arts projects. Field trips to industries, museums, etc.

251. Electricity I.  
(1-6) Cr 3. W.
Prerequisite: 255
Fundamental principles and practices in teaching of direct current electricity in industrial education. The development of experiments, projects and teaching aids for the secondary school industrial education electricity program.

253. Electricity II.
(1-6) Cr. 3. F.S.S1166.
Prerequisite: 251.
Fundamental principles and practices in the teaching of alternating current electricity in industrial education. Practical problems in power distribution, residential wiring and use of test equipment. The development of experiments, projects and teaching aids for the secondary school industrial education electricity program.

254. Basic Metal Processes.
(1-6) Cr. 3. F.S.S1166.
Principles and practices of bench metalwork; layout sawing, chiseling, filing, drilling; threading, hardening, tempering, casting.

255. Sheet Metal Fabrication.
(1-6) Cr. 3. F.S.S1167.
Principles and practices involved in the use of sheet metal tools, equipment and materials, forming and fabrication, layout techniques.

256. Machine Metals I.
(1-6) Cr. 3. F.W.S.S1166.
Prerequisite 254
Introductory course in general machine shop practice on the engine lathe and related machine tools, giving fundamental information and experience in processes and operations as applied to industrial education.

261. Power Mechanics I.
(1-6) Cr. 3. F.W.S.S1166.
Small engines: fundamentals of 2.4 stroke cycle internal combustion engines, including electrical, fuel, lubricating, and cooling systems. Use of tools and equipment for small engine overhaul and tune-up.

350. School Shop Safety Education.
(3-0) Cr. 3. F.W.S.S1166.
Prerequisite Junior classification. Messrs. Carver, Sherick.
Analysis of accidents and accident prevention in the school shop; methods of initiating an effective safety program. First-aid instruction.

352. Electricity III.
(1-6) Cr. 3. F.W.S.S1167.
Prerequisite 253 Mr Sherick.
Basic principles and practices involved in electric motor, generator and appliance construction, motor rewinding and electrical appliance repair as applied in industrial education laboratory work.

353. Care of Equipment.
(0-6) Cr. 2. F.W.S.
Prerequisite: 1 Ed. major, junior standing.
Techniques and methods involved in maintenance and repair of shop tools and machinery.

(1-6) Cr. 3. W.S.
Prerequisite: 6 credits of drawing. Mr. Sherick
Organization of subject matter, methods, teaching aids, and evaluation, as applied to the teaching of drawing in high schools.

356. Machine Metals II.
(1-6) Cr. 3. F.W.S.S1167.
Prerequisite: 256.
Advanced theory and laboratory practice in the set-up and operation of machine tools as applied to industrial education.

357. Electronics I.
(1-6) Cr. 3. F.S.S1166.
Prerequisite: 253, 255, Mr. Sherick
Basic principles of radio construction, service and repair as applied to the secondary school industrial education electronics program. Use of the oscilloscope, signal generators, signal tracer and other test equipment used in radio.

(1-6) Cr. 3. F.W.S.
Prerequisite: 105, 106, 205. Mr. Weede.
Advanced design and construction as applied to furniture and cabinet making.

361. Power Mechanics II.
(1-6) Cr. 3. F.W.S.S1166.
Prerequisite: 261.
Automobile engine overhaul procedures and techniques, including proper use of tools, equipment, and manufacturers' manuals; adjustments; measurements; development of supplementary instructional materials.

368. Power Mechanics III.
(1-6) Cr. 3. F.W.S.S1167.
Prerequisite: 261.
Automobile engine tune-up and electrical service. Theory of the automobile electric and fuel systems. Application of theory in troubleshooting and repairing these systems. Developing and presenting instructional materials and techniques.

400. Electronics II.
(1-6) Cr. 3. F.W.S.
Prerequisite 357 Mr Sherick.
Basic television construction, service and repair. Use of the oscilloscope, vacuum tube volt-ohm milliammeter and other test equipment used in television repair. The basic principles of television and frequency modulation as applied to the secondary school industrial education electronics program.

409. Shop Planning and Organization.
(3-0) Cr. 3. S Mr Carver.
Planning of school shops, selection and location of equipment; estimate of cost. Trips to secondary schools.

415. Methods of Teaching Industrial Arts.
(3-0) Cr. 3. S. Mr Carver.
Methods and techniques of teaching industrial arts: objectives, organization of subject matter, relationships, and evaluation. Field trips to schools.

416. Observation and Supervised Student Teaching in Industrial Education.
Cr 3 to 12 F.W.S.
Prerequisite 415. Mr. Carver.
Observation and supervised teaching in public schools.

456. The General Shop.
(1-6) Cr. 3. F.W.
Prerequisite: Junior classification. Messrs Carver, Wiemer.
Shop organization and procedure; selection of units, projects and teaching aids; designing and developing of suitable problems.

490. Special Problems in Industrial Education.
Cr 1 to 5 F.W.S. Staff.
Prerequisite: Junior classification, quality point average of 2.5 or more for two preceding quarters.
H. Honors Program.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Technique of Teaching Trades. (3-0) Cr 3 SSI
Prerequisite 415 Mr Shadle
Teaching processes, methods of presentation and testing, lesson planning, organization of instruction, etc., for trade preparation.

514. Foundation of Industrial Education. (3-0) Cr 3 W Alt SSI Offered 1966

518. Problems in Industrial Education. (3-0) Cr 3 Alt SSI Offered 1966
Prerequisite 415 Mr Shadle
Program organization and development, initiating federal programs, financing, staff procurement and development, facilities and other problems usually associated with the operation of an industrial education program.

519. Trade Analysis. (3-0) Cr 3 Alt SSI Offered 1967
Prerequisite 415 Mr Shadle
Basic types of analysis. Preparation of instruction sheet for teaching trade subjects.

524. Industrial Conference Methods. (6-0) Cr 3 Alt SSI Offered 1966
Prerequisite Industrial teaching or industrial experience 415 Mr Shadle
Use of conference methods in instruction. Study and practice of conference procedures, devices, and techniques.

525. Co-ordination of Part-time Industrial Education. (3-0) Cr 3 Alt SS, Offered 1966
Prerequisite 415 Mr Shadle
Demands upon supervisors, principals, teachers, and co-ordinators working in part-time industrial schools for employed minors.

554. History of Industrial Education. (1-0) Cr 3 SSI166
Prerequisite 415 Mr Carver
Historical background and development of industrial education essential to an understanding and appreciation of present day trends and developments.

555. Administration and Supervision of Industrial Education. (3-0) Cr 2 or 3 F S Alt SSI Offered 1966
Prerequisite 415 Messrs Carver, Shadle
Administration, supervision, curriculum development, selection of staff, and public relations. Evaluating administrative and supervisory efforts. Program modification. Field trips to schools and industries.

556. Teaching Multiple Activities in Industrial Education. (3-0) Cr 3 F SSI167
Prerequisite 36 credits in I Ed, graduate classification. Mr. Carver
A study of the multiple activity concept of teaching shop classes. History, development and trends; organization and operation; projects and units of instruction; planning and maintaining facilities.

557. Organization and Management of the School Shop. (3-0) Cr 3 S SSI167
Prerequisite 36 credits in I Ed. Mr Carver
Principles and practices involved in the planning, organization and management of the school shop; responsibility of school administration and teacher; basic principles of planning; selection and purchase of machines, tools, equipment and materials; maintenance, storage and control of the machines, tools, and equipment; managing the shop for effective work.

559. Materials, Products and Processes of Industry. (3-0) Cr 3 S SSI167
Prerequisite Graduate classification Mr Carver
A study of American industry; materials, processes and products to gain understanding and derive subject matter for industrial education that will reflect technology.

590. Special Topics in Industrial Education. Cr 1 to 5 F S
Prerequisite: 15 credits in Ed Messrs Carver, Shadle
A Industrial Arts.
B Trades and Industry.
C Curriculum Development.
D Evaluation and Testing.
E Administration and Organization.
F Instructional Materials.
G History and Philosophy.
J Methods of Teaching.

593F. Workshop in Industrial Education. Cr 1 to 5 SSI, II
Prerequisite 15 credits in Ed Messrs Carver, Shadle

COURSES FOR GRADUATE STUDENTS, major or minor

652. Evaluation in Industrial Education. (2 or 3-0) Cr 2 or 3 F Alt SS Offered 1966
Prerequisite 15 credits in Ed Mr Carver
Scoring of industrial education shops. Evaluating programs in industrial education. Developing testing program; interpretation and utilization of test scores; teacher rating.

656. Analysis and Organization of Teaching Materials. (1-0) Cr 3 F SSI 1967
Prerequisite 15 credits in Ed Mr Carver
Techniques for identifying, collecting, analyzing, organizing and evaluating teaching materials for instructional purposes; methods and devices for effective use.

657. Curriculum Building in Industrial Education. (3-0) Cr 3 F Alt SSI Offered 1966
Prerequisite 15 credits in Ed Mr Carver
Basic considerations in curriculum construction. Staff organization in curriculum building. Departmental articulation of subject matter. Articulation of industrial education course content with other school subjects. Continuous curriculum modification.

690. Research.
Mr Carver.
ELECTRICAL ENGINEERING

Warren B. Boast, Ph.D., Head of Department


Opportunity for Undergraduate Study

For undergraduate curriculum in electrical engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula.

Electrical engineers engage in research, development, design, application, management, and sales in electrical and associated industries. They apply the theories, circuits, and materials of electrical engineering toward improvements in all of the range of electrical devices, methods and systems that render a service to mankind.

The curriculum in electrical engineering has been designed to enable the individual to develop his imagination and knowledge so that he can enter any of these fields according to his incentive, initiative and talents.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in electrical engineering and minor work to students taking major work in other departments.

Minor work for electrical engineering majors is usually selected from mathematics, physics, chemistry, nuclear engineering, aerospace engineering or the life sciences.

The department also offers major work for the degree Master of Engineering at approved off-campus locations. Such locations require approval by the Graduate Study Committee of library, laboratory and other facilities. A minimum of 12 credits for work taken in residence on Iowa State University campus is required. The language and thesis requirements may differ from those for the Master of Science degree. For further information, see Off-Campus Courses.

Electrical engineering is quite diverse, especially at the graduate level. Thus students can find considerable course offerings and research opportunities in biomedical engineering; circuit theory; computer technology; control and information systems; electric energy sources and conversion; electromagnetic wave propagation; electronic devices; electronic materials; and power systems engineering.

The normal prerequisite to major graduate work in electrical engineering is the completion of undergraduate work substantially equivalent to that required of engineering students at this university. Because of the diversification in the electrical engineering graduate program, however, it is possible for a student to qualify for graduate study in some of the areas enumerated above even though his undergraduate or prior graduate training has been in a discipline other than electrical engineering. Supporting work, if required, will depend on the student's background and his area of research interest.
Courses normally will be offered as stated in the course description. Where no specific time of offering is stated, the course may be offered during any quarter provided there is sufficient demand.

Instruction in biomedical engineering is provided jointly by the Departments of Electrical Engineering, Veterinary Anatomy, and Veterinary Physiology and Pharmacology. Laboratory facilities are available in the Biomedical Engineering Building. See Biomedical Engineering for requirements for graduate minor.

Open to graduate students for minor only: 301, 302, 303, 313, 374, 375, 376, 377, 378, 410, 417, 418, 419, 421, 422, 423, 426, 427, 428, 441, 442, 445, 446, 451, 465, 466, 467, 486.

**COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS**

100. Technical Lecture.
   (1-0) Cr. R. S.
   Current electrical engineering thought and practices presented by staff members and visiting lecturers.

211. 212. Electric and Magnetic Circuits.
   (3-2) Cr. 4. 211. F.W.; 212. W.S.
   Prerequisite: 211. Phys. 223, credit or classification in Math 213; 212: 211.
   Basic concepts of electrical engineering Introduction to electric and magnetic circuits.

300. Seminar.
   (1-0) Cr. R. S.
   Prerequisite: Junior classification.

   (4-2) Cr. 5. S.S., 302. 303: (3-2) Cr. 4. 303. F.W.; 303. W.S.
   Prerequisite: 301. 212, Math. 321; 302. 301, Math. 322; 303. 302, Math. 323.
   Transient and steady state analysis of electric circuits using Laplace transform methods of analysis.

313. Electric and Magnetic Field Theory.
   (4-0) Cr. 4. S.S.
   Prerequisite: 303, Math. 323.
   Principles of quasi-static electric and magnetic fields. Introduction to time varying fields.

315. Television Fundamentals.
   (3-0) Cr. 3. F.W.
   Prerequisite: Sp. 301.

334. Electrical Applications.
   (3-3) Cr. 4. W.
   Prerequisite: Phys. 223.
   Elementary electrical principles and applications. For civil engineers.

341. 342. D-c and A-c Circuits and Machines.
   (3-2) Cr. 4 or 3 each. W.S.
   Prerequisite: 341. Phys. 223, Math. 212; 342: 341.
   Principles of direct and alternating current circuits and machines. For architectural, ceramic, chemical and industrial engineers.

355. Electrical Applications in Buildings.
   (3-3) Cr. F.
   Prerequisite: 15 credits of Arch. 330 Circuit arrangements in modern buildings and characteristics of electrical equipment with special consideration to application of electric lighting.

374. 375. 376. Electronics Engineering.
   (3-3) Cr. 4 each. 374. F.W.; 375: W.S.; 376. S.S.
   Prerequisite 374. 301; 375: 374; 376: 375.
   Characteristics of high vacuum, gaseous, and semiconductor electronic devices and solution of networks containing such devices.
445, 446. Electronic Circuits, Instruments, and Systems. (3-3) Cr. 4. W.S.; 446: (4-0) Cr. 4. S. Prerequisites: 445, 342 or 441; 446. 445: Basic electronic circuits. 446: Electronic instrumentation and systems. Credit will not be allowed for both the 374, 375, 376 and the 445, 446 sequences.


COURSES FOR GRADUATE STUDENTS, major or minor

504. 505, 506. Analysis of Linear Systems. (3-0) Cr. 3 each. F.W.S. Prerequisite: Math. 323. Analysis of linear systems by operational methods. Response of linear systems to random inputs.

511. Semiconductor Devices. (3-0) Cr 3 F. Prerequisite 375 or 446. Basic concepts of semiconductor devices. Design, analysis and application of transistor circuits.


515. Introduction to Biomedical Engineering. (3-3) Cr. 4. S. Prerequisite: 445. V.Phys. 514. Design of transducers, amplifiers and recorders for special measurements in living systems. Techniques for suppressing noise and interference.

518. Phenomenological Theory of Solids. (3-0) Cr. 3. S. Prerequisite: 428. Thermodynamic system parameters and their relationship to material properties. Relationships between structural symmetry and electrical properties.

531. Networks and Linear Graphs. (3-0) Cr. 3 F. Prerequisite: 504. Analysis of networks by means of linear graph theory and matrix algebra. Network parameter matrices and their properties.


549. Electromagnetic Fields. (3-0) Cr 3 F. Prerequisite: Math. 323, 511. Static electric and magnetic fields, potential theory, fields in matter.

551. 552, 553. Electromagnetic Fields. (3-0) Cr 3 each. W.S.F. Prerequisite: 551: 313 or 549; 552: 551; 553: 552. 551: Maxwell's equations, wave phenomena, guided waves. 552: Plane, cylindrical and spherical wave functions. 553: Microwave networks, variational and perturbational techniques.

561. Introduction to Logical Design. (3-0) Cr. 3 F. Number codes and systems; Boolean representation of logical operations; minimization techniques and arithmetic operations in digital systems.

562. Introduction to Information Theory. (3-0) Cr. 3 W. Introduction to information theory as applied to both discreet and continuous systems.

575. Control System Synthesis. (3-0) Cr. 3 F. Prerequisite: 486, 505. System specifications; time and frequency domain techniques for synthesizing closed loop systems.

580. Illumination Engineering. (3-0) Cr 3 each time elected. Prerequisite: 485. Fundamental concepts, radiation sources, measurement of light, geometry of sources and receivers, transfer of flux between surfaces, advanced lighting design, color.

595. Special Topics, Cr. 12 to 5 each time elected. F.W.S. Formulation and solution of theoretical or practical problems in electrical engineering.

COURSES FOR GRADUATE STUDENTS, major or minor

611, 612, 613. Synthesis of Passive Networks. (3-0) Cr. 3 each. F.W.S. Prerequisite: 505. Synthesis of passive networks.

621. Advanced Topics in Electromagnetic Theory. (3-0) Cr 3 each time elected. Prerequisite: 553.
A. Propagation in periodic structures and anisotropic media.
B. Propagation in turbulent media.
C. Radiowave propagation around the earth.
D. Coupled mode theory.

635. Advanced Topics in Power Systems Engineering.
   (3-0) Cr. 3 each time elected.
   Prerequisite: 505, 6 credits of 535.
   A. Power System Stability.
   B. Power System Transients.
   C. Economic Operation of Power Systems.
   D. Computing Aids for Power Systems.
   E. Special Topics in Transmission Engineering.

650. Advanced Laboratory.
   Cr. 1 to 3 each time elected.
   Selected projects in areas of advanced electrical engineering.

652. Advanced Topics in Information Theory.
   (3-0) Cr. 3 each time elected. S.
   Prerequisite: 506, 562, Math. 554.
   Fundamental theorems, coding and decoding.

661. Advanced Topics in Digital Systems and Logical Design.
   (3-0) Cr. 3 each time elected. W
   Prerequisite: 561
   Time-dependent logical formulations; hybrid analog-digital systems; system organization.

665. Advanced Topics in Electric Machinery.
   (3-0) Cr. 3 each time elected.
   Prerequisite: 505.
   Advanced topics in connection with machine transients, synchronous and induction machines, transformers and special machines.

673. Feedback Amplifiers.
   (3-0) Cr. 3. W.
   Prerequisite: 504.
   Mathematical definition of feedback; stability; physical realizability.

675. Advanced Topics in Systems Analysis.
   (3-0) Cr. 3 each time elected. W.
   Prerequisite: 506, 575.
   A. Random Process Theory.
   B. Sampled Data Systems.
   C. Nonlinear Systems.

681. Biomedical Engineering.
   (3-3) Cr. 4. S.
   Prerequisite: 410, 486, 515, 562, V Phys. 512.
   Advanced electronic designs for biomedical measurements. Application of information theory, electronic computers and advanced servomechanism concepts to the study of biological systems and medical automation.

690. Research
   F W.S. Graduate staff.

ENGINEERING

George R. Town, D Engr., Dean of Engineering
John E. Lagerstrom, Ph D., Associate Dean
Paul E. Morgan, M.S., Assistant to the Dean
Lawrence R. Hillyard, M.S., Personnel Officer
Raymond A. Veline, B S., Classification Officer

Opportunities for Undergraduate Study

For undergraduate curricula offered in the several departments of engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula.

The orientation courses listed are required of all freshman engineering students in order to provide information that will help the student in his work in the College of Engineering and will also help him in deciding which curriculum he will follow after the first year

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

114, 115. Orientation. (1.0) Cr R

200. 300, 400. Cooperative Work.
   Credit: Required of all cooperative students in engineering.
   Prerequisite: Permission of department head. 200. Work periods for students with sophomore standing in regularly established cooperative work-study program in any engineering curriculum. 300. Work periods for juniors. 400: Work periods for seniors. Students must register for these courses prior to commencing each work period.

ENGINEERING GRAPHICS

James S. Rising, M.S., Head of Department

Professor: Maurice W. Almfeldt, B.S.
Associate Professors: Carl A Arnbak, M.S.; Joe V. Crawford, M.S.; Milton L. Rognness, M.S.; Charles G. Sanders, M.A.

INSTRUCTORS: Wayne C. Dowling, B.S.; Daryl Dresser, B.S.; Arvid R. Eide, B.S.

Opportunities for Undergraduate Study

Adequate training in the graphical language brings the engineer a professional literacy essential and preliminary to all engineering work. Greater emphasis is being placed upon the graphical solution of problems involving space relationship as well as an increased recognition of the speed and accuracy of graphical methods to replace and supplement mathematical solutions of engineering problems.

In teaching the fundamentals of engineering graphics, attention is directed not alone to the technique of drawing but more upon the power to visualize. This power is developed both for reading and writing the language. The several phases of this graphical language are integrated in such a way as to produce a logical whole. Freehand sketches are employed extensively, using orthographic and pictorial methods, to teach rapid execution of shape-description problems, while complete working drawings are made to conform with accepted drafting standards in the several fields of engineering.

Engineering graphics in itself is not a profession. Nevertheless, proficiency in its use is the gateway through which many enter the field of engineering.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

121. Drawing and Perspective.
(1-6) Cr 3 S
Sketching and lettering. Use of drawing instruments and materials. Single and multiview projection related to interest of applied art. Basic size and material specifications. Standards and symbolic representation. Pictorial drawing; axonometric, oblique, and perspective.

131. 131A. Drawing and Projection.
(0.6) Cr 2 F W S
Freehand sketching and lettering. Use of drawing instruments, triangles, architect's and engineer's scales. Elementary space problems in pictorial or multiview projection of points, lines, planes and solids. Freehand and instrumental drawing involving sections, conventional practices, and basic size specifications. 131A: For students in architecture and architectural engineering

132. 132A. Graphical Theory and Application.
(1-6) Cr 3 W S
Prerequisite 131
Continuation of 131 to provide instruction in freehand and instrumental drawing. Axonometric, oblique and perspective drawing. Determination of true distance, clearances, true angles, true sizes and shapes. Plane, single curved, double curved, and warped surfaces. Surface developments and intersections. 132A: For students in architecture and architectural engineering

133 Working Drawings and Applied Graphics.
(1-6) Cr 3 W S
Prerequisite 132
Comprehensive treatment of dimensioning and conventional representation as applied to all fields of engineering. Details, layouts, assemblies. Specification standards, inking and drawing, reproduction. Introduction to graphical solutions. Coordinate systems, curve plotting, mathematical equations, alignment charts, vector geometry, graphical calculus.

235. Advanced Graphical Problems.
(0.5 to 15) Cr. 1 to 5 S.
Prerequisite 133, permission of department head

ENGINEERING JOURNALISM

Administered by the Department of Industrial Engineering in cooperation with the Department of Technical Journalism

A program in engineering journalism has been designed in the engineering operations curriculum for students who desire a knowledge of the fundamentals of management, engineering, science, communications, and human behavior, and who do not wish to pursue the more specialized engineering curricula. Graduates of this new program should find interesting opportunities in a number of administrative areas in industry such as technical information, industrial communications, public relations, engineering sales, procurement, and production.
The program will be administered in the Department of Industrial Engineering and will lead to the degree of Bachelor of Science. Additional information concerning the journalism courses and requirements may be obtained from the Head of the Department of Technical Journalism.

Required courses in engineering journalism include all the required courses in the engineering operations curriculum with the following substitutions:

Arch. 103 for E. Graphics 133 (Optional)
Tech. Jl. 430 for I. Ad. 365A
Tech. Jl. 400A for English 414A

In the required groups of electives for the engineering operations curricula, the following number of credits in technical journalism must be included for the engineering journalism program:

Social-Humanities Sequences—6 cr. (including Tech. Jl. 431)
Mgt. Production, Business and Sales—12 cr

Ten additional credits in technical journalism must be added to the above courses to bring the total number of credits in technical journalism to 34. The minimum total credit hours required for graduation in the engineering journalism program is 203.

The following technical journalism courses should be included:
221, 222, 223, 341.
317, 325 (may apply to Management Electives Group)
431 (may apply to Social-Humanities Elective Group)

**ENGINEERING MECHANICS**

Harry J. Weiss, D Sc., *Head of Department*

**Professors**

**Associate Professors**
Aldor C. Peterson, M.S.; Kirk C. Valanis, Ph.D.

**Assistant Professors**
Frank H. Brittain, Ph.D.; Frederick M. Graham, M.S.; Shun-Ku Lee, Ph.D.; Kenneth G. McConnell, Ph.D.; Michael A. McCoy, M.S.; Jack S. Petersen, M.S.; Thomas R. Rogge, Ph.D.

**Instructors**
Derwin C. Merrill, M.S.; Clair W. Slater, B.S.; Donald P. Smith, B.S.

**Opportunities for Undergraduate Study**

The courses in mechanics are intermediate between those in physics and mathematics and the professional and design courses of the several engineering curricula. In the work of this department the student is expected to acquire an understanding of the principles underlying the technique of analysis and a knowledge of those properties of materials which influence the manner and extent of their use for engineering purposes. He is expected to gain some insight into the background of purchase and design specifications. Physical properties of engineering materials are studied in the classroom and are evaluated in the laboratory. General laws, such as those of Newton, are given mathematical expression and are made suitable for use in the solution of specific problems in machine and structural design and in the flow and measurement of fluids.

**Opportunities for Graduate Study**

The department offers major work for the degrees Master of Science and Doctor of Philosophy in engineering mechanics, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the satisfactory completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this institution. This should include the undergraduate courses necessary for the particular field chosen.

Courses open to graduate students for minor graduate credit only: 324, 327, 337, 344, 354, 378, 444, 498.
COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

274. Statics of Engineering.
(4-0) Cr. 4. F.W.S.SSI, II
Prerequisite: Math. 212, Phys. 221
Vector and scalar treatment of coplanar and noncoplanar force systems. Resultants, equilibrium, friction, centroids, moment of inertia, product of inertia, principal moment of inertia, virtual work.

(3-0) Cr. 5. F.W.S.SSI, II
Prerequisite: 274
Plane stress, principal stress, two-dimensional strain. Elements of stress and deformation analysis applied to members subjected to centrifugal, torsional, flexural, and combined loading; statically determinate and indeterminate systems. Elementary stability; applications to columns. Static, dynamic, repeated loading.

327. Materials Laboratory.
(0-3) Cr. 1. F.W.S.SSI
Prerequisite: 324
Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 324. Use of strain measuring devices. Preparation of reports.

337. Materials Laboratory.
(0-6) Cr. 2. F.W.S.SSI
Prerequisite: Credit or classification in 324 and 334
Similar to 327 with additional topics, and added emphasis on concrete. One-day inspection trip.

344. Dynamics of Engineering.
(4-0) Cr. 4. F.W.S.SSI, II
Prerequisite: 274
Vector and scalar treatment of kinematics; coplanar motion of particles and rigid bodies. Kinetics; vector and scalar treatment of force-mass-acceleration and impulse-momentum methods; constant and variable mass; coplanar and noncoplanar systems, work-energy method.

(3-0) Cr. 3. F.W.S.
Prerequisite: Credit or classification in 324
Properties, uses and manufacture of metals, timber, stone, clay products, cements, concrete and other engineering materials.

378. Mechanics of Fluids.
(3-2) Cr. 4. F.W.S.SSI
Prerequisite: 344

444. Mechanical Vibrations.
(3-2) Cr. 4. W.
Prerequisite: 344
Elementary vibration analysis, and multiple degrees of freedom, energy methods, free and forced vibrations, viscous damping, transmissibility, influence coefficients, lateral vibrations of beams.

490. Special Problems.
Cr. Arr. F.W.S.
Prerequisite. Permission of instructor Staff

354 and 327 or 337.
Field inspection, sampling, testing methods; advanced and studies relating to structural use of such materials as timber, concrete, clay products, and metals. One-day inspection trip.

A student who is not present for the first laboratory meeting of his own section may qualify for continuation in the course only by attending the first laboratory meeting of some other section of either of these two courses.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

500. Special Topics.
Cr. 2 to 5 each time elected As arr.

514 Advanced Mechanics of Materials.
(3-0 or 4-0) Cr. 3 or 4. F
Prerequisite 324, 344
Special problems met in engineering. Limitations of flexure and torsion formulas, unsymmetrical bending, curve beams, combined stresses, theories of failure, thin tubes, thick hollow cylinders, photoelasticity

(2 to 4-0) Cr. 2 to 4
W
Prerequisite 324, 344
Historical development of the expression of the principles of mechanics.

517. Advanced Mechanics of Materials Laboratory.
(0 to 4) Cr. 1 to 2. F
Prerequisite Credit or classification in 514
Experimental techniques of stress evaluation; strain measuring equipment, brittle varnish, photoelastic studies. Analogies.

518. Experimental Stress Analysis.
(1-4) Cr. 3 F.S.
Prerequisite 327 or 317
Modern techniques for experimental determination of stresses in complex members. Strain gages, stress coat, photoelasticity, strainflux, and ultrasonic analysis

544. Mechanical Vibrations.
(3-2) Cr. 4. W
Prerequisite: 344, Math. 321

548-549. Advanced Engineering Dynamics.
548: (3-2) Cr. 4. S; 549 (3-0) Cr. 3 F
Prerequisite: 544

561. 561 Mechanics of Continua.
(Math 560, 561) See Mathematics

564. Elastic Stability.
(3-0) Cr. 3. F
Prerequisite: 514, credit or classification in Math. 322
Stability of columns, beam-columns, and panels. Assumptions and limitations. Lateral
Opportunities for Undergraduate departments.

The curriculum is designed particularly for those students who wish to receive comprehensive training in the fundamental principles and concepts of engineering rather than to specialize in one particular field. The core of the program, which is based on an extensive background in chemistry, mathematics and physics, consists in the engineering sciences of mechanics of solids, mechanics of fluids, nature and properties of materials, electrical theory, thermodynamics and rate processes. A sequence in analysis and design in the senior year serves to integrate the entire program in engineering science.

The curriculum is well adapted as a base for those students intending to pursue a graduate program in one of the engineering sciences or in nuclear engineering or who wish to enter the research, development or design areas of engineering.

The curriculum in engineering science is administered in the Department of Nuclear Engineering.

Opportunities for Graduate Study

Minor work in engineering science is available to students taking major work in other departments.

Open to graduate students for minor only: 351, 352, 353, 481, 482, 483, 484, 491, 499.
COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Technical Lecture. 
   (1-0) Cr. R. S.

   (2-2) Cr. 3. F.  
   Prerequisite: Credit or classification in E.M. 324. 
   Resistance of materials to failure, definitions and evaluation of properties, relationship to design. Effects of environment on properties. Laboratory determinations.

   (3-2) Cr. 4. W.  
   Prerequisite: 351 or E.M. 354. 
   Structure of materials, and influence of structure upon properties. Properties of single crystals. Interatomic forces, energy considerations.

   (3-2) Cr. 4. S.  
   Prerequisite: 352. 
   Thermal and electrical characteristics, polycrystalline systems, aggregates of domains. Engineering applications.

401, 402, 403. Seminar. 
   (1-0) Cr. R. F.W.S. 
   Prerequisite: Senior classification.

481, 482, 483. Engineering Analysis. 
   (3-2) Cr. 4 each. F.W.S.  
   Prerequisite: Chem.E. 401, E.M. 324, 344, Math. 323. 
   Application of the engineering sciences to the analysis of components and systems.

484. Principles of Similitude. 
   (3-2) Cr. 4. F.  
   Prerequisite: E.M. 324. 
   Dimensional analysis. Principles governing the design and operation of models for the solution of engineering problems. Analogies.

491. Engineering Design. 
   (1-0) Cr. 4. S.  
   Prerequisite: Credit or classification in 483. 
   Design problems in engineering science.

499. Special Problems.  
   Cr. 2 to 5. F.W.S.  
   Prerequisite: Permission of department head.
   Investigation of an approved problem commensurate with the training, interest and ability of the student.

ENGLISH AND SPEECH

Albert L. Walker, Ph.D., Chairman of Department


Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in English and speech, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum. 

Students may choose one of the following options: English, Speech, Telecommunicative Arts.
The programs for majors in English and speech are flexible. Students can prepare, first, to teach English, speech, or drama in the secondary schools. For the University statement of requirements for teacher certification, see Teacher Certification. Second, students can prepare for graduate study and eventual teaching in college or university. Third, students can prepare for positions in business and industry: technical writing, advertising, sales and public relations, personnel, radio and television. Students also can pursue pre-medical, pre-legal, or pre-theological studies.

Students majoring in other departments or colleges may in many instances choose English, speech, or telecommunicative arts as a minor.

Basic instruction in the department is designed to establish proficiency in communication and comprehension necessary for successful college work and requisite to the demands of later personal, professional and civic life. Engl. 101, 102 and 103 are required of all undergraduates, and Sp. 311 is required in all curricula in the College of Sciences and Humanities and in most curricula of other colleges. Engl. 201 is prerequisite for all other courses in literature. Advanced instruction in oral and written composition, language, and literature is designed to maintain and increase proficiency and knowledge in these areas.

The department conducts a Writing Clinic for sophomores, juniors, seniors, and graduate students who wish to improve their written English, and a Speech Clinic for all students who wish help with individual speech problems.

The department conducts a laboratory in Developmental Reading to meet the needs of students who wish to increase their proficiency beyond the average level (see Engl. 200).

The program emphasizing English usually includes the following courses: 363A, 364A, 374A, 375A, 376A, 450, 464A. The program emphasizing speech usually includes the following courses (listed under Speech and Telecommunicative Arts): 207, 305, 309, 324, 326, 334, 336, and 375. The program emphasizing telecommunicative arts usually includes the following courses (listed under Speech and Telecommunicative Arts): 206, 301, 302, 321, 326, 328, 400B, 400C, Engl. 315. These lists should not be regarded as a complete outline of necessary or desirable courses. Students will plan their complete programs according to individual needs, with the help of their advisers.

Courses in English

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

10A. 10B. 10C. English for Foreign Students.
(4-2) Cr. 0. 10A F W S; 10B F.W; 10C F S
Prerequisite 10B 10A or permission of instructor.
10A Grammar, both oral and written 10B. Composition and reading comprehension. 10C. English pattern practices and pronunciation. 10A and 10C may be taken concurrently. A two-hour laboratory is required with 10A and 10C.

(3-0) Cr. 3 each. 20 F.W; 21 W.S.
Prerequisite 21 or equivalent
Accepted for credit in Technical Institute only. Principles of written composition, including grammar, mechanics, punctuation, vocabulary and sentence structure. Practice in expository writing.

(3-0) Cr. 3 F W S
Prerequisite 21 or equivalent
Accepted for credit in Technical Institute only. Discussion of form and layout of formal pieces of writing. Practice in formal presentation of material from technical projects.

101. 102. 103. Principles of Composition.
(3-0) Cr. 3 each. 101 F.W.S.SSI, II; 102: F.W.S.SSI; 103: F.W.S.SSI.
Prerequisite 101. 101; 103 102. Mr Herrnstadt, staff

Application of principles governing the use of language in writing and reading. 101: Adaptation of expression to specific purposes of communication; narrative and descriptive techniques; introduction to expository writing. 102: Techniques of informative and persuasive writing; expository readings. 103: Selection of techniques for communicating fact, opinion, and feeling; function of literature as a source of ideas and values.

131. 132. Principles of Composition.
(3-0) 131. Cr. 3 F; 132. Cr. 5. W.
Prerequisite. Selection of students solely by the Department of English and Speech on the basis of high school preparation and competence displayed in examinations. Mr. Herrnstadt, staff.

Application of principles governing the use of language in writing and reading. An accelerated course designed for especially advanced students as an alternate to 101, 102, 103. Satisfies 101-2-3 requirement in all curricula.

200. Developmental Reading.
(0-2) Cr. 1 each time elected, maximum 3. F W S.SSI, II. Mr. Wright, staff.
Acceptable only for elective credit in Sciences and Humanities. Training in reading proficiency through improvement of comprehension and cultivation of motor skills and habits conducive to increased reading speed. Emphasis on vocabulary development.
201. Introduction to Literature. (3-0) Cr. 3. F.W.S.S.S1. I. Prerequisite: 103. Mr. Speer, staff. Introduction to the functions of the arts, particularly literary. Emphasis on comprehension of both older and more recent literary types. Literature in its relation to recurrent human problems; foundations for more advanced study.

204. Intermediate Composition. (3-0) Cr. 3. F.W.S. Prerequisite: 103. Expository writing: practice in writing and criticizing exposition. Concepts of grammar and rhetoric where pertinent to analysis of writing.

205. Propaganda Analysis; Reasoning and Writing. (3-0) Cr. 3. F.W.S.S.S1. I. Prerequisite: 103. Mr. Lipo, staff. Study of the language in which current issues are presented to the public, especially language which may arouse feeling or confuse thought. Application of basic rules of thinking to issues studied; practice in informative and persuasive writing; reading and discussion.

256. Modern Literature. (3-0) Cr. 3. W.S.S.S1. Prerequisite: 201. Mr. McCay, staff. Introduction to modern literature through the reading, interpretation and evaluation of prose, fiction, drama and poetry of representative American and British authors of the twentieth century.

304. Advanced Composition. (3-0) Cr. 3. F.W.S. Prerequisite: 103, junior or senior classification. 304A: Miss Hogreve, Messrs. Jumper, Loure, Walker; Medames Lipo, Loure; 304B: Messrs. Fennberg, Yates. 304A: Descriptive and narrative techniques; emphasis on characterization and the short story. Writing, reading, criticism. 304B: Personalized exposition; personal, social, or scientific material with individualized expression.

306A, 306B. Advanced Composition. Cr. 3 each time elected. F.W.S Prerequisite: 304A or 304B, permission of instructor. Mr. Jumper, staff. 306A: Individual projects, stories, novels, poems. 306B: Individual projects: essays, biography, autobiography.

315. Script Writing for Television, Film, and Radio. (3-0) Cr. 3. W. Prerequisite: 304, Sp 302, permission of instructor. Mr. Gustafson. Techniques of writing for television, film, and radio. Selected scripts used in broadcasts on WOI.

344. Readings in Biography. (3-0) Cr. 3. S. Prerequisite: 201, Mr. Huntress. Selections from biography and autobiography of great creative workers in science, engineering, agriculture, the arts, government. Other eminent contributors to civilization. Special attention to lives of scientists and to procedures of science. Impact of great men upon their own and later times.

354A, 354B. World Literature. (3-0) Cr. 3 each. 354A: W.S.S.S1; 354B S.S.S.S1. Prerequisite: 201. Mr. Orlovich, staff. 354A: Ancient classics to Renaissance: Greek and Roman literature; European literature of the middle ages; selections from Indian, Chinese, Arabian, and Persian literature. 354B: European literature, Renaissance to 1900. Selected European literature from early Renaissance to modern times.

356. Old Testament. (3-0) Cr. 3. S. Prerequisite. 201. Mr. Mallam. Literature of Old Testament and apocrypha including narrative, poetry, wisdom literature, and apocalyptic literature.

363A, 363B. American Literature to 1850. (3-0) Cr. 3 each. 363A: F.W.S.S.S1; 363B: Alt. S. Offered 1966. Prerequisite: 363A: 201, Mr. Huntress, staff; 363B: 363A or equivalent. Mr. Huntress, staff. 363A: Selected American masterpieces to 1850, their literary value and their significance as expressions of varying attitudes toward the individual and society. 363B: Literature of Colonial America. Significant American literary figures from 1600 to 1800.

364A, 364B. American Literature, 1850-1900. (3-0) Cr. 3 each. 364A: F.W.S.S.S1; 364B: Alt. F. Offered 1966. Prerequisite: 364A: 201, Mr. Huntress, staff; 364B: 364A or equivalent. Mr. Huntress, staff. 364A: Selected American masterpieces, 1850-1900, with attention to their literary value and their significance as expressions of varying attitudes toward the individual and society. 364B: Realism in American literature. Significant writers and works in the rise of American realism between the Civil War and World War I.

366. World Drama: The Greeks to Ibsen. (3-0) Cr. 3. W. Prerequisite: 201. Mr. Lowrie. The development of drama from classical times through the nineteenth century.

367. World Drama: Ibsen to the Present. (3-0) Cr. 3. S. Prerequisite: 201. Mr. Lowrie. The development of twentieth century drama.

368A, 368B. British Drama. (3-0) Cr. 3 each. 368A: Alt. W. Offered 1966; 368B: Alt. S. Offered 1966. Prerequisite: 201. Mr. Lowrie. 368A: Beginnings to 1642 (exclusive of Shakespeare). The medieval, Elizabethan, and Jacobean periods; reading, discussing, and criticism of representative plays. 368B: The Restoration and eighteenth century. Reading, discussion, and criticism of representative plays.

374A, 374B. English Literature. (3-0) Cr. 3 each. 374A: F.W.S.S1; 374B: Alt. W. Offered 1967. Prerequisite: 374A: 201, Mr. Lipo, staff; 374B: 374A or equivalent. Messrs. Benson, Johnson, Lipo. 374A: Selected British authors and works to 1600. Introduction to early period of English literature. 374B: Chaucer. Major Canterbury Tales; rapid reading of Troilus and Cressida; Chaucer's language; social and intellectual backgrounds of the age; the medieval literary tradition.

375A, 375B. English Literature. (3-0) Cr. 3 each. 375A: W.S.S.S1; 375B: Alt W. Offered 1966. Prerequisite: 375A: 201. Mr. Mallam, staff; 375B: 375A or equivalent. Messrs. Benson, Mallam, Speer. 375A: Selected British authors, 1600-1800. 375B: Milton and his contemporaries. Select-
ed works of Milton in verse and prose; prose selections from Sir Thomas Browne, Walton, Pepys, and others; poetry of Marvell, Cowley, and others.

376A, 376B. English Literature.
(3-0) Cr 3 each 376A F.S.; 376B Alt S
Offered 1967.
Prerequisite: 376A 201 Mr. Brunner, staff; 376B 376A or equivalent Messrs. Brunner, Mallam.
376A. Selected British authors, 1800-1900. Introduction to English literature of the Romantic and Victorian periods. 376B The Romantic Movement, Blake, Burns, and minor precursors of romanticism; Wordsworth, Coleridge, Scott, Byron, Shelley, Keats, Lamb, Hazlitt, DeQuincey.

384A, 384B. Modern Fiction.
(3-0) Cr 3 each 384A: F.S. 384B S
Prerequisite 201. 384A Mr. Palmer, staff; 384B Mr. Yates, staff.

388. Modern Poetry.
(3-0) Cr. 3
Prerequisite: 201 Mr. Huntress
Reading of representative work of significant American and British poets of the twentieth century; interpretation of the poems as the communication of personal and social values.

392A, 392B. The English Novel to 1900.
(3-0) Cr. 3 each 392A Alt. S Offered 1967
392B Alt S Offered 1967
Prerequisite 201 Messrs. Brunner, Mallam, Spear.
392A: Development of the English novel to 1832, 392B: The Victorian novel.

404. Business Correspondence.
(2-0) Cr. 2 W.S
Prerequisite 103, junior classification. Mr. Humphrey
Principles which govern the writing of business letters. Types of business letters.

414A, 414B. Writing of Reports and Technical Papers.
(3-0) Cr. 3 each 414A F.W.S SSI 11
Prerequisite 414A: 103, junior or senior classification, 414B Instructor's permission required Mr. Johnson, staff.
414A Technical, research, and business report writing. Principles of engineering and technical exposition, problems in engineering and technical reports and in research papers of various kinds. 414B Advanced expository writing. Emphasis on putting research material into report form; individual projects.

419. Modern Grammar.
(3-0) Cr. 3 W
Prerequisite: 103 Messrs. Johnson, Mendelson.
Introduction to modern grammar and linguistics; methods of grammatical analysis.

420. Development of the English Language.
(3-0) Cr. 3 S
Prerequisite 9 credits in Eng 103 or the equivalent in Modern Language. Mr. Johnson.
Background and development of the English language; its relationships with other languages of the past and present; modern English grammar; contemporary developments in the language.

450. Literary Criticism.
(3-0) Cr. 3 S
Prerequisite: 154A, 464A. Mr. Lips.
The nature of criticism; ideas and attitudes of critics from early times to the present; relationships between literature and psychology. Literary scholarship as related to criticism. The book review as a critical form.

456. The Augustans.
(3-0) Cr. 3 Alt. W Offered 1967.
Prerequisite: 376A Messrs. Mallam, Spear.
Representative literary figures of the Augustan age. Characteristics of neo-classicism; spirit of the age and its impact on later thinking.

464A, 464B. Shakespeare.
(3-0) Cr 3 each 464A: F.S.; 464B: W.
Prerequisite: 464A 201; 464B: 464A. Mr. Walker, Miss Hogrefe.
464A Introduction to Shakespeare's dramatic art. Selected comedies, histories, and tragedies; with emphasis on the understanding of character. 464B: Shakespeare's development as a dramatist. Intensive study of selected plays, with emphasis on Shakespeare's development as a playwright; background of the period; introduction to Shakespearean scholarship.

468. English Literature of the Renaissance (excluding drama).
(3-0) Cr. 3 Alt. S Offered 1966.
Prerequisite: 374A. Messrs. Benson, Johnson, Mendelson.
Study of selected English poetry and prose of the sixteenth and early seventeenth centuries.

476. Victorian Poetry.
(3-0) Cr. 3 Alt. F Offered 1967.
Prerequisite: 376A Messrs. Brunner, Davies, Herrnstadt, Mallam.
Selected Victorian poets. With attention to later and transitional figures. Aspects of the Victorian age reflected in the poetry.

477. Victorian Prose.
(3-0) Cr. 3 Alt. W. Offered 1967.
Prerequisite 376A Mr. Brunner.
Selected Victorian prose. Aspects of the Victorian age reflected in the prose.

490. Seminar in Literature.
(3-0) Cr 3 each time taken. F.W.S.
Prerequisite: 9 credits in literature courses beyond 103, permission of instructor. Staff Directed study of a single author or of a single area of literature, with an introduction to the techniques of scholarly investigation.

494. The Teaching of English.
(3-0) Cr 3 W.
Prerequisite: Quality point average of 2.5 in 9 credits in Eng in courses above 103 selected by the student with the approval of the department chairman. Messrs. Anderson, Mallam, Zbaracki.

499. Special Problems.
Cr 2 to 5 each time taken. F.W.S.SSI. II
Prerequisite: 9 credits in Eng beyond 103; junior classification, permission of department chairman, Staff.
Designed to meet the needs of (1) students who seek work in areas other than those in which courses are offered; (2) students who desire to take a study of literature or language with special problems in major fields. A. Literature.
B. Language (history of the language; grammar and modern usage).
C. Semantics.
D. Criticism.
H. Honors.
COURSES PRIMARILY FOR GRADUATE STUDENTS, open to qualified undergraduates

599. Special Topics.
Cr. 1 to 6 each time taken Maximum of 18.
Prerequisite: Permission of department chairman.
A. Linguistics: semantics.
B. Literature; criticism.
C. Rhetorical analysis; communication.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

15. Remedial Speech.
(0-2) Cr. 0. F.W.S.
Prerequisite: Permission of instructor. Mr. Valier.
Analysis of the student's speech handicaps followed by intensive training or therapy in the speech clinic.

30. Public Speaking.
(3-0) Cr. 3. W.S.
Prerequisite: Engll 21.
Accepted for credit in Technical Institute only. Basic elements of public speaking, including content and organization; practice in the preparation and delivery of speeches.

120. Introduction to Theatre.
(3-0) Cr. 3. F.W.S.
Prerequisite: Engl. 101 or 131 Mr. Kasser.
Development of the performing arts from antiquity to the present.

(0-4) Cr. 2 each. F.W.S. SSI, II.
Prerequisite: 206B, 206A, 206C 206B.
206A: Introduction. Theory and function of studio facilities; duties of television production team; drill and practice in various duties.
206B: On-the-air experience in educational television production and direction via closed circuit or floor work and talent in WOI-TV programs. 206C: Continuation of 206B.

207. Voice and Diction.
(3-0) Cr. 3. F.W.S.SSI. Mrs. Hoopes, Mr. Kasser.
Basic principles underlying development of acceptable habits of speech: voice, enunciation, pronunciation, poise.

228. Development of the Motion Picture.
(2-2) Cr. 3 Alt. W. Offered 1966.
Prerequisite: Engl. 103 or 132. Mr. Kraemer.
Development of the motion picture from prephotographic eras to the present; individuals responsible for major advances in theory and technique.

232A: (3-0) Cr. 3. 232B: Cr. 1 to 3 each time elected, with maximum of 6 credits. F.W.S.
Prerequisite: 232A: Engl. 103 or 132, permission of instructor; Messrs. Bodahen, Myers.

301. Survey of Radio and Television Broadcasting.
(3-0) Cr. 3 W.
Prerequisite: Engl. 132 Mr. Weinman.
The American structure of radio-television and related industries; analysis of types of programs; role of broadcast media in education, entertainment, and public service; standards of evaluation.

302. Television and Radio Speech.
(3-0) Cr. 3. F.S.
Prerequisite: Englt. 103 Messrs. Frahm, Weinman.
Theory and practice of effective television and radio speaking under closed circuit conditions.

305. General Semantics.
(3-0) Cr. 3. F.W.S.SSI.
Prerequisite: Engl. 101. Mr. Underhill.
Nature of symbolic processes; influence of verbal habits in human affairs; relationships between language and personal or social problems; accuracy and precision in the use of verbal symbols.

309. Oral Interpretation.
(3-0) Cr. 3. F.S. Mr. Dremler.
Principles of oral interpretation; practice in analysis and reading aloud of literary selections.

(3-0) Cr. 3. F.W.S.SSI, II.
Prerequisite: Engl. 103. Staff.
Fundamental principles of public speaking; audience analysis; interest and attention; selection and organization of speech material; delivery. Practice in preparation and delivery of extemporaneous speeches.

(3-0) Cr. 3. F.W.S.SSI.
Prerequisite: 311. Staff.
Methods of application of fundamental principles of public speaking to composition and delivery of common types of business and professional speaking; practice in preparation and delivery of various types of speeches.

320. Dramatics.
Cr. 1 to 3 each time elected, with a maximum of 6 credits. F.W.S.
Prerequisite: Engl. 103, permission of instructor. Mr. Brandt.
Rehearsal and production of plays.

Cr. 1 to 3 each time elected, with maximum of 6 credits. F.W.S.
Prerequisite: Engl. 103, permission of instructor. Mr. Frahm.
Introduction to radio techniques in announcing, writing, acting, use of sound and music. Practice in integrating the various audio elements in the actual production of radio programs.

324A, 324B. Dramatic Production.
(3-0) Cr. 3 each. 324A: W. 324B: S
Prerequisite: Engl. 103. Mr. Brandt.
324A: Principles of play production; choosing the play, casting, rehearsing, acting, staging, lighting, and make-up. 324B: Theory of directing plays with special attention given to problems of casting, rehearsal, blocking, movement, picturization, style, mood, and character business.
298/Description of Courses

325. Technical Theatre.
(3-0) Cr 3. W S
Prerequisite Eng. 103 Mr Waggoner
Principles and history of scene design and staging methods.

326. Television Performance.
(1-4) Cr 3. W S.
Prerequisite 207 or equivalent; Mr Wilson
Problems of the television performer; adaptations in composition and interpretation which the medium requires of the announcer narrator, master of ceremonies or actor. Studio situations designed to aid student in improving his performance skills.

328A, 328B. Televised Production and Direction.
(3-0 and 1-4) Cr 3 each 328A F; 328B W
Prerequisite 328A: Two quarters of 206, 326
Mr Wilson 328B 328A Mr Weinman

334. Persuasion.
(3-0) Cr 3. F.S.
Prerequisite: 311 Mr Orban, Staff
Principles and methods of persuasive speaking; discovery and use of evidence; proof, refutation; appeals to organization. Practice in preparation and delivery of persuasive speeches upon topics of current interest.

336. Group Discussion.
(3-0) Cr 3 F.W S
Prerequisite 311 Messrs. Myers, Orban.
Practice and procedures of problem-solving groups; communication theories related to group procedure; group leadership and participation.

(3-0) Cr 3 S.
Prerequisite 311 Mr Underhill
Analysis of the relations between speakers, speeches and political or historical events.

361. History of Theatre.
(3-0) Cr 3. F.
Prerequisite 120. Mr. Drexler
Survey of the development of the theatre and theatrical art to the twentieth century.

362. Creative Dramatics.
(3-0) Cr 3 W.
Prerequisite 120 Miss Langford
Improvisation and playmaking with children and adults in the school, home, and community; emphasis on the elementary and preschool child.

363. Play Selection.
(3-0) Cr 3 S.
Prerequisite 120 Mr. Drexler
Study of plays suitable for production by school and community groups.

375. Speech Correction Principles.
(3-0) Cr 3 F.W.S.SSI
Prerequisite 311. Mr. Valier.
Speech disorders found among school children; methods which the classroom teacher can employ in handling these disorders; referral and cooperation with the speech therapist.

400A, 400B, 400C. Telecommunicative Arts.
(1.5 to 9) Cr 1 to 3 each time elected. 400A Maximum of 6 credits; 400B. Maximum of 10 credits; 400 C. Maximum of 8 credits
400A, 400C; F.W.S.; 400B F.W.S.SSI
Prerequisite: 400A: 302, 301 or Tech. Jr.
400A: Creating, writing, and directing of a variety of educational and public information programs. Research methods; narrative and expository writing techniques; audio control; direction of talent; production procedures. Selected programs each week on WOI-FM, AM. 400B. Television. Students who have emphasized in earlier work, writing, lighting, staging, newscasting, demonstration, and performing will work as crews to create, write, direct, and produce programs for weekly broadcasts on WOI-TV. 400C: Motion Pictures for Television. Camera and staging techniques keyed to motion picture characteristics required for television broadcast, including continuity, acting, photographic treatment, lighting, set design, animation, creative editing and fusion of picture and sound. Advanced students write, direct and produce dramatic and informational sound motion pictures for television.

405. Speech Criticism.
(3-0) Cr 3. S.
Prerequisite 9 credits of Sp. and permission of instructor Mr. Underhill.
Development of speech theory and practices from Corax to modern times. Application of principles of criticism to current public speaking practices.

495. The Teaching of Speech.
(3-0) Cr 3 W.
Prerequisite. Quality point average of 2.5 in 9 credits of Sp in courses selected by student, with approval of department chairman. Mr. Underhill
Problems, methods, and materials related to the teaching of speech in the secondary school. Particular attention to the extracurricular program.

499 Special Problems.
Cr 2.5 each time taken F.W.S.SSI Staff
Prerequisite: 12 credits in Sp junior classification, permission of department chairman.
A. Public Address.
B. Speech Correction.
C. Rhetoric.
D. Speech Education.
E. Radio, Television and Film.
H. Honors.

TELECOMMUNICATIVE ARTS

Television, Radio, Motion Pictures for Television

George P. Wilson, Jr., Ph D, Director of Telecommunicative Arts Training Program
Committee of Student Advisers: George P. Wilson, Jr., Ph.D., Chairman; Wallace L. Cassell, M.S.; Julia M. Faltinson, M. S; James W. Schwartz, M.S.
Iowa State University is interested in educating students in television, radio and motion pictures, either (a) for full-time professional work in these fields, or (b) as background or minor study adapted to the needs of students from departments in Agriculture, Home Economics, Engineering, or Sciences and Humanities. Study in telecommunications often holds career possibilities for students whose major study lies elsewhere. Courses in production, direction, programming, performance, writing, management, news, advertising and sales are offered in cooperating departments: Applied Art, Architecture, Economics, Electrical Engineering, English and Speech, Household Equipment, Industrial Administration, Music, Psychology, Statistics and Technical Journalism.

Students wishing to concentrate in radio and television should choose the option in Telecommunicative Arts, offered in the Department of English and Speech. Students from other colleges and departments wishing work in radio and television in connection with major programs outside this field may take regular minor programs or selected courses.

The broadcasting, film, and closed circuit facilities and laboratories of the University are regularly utilized by students in Telecommunicative Arts. The University's radio station, WOI, has been a pioneer in educational broadcasting since 1922. The nation's first educationally owned television station, WOI-TV, has operated since 1950.

A unique opportunity in telecommunications at Iowa State is the summer apprenticeship program. Since 1953 over 100 advanced students have been placed with commercial and educational stations throughout the country for the three-month summer period.

ENTOMOLOGY
For description of courses, see Zoology and Entomology.

FARM OPERATION
For information about this curriculum, see College of Agriculture, Curricula.

FISHERIES AND WILDLIFE BIOLOGY
For description of courses, see Zoology and Entomology.

FOOD AND NUTRITION
Wilma D. Brewer, Ph.D., Head of Department

Professors: Lotte Arnrich, Ph.D.; Mary Agnes Frances Carlin, Ph.D.; Ercel S. Eppright, Ph.D.; Thelma J. McMillan, Ph.D.; E Madge Miller, Ph.D.; Charlotte E. Roderuck, Ph.D.; Pearl Swanson, Ph.D.

Associate Professors: Pilar Garcia, Ph.D.; Jewel B. Graham, M.S.; Maxine A. Hinton, Ph.D.; Nelle E. Thompson, M.A.

Assistant Professors: Mary Alice Kenney, Ph.D.; Phyllis J. Olson, M.S.; Margaret B. Tait, M.S.

Instructors: Rosalie J. Ackerman, M.S.; Diane R. McComber, B.S.; Marcia Nelson, B.S.; Elnor V. Niffenegger, M.S.

Opportunities for Undergraduate Study

Courses in food and nutrition acquaint the student with the principles underlying the selection, preparation and use of food for human health and for the welfare of society. Emphasis is placed on the scientific, cultural and professional aspects of the broad area of food and nutrition.

Four majors are offered: food science, community nutrition, dietetics, and food and nutrition and related science.

Each of these majors affords excellent preparation for many different kinds of positions
and provides a good basis for graduate study for students who wish to continue for advanced degrees.

The major in food science (formerly called experimental foods) serves those who are interested in preparation of food and in food product development in experimental kitchens or laboratories of industries or universities. It prepares students for food product development or promotion programs in industries, for food editorships in papers and magazines, and for conducting food-centered programs on radio and television. It leads to careers in business and food research.

The major in community nutrition offers preparation for work as a nutrition consultant in public health, social welfare organizations, extension service or industry. This major is planned for students interested in helping people everywhere to use knowledge in nutrition for the betterment of their health.

The major in dietetics is planned for students interested in food service and nutrition education. Graduates are prepared for a wide variety of positions in hospitals, clinics, sanatoriums, homes for children and for the aged. They may work as private nutrition consultants in cooperation with physicians, or as nutritionists with food industries. This major includes the academic requirements of the American Dietetic Association.

The major in food and nutrition and related science prepares students for positions as research assistants in laboratories of colleges and universities, experiment stations, government agencies, industries and foundations. It affords an especially strong background for graduate work.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in food science and in nutrition and minor work for students taking major work in other departments.

Prerequisite to major work is the completion of a curriculum in food and nutrition substantially equivalent to that required of undergraduates at Iowa State University. Students with undergraduate majors in biological and physical sciences are qualified for graduate study in food science and nutrition.

Students taking major work for the degree Doctor of Philosophy either in foods or in nutrition may choose minors to further their interests in related areas. Minors may be selected from other fields of home economics as well as from chemistry, biochemistry, bacteriology, food technology, psychology, physiology, economics, statistics or technical journalism. For the language requirement see the Graduate College.

Open to graduate students for minor only: 305, 409, 410, 414.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

(4-0) Cr. 4. F.W.S.S.
Prerequisite: Zoöl. 155.
The selection and use of food for health and satisfaction of the individual and the family.

208. Principles of Food Preparation. 
(2-6) Cr. 5. F.W.
Prerequisite: 107, credit or classification in Chem. 231 or 334.
The composition and nature of foods and principles underlying the preparation of food products of standard quality.

214. Foods I. 
(2-6) Cr. 4. F.W.
Prerequisite: 107, Chem. 231 or 334.
The composition and structure of foods and principles underlying the preparation of food products of standard quality.

215. Foods II. 
(1-6) Cr. 4 W.S.
Prerequisite: 214.
Continued study of the behavior and the interactions of the constituents of food.

301. Food and Meal Management. 
(0-6) Cr. 3. W.
Prerequisite: Junior or senior classification.
Miss Thompson.
For students not in the College of Home Economics. A survey of selected areas of nutrition, food preparation, management and consumer economics; the relation of these to feeding the family. Choice, purchase, preparation and service of food for family meals.

(3-0) Cr 3 Alt. W. Offered 1967.
Prerequisite: 107, Chem. 231.
Nutritional needs during reproduction, growth and life; adjusting meals to meet the needs of family members. Not available to students with credit in 305 or 410.

303. Family Meal Management. 
(1-6) Cr. 3 F.W.S.
Prerequisite: 107 or 305, and 208 or 215.
Miss Thompson.
Choice, purchase, preparation and service of foods; a study of foods on the market; time, energy and money management in relation to...
feeding the family, consideration of nutritional needs, food habits and social customs of family groups.

305. Nutrition and Dietetics.
(3-3) Cr. 4 F.W. S 3 S 1
Prerequisite: B and B 301, Zool 155 or 355 Miss McMillan
Physiological and chemical bases for nutrient needs; factors to consider in satisfying these needs for individuals and populations.

320. Fundamentals of Food Measurements.
(1-6) Cr. 3 S.
Prerequisite: 215, 303; Physics 106 or 111. Soc. 218
Basic concepts and principles of the assessment of foods; introductory aspects of subjective and objective evaluation of food quality. Certain basic influences in food acceptance patterns.

400. Field Study Tour.
Cr. R. F.S.
Prerequisite: A Credit or classification in 409; B Senior classification, permission of instructor Miss Miller
Observation of the diettian in a medical teaching center, hospital, clinic and public health department. B. Guided study tour of industrial food centers, food research laboratories and experimental test kitchens.

404. Seminar in Food and Nutrition.
(2-0) Cr. 2 F.W.
Prerequisite: 305
Orientation to professional work; state, national and international problems in food and nutrition.

409. Diet Therapy.
(3-0) Cr. 3 F.W.
Prerequisite: 305 Mrs. Tait
Physiological bases for the use of therapeutic diets.

(2-2) Cr. 3 F.S.
Prerequisite: 305 Mrs. Tait
Nutritional needs during growth; indices of nutritional status and application of principles of nutrition to feeding infants and older children.

411. Experimental Studies of Food.
(2-6) Cr. 4. F.W.S.
Prerequisite: 215, and B. and B. 301 or 304 Miss Miller
Application of scientific principles to the solution of problems in food preparation. Not to be taken by majors in food science or students desiring to take 421 and 422.

414A. Community Nutrition.
(2-3) Cr. 3 F.
Prerequisite: 305 Mrs. Hinton
Survey of nutrition problems arising from food habits of population groups; methods of making dietary studies and judging apparent nutritional status; application of principles of learning to nutrition instruction of various groups in the community. Field trips in conjunction with programs of the Iowa State Department of Health and the Agricultural Home Economics Extension Service.

414B. Seminar in Community Nutrition.
(2-0) Cr. 2 S.
Prerequisite: 414A. Mrs. Hinton
Evaluation of current nutrition problems and discussion of appropriate educational approaches.

415. Introduction to Nutrition Research.
(0-9) Cr. 3 F.W.
Prerequisite: 305, Bact. 304; B. and B. 301 or 304; permission of instructor Misses Arrnich, Brewer, Garcia, Roderick.
Introduction to methods used in nutrition research with application to selected problems.

418. Methods of Teaching Nutrition.
(3-0) Cr. 3 S.
Prerequisite: 409, H Ed. 415. Mrs. Hinton
Objectives, organization of subject matter, practical application of methods and techniques for teaching patients, medical and diettietic interns, student nurses and employees.

421. Principles of Food Science I.
(1-6) Cr. 3 F.
Prerequisite: 215, and B. and B. 301 and 311, H Eq 154 Miss Miller
Experimental approach to the study of factors influencing behavior of foods; eggs, emulsions, gels, batters and doughs.

422. Principles of Food Science II.
(1-6) Cr. 3 W.
Prerequisite: 421 Miss Miller
Experimental approach to the study of fats and oils and meats.

423. Introduction to Research in Food Science.
(1-6) Cr. 3 S.
Prerequisite: 422 Miss Miller,
Guidance and individual experience in planning, executing and reporting a problem in food research. Interpretation and evaluation of pertinent literature.

490. Special Problems.
Cr. arr F.W.S. SSI. II
Prerequisite: Permission of instructor.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

521, 522, 523. Selected Studies in Food Science.
(1-6) Cr. 3 each Yr.
Prerequisite: 215, and B. and B. 301 or 311, Bact. 304. Miss Miller
521, 522: Experimental approach to the study of chemical and physical properties of interactive components of selected foods; correlated emphasis on selection, application, and evaluation of pertinent literature. 523: Individual design, execution and summarization of the laboratory investigation of a problem in food research. Emphasis on development of critical evaluation and interpretation of data and supporting literature.

(3-0 or 6) Cr. 3 or 5 S.
Prerequisite: 411, 421 or 521. Miss Carlin
Physical and chemical aspects of commercially prepared foods; methods of standardization; preservation, evaluation of quality.

590. Special Topics.
Cr. arr F.W.S.SSI. II.
Prerequisite: 305.
A. Nutrition.
B. Food Science.
C. Professional Problems.
COURSES FOR GRADUATE STUDENTS, major or minor

601. Principles of Nutrition. (3-0) Cr 3 S
Prerequisite 305, B and B 305 Miss Rodersuck
Advanced study of nutrition Required of all graduate students in the department.

606. Research Methods in Nutrition. (1-9) Cr 4 W
Prerequisite 305, course in quantitative analysis is advised. Miss Kenney
Application of chemical techniques to research in nutrition.

607. Research Methods in Nutrition. Cr 2 each time taken W (1-3); S (0-6)
Prerequisite 606 or Chem 211 or equivalent Miss Arnnich
The animal feeding experiment as a technique in nutrition research. Two quarters taken consecutively are required Principles and basic experimental design using small laboratory animals. Individual problems in the animal laboratory.

608. Research Methods in Nutrition. (1-6) Cr 3 S
Prerequisite 606 Miss Roderuck
Application of the micro-biological assay to the quantitative estimation of vitamins and amino acids in foods, tissues and metabolic materials

609. Seminar
Cr 0 F.W.S Staff
Required of all graduate majors in the Food and Nutrition Department

A. Nutrition Misses Arnnich, Brewer, Garcia, Roderuck, Mrs. EpRIGHT.
B. Food Science Misses Carlin, Miller.

615. Advanced Nutrition. (3-0) Cr. 3 F.W.S.
Prerequisite: 601. Misses Arnnich, Brewer, Roderuck
Series of non-sequence courses selected from the following topics.
A. Proteins.
B. Vitamins.
C. Minerals.
D. Lipids.
E. Energy Metabolism.
F. Evaluation of nutritional status.
Classical and current research literature in each area listed

619. Research Methods in Food Science. (1-6) Cr. 3 F or W
Prerequisite: 521, 606 Miss Carlin
Techniques for subjective and objective measurements of food quality

620. Advanced Food Science. (3 or 2) Cr. 3 or 4.
Prerequisite: 522. Miss Carlin
Physical and chemical behavior of basic food constituents. A series of non-sequence courses.
A. Proteins
B. Fats
C. Carbohydrates

680 Modern Views of Nutrition.
(An S 680, B and B. 680, Po S. 680) See Animal Science

FORESTRY

Carl H. Stoltenberg, Ph.D., Head of Department

PROFESSORS: Dwight W. Bensend, Ph.D; Gordon F. Gatherum, Ph.D; Leonard F. Kellogg, M.F., (Emeritus); Harold S McNabb, Jr., Ph.D.; Wayne H Scholtes, Ph.D; George W Thompson, Ph.D.

ASSOCIATE PROFESSORS: Raymond F Finn, M S; Frederick S Hopkins, Jr., Ph D; Julius A Larsen, Ph D; Kenneth D. Ware, Ph D

ASSISTANT PROFESSOR: William R Bentley, Ph D

INSTRUCTOR: James H Gottsacker, M F

Opportunities for Undergraduate Study

For undergraduate curricula in forestry leading to the degree Bachelor of Science, see Forestry, Curricula

The department offers a four-year curriculum with options in Forest Management and Forest Products and a five-year curriculum with five options as listed in the curricula section.

An eight-week summer camp between the freshman and sophomore years is required of all students

The four-year curriculum with two options is designed to prepare students for administrative or research work with the United States Forest Service and other federal agencies; for similar positions with various state forestry departments; for the lumber, paper, plywood, and other forest industries; for wholesale and retail lumber marketing; for grazing and recreational land management; for teaching and extension work; and for farm forestry work.

The five-year curriculum offers opportunity for additional specialization for major work in the following fields: forest management, forestry economics, farm forestry, forest range management, forest products or wood technology.
Opportunities for Graduate Study

The department offers major work for the degree Master of Science in forestry economics, forest management, mensuration, forest range management, silviculture, wood technology and forest utilization. It offers minor work to students taking major work in other departments. Work may be taken for the degree of Doctor of Philosophy in forestry economics, silviculture or wood technology, as divided major with departments offering work in related fields. Work in the area of water resources is offered under a cooperative arrangement between the Department of Forestry and the Departments of Agricultural Engineering, Agronomy, Bacteriology, Botany and Plant Pathology, Civil Engineering, Economics, Geology, and Zoology and Entomology. See Water Resources.

Students desiring to major in this department should present forestry credits substantially equivalent to those required of undergraduate students in this institution.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head.


COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. General Forestry. (3-3) Cr. 4. F Mr. Stoltenberg.
Survey of timber, recreation, water, forage, and other forest uses. Consumption trends; opportunities for more efficient use; methods of producing future forest benefits; current policy issues.

110. Seminar. (1-0) Cr. R. F.
Discussion of current topics relating to forestry.

Field study of the relationships of physical factors to the productivity of forests in a major forest area; forest practices to increase the sustainable production of timber, water, and forage values.

220. Farm Forestry. (2-2) Cr. 3. P S Mr. Thomson.
Place of forestry on the farm. Establishment, protection and management of plantations, windbreaks and woodlot products. Field demonstrations. Not open to forestry students.

224. Logging and Milling. (4-0) Cr. 4. F.
Logging and milling practices in the principle forest regions; methods employed and equipment used.

234. Wood Utilization. (0-9) Cr. 3. Summer Camp.
Timber products industries of an important forest area; techniques and problems encountered in harvesting and processing wood products; field study of efficient use of timber.

241. Forest Mensuration. (2-6) Cr. 4. W. Mr. Ware.
The measurement of trees, logs, and forest products. Principles of estimation by sampling and applications to the inventory of forest resources.

242. Forest Mensuration. (2-3) Cr. 3. S.
Prerequisite: 241 Mr Ware.

244. Forest Mensuration and Mapping. (0-12) Cr. 4. Summer Camp.
Prerequisite: 103.
Field studies and practice in the measurement of logs, trees, and forest stands. Field surveying. Collecting data and preparing forest maps.

250. Forest Operations. (0-6) Cr. 2. Summer Camp.
Discussion and field examination of forest land management programs and organizations; administrative problems and policies; examples of single and multiple use; relationship of forest use and local communities.

301. Silvics. (4-0) Cr 4 W.
Prerequisite: Bot. 310, Gen. 301; concurrently with Agron 357 Mr. Gatherum.
The tree and environment as variables in forest production. Forest vegetational units: development and classification.

302. Silviculture. (3-3 or 3-0) Cr. 4. or 3. S.
Prerequisite: 301. Mr. Gatherum.
Silvicultural systems of establishing, tending, and harvesting forests with application to species, types, and regions in the United States. Laboratory and field work. One weekend field trip.


385. Timber Processing I. (2-2) Cr. 3. W.
Prerequisite: 425, Chem. 231 or equivalent Mr. Bensend.
Impregnation of wood including treatments to protect against decay and insect attack, to resist fire, and to reduce moisture change and shrinkage; cellulose-derived products; carbonization and destructive distillation; wood hydrolysis.

388. Wood Technology I. (1-6) Cr. 3 F.W.
Prerequisite: Bot. 101 Mr Bensend.
Wood anatomy, macroscopic identification, and principle uses of commercial timbers. Physical properties including evaluation of wood quality.

389. Wood Technology II. (2-3) Cr. 3. F.
Prerequisite: 388, Chem. 231 or equivalent Mr. Bensend.
304/Description of Courses

Cell wall structure. Wood in relation to moisture, specific gravity. Microscopic anatomy and identification.

390. Forest Protection. 
(3.0) Cr 3. 
Prerequisite: Phys. 111. 
Character and extent of damage to forests by fire, weather, animals and disease. Forest fire prevention, pre-suppression and suppression. Fire control equipment.

400. Forest Conservation. 
(3.0) Cr 3 F. 
Prerequisite Bot 101. 
Not open to forestry students. Development of forest conservation, national, state, and private. Forests in relation to human needs. Forestry as related to other conservation work.

402. Forest Policy. 
(3.0) Cr 3 S. 
Prerequisite: 471. Mr. Bentley. 

407. Forest Influences. 
(3.0) Cr 3 W. 
Prerequisite: 302. Mr. Gatherum. 
Influence of forests on climate, soil, water yield and soil erosion. Water yield and soil erosion control.

411. Seminar. 
(1.0) Cr 1 FW. 
Current reports on forestry and allied topics.

416 Forest Pathology. 
(Bot 410) See Botany.

417. Wood Deterioration. 
(Bot 417) See Botany.

425. Physical Properties and Seasoning of Wood. 
(2.2) Cr 3 S. 
Prerequisite: 488. Phys 112 or 222 Mr. Duff. 
Wood in relation to heat, light, sound, and electricity. Air seasoning, kiln drying and storage.

438. Lumber Industry Organization. 
(3.0) Cr 3 F. 

440 Special Problems. 
Cr 2 to 6 each time elected FWS. 
Prerequisite: Junior classification, permission of instructor.

A Silviculture. 
B Wood Technology. 
C Forestry Economics. 
D Forest Management. 
E Range Management. 
F Forest Mensuration and Photogrammetry. 
H Honors Program.

445 Forest Photogrammetry. 
(1.0 or 1-2) Cr 4 or 1 F. 
Prerequisite: 241, C E 210 Mr. Thomson. 
Use of aerial photographs in forest management. Measurement of land, trees and timber stands on vertical photographs. Preparation of type, planimetric, and topographic maps from aerial photographs. The one credit of fering is a resume of techniques for students outside of Forest Management.

447. Photogrammetry and Photo-Interpretation. 
(2-2) Cr 3 S Mr. Thomson. 
Use of aerial and terrestrial photographs in resource management and research. Techniques of measurement, cartographic methods and interpretation applicable to controlled photographs.

460. Forest Recreation. 
(3.0) Cr. 3 W. 
Prerequisite: 470 Mr. Hopkins. 
Study of forest recreation in the United States. Relationship between forest recreation benefits and forest practices. Recreation policies and programs of public and private forest owners. Planning for recreation in forest management. Current problems and issues.

470. Principles of Forestry Economics I. 
(Econ. 470) (3-3) Cr. 4 F. 
Prerequisite: 242, Econ 242 Mr. Hopkins. 
Economic factors and analysis underlying management decisions by the firm with respect to labor, capital, and land. Comparative valuation. Taxation.

471. Principles of Forestry Economics II. 
(2-3) Cr. 3 W. 
Prerequisite: 470. Mr. Hopkins. 
Supply and demand for forest goods and services. Price and quantity determination. Marketing, Appraisal. Social planning in the forest economy.

484. Properties of Wood. 
(3.0) Cr 3 Alt. SS offered 1967. 
Prerequisite: 1 Ed 205. Mr. Bensend. 
Structure and identification of wood, storage and handling of lumber, seasoning and other defects in lumber; machining and preparation of wood for gluing, woodworking glues. Not open to forestry majors.

486 Timber Products. 
(3.0) Cr 3 F. 
Prerequisite: 188. 
Production and processing of round timbers, mine timbers, railroad ties, veneer, furniture, shingles and containers. Wood as fuel. Pulp and paper. Naval stores.

487 Timber Processing II. 
(2.2) Cr 3 S. 
Prerequisite: 425 Mr. Bensend. 

488 Mechanical Behavior of Wood. 
(3.3) Cr 4 W. 
Prerequisite: 389, Phys 211 or 221. 
Mechanics of materials. Mechanical properties of wood and wood base material. Design criteria.

491 Forest Range Management I. 
(2.3) Cr 3 W. 
Prerequisite: Bot 306 Mr. Thomson. 

492 Forest Range Management II. 
(3.0) Cr 3 Alt. SS offered 1967. 
Prerequisite: 470, 491 Mr. Bentley. 
493. Forest Range Management III.  
(2-3) Cr 3 Alt. S. Offered 1966  
Prerequisite: 242, 491 Mr. Ware  

497. Forest Management.  
(3-0) Cr 3 W.  
Prerequisite: 302, 470 Mr. Thomson.  
Organization of the forest for management. Study of the factors used in forest regulation.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

502. Advanced Silvics.  
(3-0) Cr 3 W.  
Prerequisite: 302 Mr. Gatherum.  
The tree and the site as factors in forest production. Forest tree improvement. Site factors and site evaluation in relation to forest tree productivity.

540. Special Topics.  
Cr 2 to 5 each time elected F.W.S  
Prerequisite: 15 credits of acceptable graduate work, permission of instructor.  
A Silviculture, Mr. Gatherum.  
B Wood Technology, Mr. Bensend.  
C Forest Economics, Mr. Hopkins.  
D Forest Management, Mr. Thomson.  
E Range Management.  
F Forest Mensuration and Photogrammetry.  
Messrs. Thomson, Ware.

543. Forest Mensuration.  
(2-3) Cr 3 W.  
Prerequisite: 242, Mr. Ware.  
Estimation of current stand volume and of stand growth. Selection of variables for volume and yield tables. Applications of sampling methods to forest resource surveys.

570. Economics of Forest Production.  
(2-2) Cr 3 F.  
Prerequisite: 471, Econ. 308 Mr. Hopkins.  
Economic analysis of production alternatives in forestry firms. Critical analysis of related research.

577. Advanced Forest Pathology.  
(Bot. 577) See Botany.

(1-0) Cr 3 W.  
Prerequisite: 389, Bot 553 Mr. Bensend.  
Preparation of wood tissue for microscopic examination. Advanced studies in wood anatomy.

COURSES FOR GRADUATE STUDENTS, major or minor

600. Research.  
F.W.S.  
A Silviculture, Mr. Gatherum.  
B Wood Technology, Mr. Bensend.  
C Forest Economics, Mr. Stoltenberg.  
D Forest Management.  
F Forest Mensuration and Photogrammetry.  

601. Research Methods in Forestry.  
(2-2) Cr 3 W Mr. Stoltenberg.  
Scientific method; hypothesis formulation and testing; project and study planning; preparation and critical analysis of study plans. Communication of research results. Institutional factors in research.

604. Advanced Silviculture.  
(3-0) Cr 3 Alt. S. Offered 1967.  
Prerequisite: 502 Mr. Gatherum.  
Detailed analysis of reproduction methods and intermediate cuttings in relation to genetic and environmental factors.

645. Advanced Forest Mensuration.  
(4-0) Cr 4 Alt. S. Offered 1966.  
Prerequisite: 543, Stat. 401, 402, 421. Mr. Ware.  
Theory and application of statistical and mathematical methods to forest measurement. Quantification of problems in stand structure and growth. Sampling methods for forest inventory and estimation of past and future growth. Recent developments in forest mensuration.

670. Resource Allocation in Forestry.  
(2-2) Cr 3 Alt. S. Offered 1966.  
Prerequisite: 471, Econ. 308 Mr. Stoltenberg.  
Critical examination of public and private forest-related problems. Forestry programs designed to solve these problems, and related research.

688. Advanced Wood Technology.  
(3-0) Cr 3 S.  
Prerequisite: 388 Mr. Bensend.  
Structure of the cell wall in woody plants. Measures of wood quality; environment as related to quality. Structure as related to the physical properties of wood.

689. Timber Industries.  
(3-0) Cr 3 Alt. S. Offered 1966.  
Prerequisite: 487 Mr. Bensend.  
Recent contribution of research and technology to product development. Areas of emphasis in basic and applied research.

694. Advanced Forest Management.  
Cr 2 to 5 F.  
Prerequisite: 498, Mr. Thomson.  
Special problems in regulation of forest yield. Forest working plans.

GENETICS

Joseph G. O'Mara, Ph.D., Chairman of the Department

PROFESSORS: Willard F. Hollander, Ph.D.; Peter A Peterson, Ph.D.; Donald S. Robertson, Ph.D.

ASSOCIATE PROFESSORS: Wilmer J. Miller, Ph.D.; Kiyoshi Sadanaga, Ph.D.; Peter E. Thompson, Ph.D.
Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in genetics, leading to the degree of Bachelor of Science, see Sciences and Humanities, Curriculum.

The Department of Genetics offers instruction in the science of heredity, and in the operation of the laws of inheritance in nature, in domesticated animals, in economic plants, and in human populations. The courses also are intended to demonstrate the broad cultural and philosophical aspects of this biological science.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in genetics and minor work to students taking major work in other departments. Prerequisite to major work is the completion of a thorough undergraduate curriculum in agriculture, or in a biological science, with evidence of excellent scholarship and aptitude for scientific research.

Students taking major work in genetics ordinarily will take minor work in agronomy, animal science, bacteriology, biochemistry, botany, horticulture, mathematics, statistics, veterinary medicine or zoology.

Major and minor work in the area of cell biology is offered under a cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, Genetics, and Zoology and Entomology.

Open to graduate students for minor only: 401, 460.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

*301. Introductory Genetics. (3-0) Cr 3 S F W SSSI.
Prerequisite: Elementary course in biology. Messrs. English, Hollander, Miller, Robertson, Thompson.
Elementary principles of genetics and their operation and significance in plant, animal, and human populations.

305. Elementary Genetics Laboratory. (0-6) Cr 2 F W S.
Prerequisite: Should accompany or follow 301 in Thompson.
Laboratory experiments illustrating the laws of heredity.

*400. Human Heredity. (3-0) Cr 3 S Mr. Thompson.
Principles of heredity in man, the relation of inheritance to disease, blood types, legal medicine, and eugenics.

401. Intermediate Genetics. (3-0) Cr 3 S.
Prerequisite: 301 Staff.
Fundamental methods and concepts in genetics, chromosome mapping, gene structure, elementary mathematical genetics, polyploidy, and meiotic analysis.

450. Special Problems
Cr arr. F W SSSI, II
Prerequisite: 305, 401

460. Introduction to Mathematical Genetics.
(3-0) Cr 3 S.
Prerequisite: 401, Math. 101 or equivalents. Mr. Pollak.
Elementary probability and its application to Mendelian, population, and quantitative genetics.

*Both courses cannot be used for graduation credit

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates


COURSES FOR GRADUATE STUDENTS, major or minor

605. Cytogenetics. (Bot 605) See Botany.

610. Principles of Genetic Analysis. (1-0) Cr 3 S
Prerequisite: 401 Mr. Thompson.
Methods of genetic investigation, with emphasis on mutation, gene action, chromosome organization, and the properties of the genetic material.

630. Advanced Genetics. (3-0) Cr 3 S
Prerequisite: 401.
Fundamental theories in classical and modern genetics: linkage, polyploidy, translocation, nullisomic analysis, population variability and heterosis.

635. Animal Genetics. (3-2) Cr 4 W.
Prerequisite 305, 401 Mr Hollander
Analytical procedures by means of markers, with special regard to Drosophila; surveys of the status of genetic analysis in animals, especially domesticated species.

640. Genes and Mutations.
(3-0) Cr 3 Alt. W' Offered 1967
Prerequisite 401. Mr Peterson
Causes, rates, and evolutionary aspects of mutation.

645. Recent Developments in Genetics.
(2-0) Cr. 2 Alt W' Offered 1966
Prerequisite 401. Mr. Peterson
Selected topics in genetics with special emphasis on recent advances.

646. Immunogenetics.
(2-6) Cr. 5. F
Prerequisite. 401 Mr Miller
Application of immunological principles to genetics; analytical procedures of blood typing, individual and species variation.

650. Seminar
Cr 1 F W'S Mr Hollander

654. Genetics of Breed Improvement.
(Am S 654) See Animal Science

(Am S 655) See Animal Science

660. Research.
F W'S SS1, 11
Messrs Hollander. Miller, Peterson, Robert son Yada-naga

698. Seminar in Cell Biology.
(Bact 698, B and B 698, Bot 698E, Zoö 698) See Zoology and Entomology.

GOVERNMENT
For description of courses, see History, Government and Philosophy

HISTORY, GOVERNMENT AND PHILOSOPHY
Clarence H Matterson, Ph.D., Head of Department
Professors: Donald E. Boles, Ph.D.; Herbert C. Cook, Ph.D.; W. Robert Parks, Ph.D.; Earle D. Ross, Ph.D.; Emerson W Shudeler, Ph.D.; F. B. Smith, Ph.D.; Ross B Talbot, Ph.D.
Associate Professors: Don F. Hadwiger, Ph.D.; James B. Hartman, Ph.D.; V. Alton Moody, Ph.D.; Edwin W. Peterson, M.S.; Harold I. Sharlin, Ph.D.; Barbara Teters, Ph.D.
Assistant Professors: Monte Palmer, Ph.D.; Rolf W. Theen, Ph.D.; Richard J. Van Iten, Ph.D.; Charles W. Wiggins, Ph.D.; James W. Whitaker, Ph.D.
Instructors: Robert B. Dove, M.A.; Craig Harrison, B.A.; Gregory A. Calvert, B.A.; George T. McJimsey, M.A.; Philip B. Zaring, M.A.

Opportunities for Undergraduate Study
The department provides general introductory courses of instruction in history, government and philosophy designed for all students to serve either as a part of their general education or as a background for further work in any of the three fields. The department also offers courses for students who need a knowledge of history, government or philosophy as a corollary to or preparation for their vocational training.

The department offers majors in both history and government, and courses are offered to provide advanced undergraduate work in the areas of American history, European history, the history of science, international relations, government and philosophy.

Undergraduates majoring in other departments may take minors in either history, government or philosophy.

Students who wish to specialize in the study of international affairs may do so through the International Service Program while majoring in history or government. See International Service.

The department presents the opportunity of preparation for the study of law by completion of three years in its curriculum followed by one year satisfactorily completed in a recognized college of law after which the degree Bachelor of Science with a major in history or government will be awarded by Iowa State University.

Undergraduate majors in this department usually have included the following basic courses in their programs: 311, 312, 313 and 321, 322, 323. As supporting work, undergraduate majors have found the following courses desirable: Econ. 241, 242; Soc. 134; Engl. 354, 363; Phil. 260. These lists of courses should not be regarded as statements of fixed require-
ments or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

**Opportunities for Graduate Study**

The department offers major work for the degree Master of Science in either history or government and minor work in history, government, and philosophy to students taking major work in other departments.

Prerequisite to major graduate work in the department is the completion of at least 30 quarter credit hours in history or government.


**Courses in History**

**COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite</th>
<th>Description</th>
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<tbody>
<tr>
<td>211, 212, 213</td>
<td>European and American Civilization Since 1350</td>
<td>(3-0) Cr 3 each Yr</td>
<td>Prequisite 211, 212: Survey of breakup of medieval society; the Renaissance and conditions which produced the expansion of Europe; the impact of Europe upon colonial America; the American Revolution and its results. 212: The influence of revolutions, political and industrial, upon both Europe and America; background of the civilization of the present. Present century similarities and differences; inter-relationships between Europe and America. Origins and results of wars and depression.</td>
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<tr>
<td>311, 312, 313</td>
<td>Introduction to Western Civilization</td>
<td>(3-0) Cr 3 each 311: F.W.; 312: W.S; 313: S</td>
<td>Prequisite 312: Mr. Calvert. Mr. Zarling 313: 312 Social and cultural development of Western civilization from the Ancient Orient to the present, emphasizing economic and political institutions; changes in habits, customs, and ideas; the background of recent developments.</td>
</tr>
<tr>
<td>324</td>
<td>History of American Agriculture</td>
<td>(3-0) Cr 3 F.W.S. Mr. Whitaker</td>
<td>Colonial foundations; westward movement; public land policies; regional specialization; transportation and markets; science and technology; relation of state to agriculture.</td>
</tr>
<tr>
<td>*334, 335</td>
<td>Economic History of the United States</td>
<td>(3-0) Cr 3 each 334: F; 335: W</td>
<td>Prequisite: Sophomore standing. Mr. Sharlin. 334: To 1865. 335: Since 1865 Growth of important industries; regional specialization; development of economic institutions; relation of government to business enterprise.</td>
</tr>
<tr>
<td>355, 356, 357</td>
<td>History of England and Great Britain</td>
<td>(3-0) Cr 3 each Yr Mr. Zarling. 355: Anglo-Saxon period and the Norman conquest; constitutional and cultural developments in the medieval period. 356: The Age of the Tudors and Elizabethan England. Constitutional and religious issues in Stuart England; emergence of modern political institutions, growth and loss of empire; industrial revolution, struggle against the Napoleonic Empire. 357: Victorian Age and the climax of the British Empire, Great Britain and World War I, the inter-war period and World War II.</td>
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<tr>
<td>*401, 402</td>
<td>Economic History of Modern Europe</td>
<td>(3-0) Cr 3 each W.S.</td>
<td>Prequisite 6 credits in Hist Mr. Calvert. 401: Economic and political revolutions 1750-1900: English and Continental heritage from medieval Europe; commercial, industrial, agricultural revolutions; economic institutions and reforms, capitalism, competition, imperialism. 402: Rise of Continental industry; changes in labor, transportation, markets, reparations, revolutions, reconstruction, competition, depression and war.</td>
</tr>
<tr>
<td>405A, 405B</td>
<td>Ancient History</td>
<td>(3-0) Cr 3 each 405A: F; 405B: W</td>
<td>Prequisite 313. 405A: Ancient Empires of Egypt and Asia Minor. Rise of the Greeks and Hellenic civilization. The Hellenistic Age. 405B: The Roman Republic, transition to Empire. Roman dominance of the Western world, disintegration of the Empire.</td>
</tr>
<tr>
<td>407A, 407B</td>
<td>The Renaissance and Reformation</td>
<td>(3-0) Cr 3 each 407A F.; 407B: W.</td>
<td>Prequisite: 313 407A: The Italian Renaissance, emergence of towns and cities, growth of a secularized society, early expansion of Europe; new intellectual interests. 407B: The High Renais-</td>
</tr>
</tbody>
</table>
sance, emergence of religious dissent, the Protestant Revolt, end of universality of the Church, era of religious wars, the emergence of dynasties, development of capitalism and the Commercial Revolution.

425A. 425B. Twentieth Century Europe.
(3-0) Cr 3 each 425A F.; 425B W.
Prerequisite: 6 credits in Hist. Mr Mattey.
425A: Europe on the eve of war of 1914; the war and its effect intellectually; economically; politically; rise of totalitarianism.
425B: The depression and the breakdown of international relations in the 1930's, World War II and its results.

*440. History of Science from the Beginnings to Copernicus.
(3-0) Cr 3. F.
Prerequisite: Junior classification. Mr. Sharlin.
Development of natural science in Babylonia, Egypt, China, India; Greek science; medieval and Arabic science.

*441. Beginnings of Modern Science.
(3-0) Cr 3. W.
Prerequisite: Junior classification. Mr Sharlin.
The sixteenth, seventeenth, and eighteenth century revolutions in astronomy, mechanics, biology and chemistry. Rise of scientific societies and the experimental method.

*442. History of Modern Science.
(3-0) Cr 3 S
Prerequisite: Junior classification Mr Sharlin.
Developments of physics, chemistry and biology in the nineteenth and twentieth centuries.

450. History of Modern Russia.
(3-0) Cr 3 S
Prerequisite: 6 credits in Hist. Mr Matterson.
Emergence of Russia in the eighteenth century as an European power; Tsarist Russia as the stronghold of autocracy in the nineteenth century; background of the Revolution of 1917; the Revolution and the Lenin period; the Stalin period.

459. History of the Far East to 1600.
(3-0) Cr 3. F
Prerequisite: 6 credits in Hist. Miss Teters.
A survey of political, economic, intellectual, cultural and social developments of China, Japan, and Korea from earliest times to 1600.

460. The Far East in Modern Times.
(3-0) Cr 3 W
Prerequisite: 6 credits in Hist. Miss Teters.
Early impact of Europe on the Far East; emergence of China and Japan as important nations in the nineteenth century; rise of Japan as a world power and the rise of nationalism in the twentieth century; revolutionary movements in East Asia since World War II.

465. History of Latin America.
(3-0) Cr. 3 W
Prerequisite: 6 credits in Hist. Mr Smith.
Spanish and Portuguese colonization in America; colonial institutions; wars of independence; development of Argentina, Brazil, Chile, and Mexico; emphasis on Pan-Americanism and relations of the United States with Latin America.

470. Sectional Conflict and the Civil War.
(3-0) Cr. 3. F
Prerequisite: 6 credits in Hist. Mr Smith.
Intensive study of the economic, social, political, and psychological conflicts which undermined the democratic process and drove the United States to Civil War.

480. Recent American History, 1929 to Present.
(3-0) Cr. 3 S
Prerequisite: 6 credits in Hist including 323, Mr McJimsy.
History of the United States during the depression and the New Deal, World War II and the Cold War.

495. Special Problems.
Cr 2 to 5 each time elected
Prerequisite: Permission of department head.
Reading and reports on problems selected in conference with each student.
H. Honors Program.

*Any subject listed in the following history sequence may be taken independently: 321, 322, 323; 334, 335; 401, 402; 440, 441, 442.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Science and Modern Thought from 1500 to Present.
(3-0) Cr. 3. S
Prerequisite: 9 credits in Hist. Mr Sharlin.
Interaction of scientific with social, political and economic thought.

(3-0) Cr. 3. S
Prerequisite: 9 credits in Hist and Govt Mr McJimsy.
Development of social and intellectual movements, institutions, and leaders.

(3-0) Cr. 3. F
Prerequisite: 9 credits in Hist or Govt Mr Boles.
Constitutional heritage from England; colonial contributions to constitutional development, making the Constitution; problems of the new government; development of constitutional activities through Supreme Court decisions; effect of the Civil War on the Constitution.

(3-0) Cr. 3 W
Prerequisite: 9 credits in Hist. or Govt. Mr. Boles.
Constitutional significance of the World Wars, the Progressive movement and the New Deal.

534. The Westward Movement.
(3-0) Cr. 3. F
Prerequisite: 9 credits in Hist. Mr. Whitaker.
The West under Spain, France and England; territorial acquisitions; westward movement to the Mississippi; economic, political and social development of the frontier; settlement of the prairie states.

535. The Trans-Mississippi West.
(3-0) Cr. 3 W
Prerequisite: 9 credits in Hist. Mr. Whitaker.
Exploration and settlement of the Great Plains and Rocky Mountain areas; the development of fur trade, cattle and mining; national and institutional modifications; passing of the frontier; effect of the Far West on national development.
COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

215 American Government.
(3-0) Cr. 3 F W S.  
Prerequisite 9 credits in Hist and Govt Mr Smith  
Fundamentals of democracy; nature of federalism; fundamentals of the Presidential, Congressional and Judicial process; the role of public opinion, interest groups and political parties in the governmental process

241. Comparative Political Systems.
(3-0) Cr 3 F W S.  
Prerequisite 215 Staff  
Comparative examination of the political institutions of the major political systems of the world. Institutions and political processes contrasted with those of the United States

305. Functions of American Government.
(3-0) Cr 3 F W S.  
Prerequisite 215 Staff  
Functions and problems of national, state and local governments; national security, foreign policy, governmental finance; regulation of business; labor and agriculture; science, education and welfare activities; state and local institutions

310. State and Local Government.
(3-0) Cr 3 S  
Prerequisite 215, 305 recommended.  
Organization and functions; state regulations and operation; special problems including reorganization of state and local government; consolidation of government areas; financial control; state civil service.

311. Municipal Government and Administration.
(3-0) Cr 3 F S.  
Prerequisite 215, 305 recommended Mr Doyle  
Rise of city in American life; legal position of municipal corporation; forms of organization; personnel and fiscal administration; planning; streets and lights; police and fire administration; public health; recreation; water supply; sanitation; schools; libraries; public welfare administration; utility regulation.

(3-0) Cr 3 F.  
Prerequisite 215 Mr Wiggins  
Analysis of basic concepts: popular sovereignty, liberty, power, justice. Governmental techniques as applied to the democratic process; constitutions; political parties and public opinion, representative systems, legislatures, bureaucracy, governmental career service

351, 352, 353. World Politics and International Organization.
(3-0) Cr 3 each Yr.  
Prerequisite 352: 351; 353.  
351: Survey of the basic factors underlying international politics; the nation-state system; elements, distribution, and role of national power; objectives of foreign policy; causes of war and conditions of peace. 352: Application of principles underlying international politics to the power position and foreign policy of the individual nations and to international conflicts and their solution. 353: Organization and methods devised by states for dealing with their common problems of peace and security; welfare activities at the international level; special attention to the problems arising in the United Nations.

420. Constitutional Law.
(3-0) Cr 3 F.  
Prerequisite 215, 305 recommended Mr Boles
Development of the United States Constitution through judicial action; influence of public law and judicial interpretations upon American government and society.

421. Civil Liberties. (3-0) Cr. 3. W. 
Prerequisite: 420. Mr. Boles. 
American Constitutional and statutory guarantees of civil rights. First Amendment rights of conscience and freedom of expression as well as the rights of defendants. Application of equal protection of the laws to minority groups. Various reform proposals.

422. International Law. (3-0) Cr. 3. S. 
Prerequisite: 351. Mr. Boles. 
Development of the principles of international law of peace and war; analysis of theories concerning its nature and fundamental conceptions, its relation to national law; problems of international legislation and codification.

430. Development of Political Thought: Ancient and Medieval. (3-0) Cr. 3. W. 
Prerequisite: 305 or 241. Mr. Talbot. 
Major political writings from Plato to Bodin. Primary emphasis on the study of translations of original works. An analysis of the ideas contained therein and of the relationships between the theories and their historical context.

431. Development of Political Thought: Modern. (3-0) Cr. 3. W. 
Prerequisite: 420. Mr. Talbot. 
Major political writings from the social contract theories to Niebuhr. Principal areas of attention: liberalism, democratic socialism, communism, fascism, and conservatism.

433. American Political Thought. (3-0) Cr. 3. S. 
Prerequisite: 305 or 241. Mr. Talbot. 
Analysis of main trends in the development of American political ideas, political institutions and governmental policies: an attempt to explain the geographic, economic, social and cultural forces motivating the development of American political thought; to indicate the relation of the developing theories to reality, and to show how theories determine subsequent political action.

440. British and Commonwealth Governments. (3-0) Cr. 3. F. 
Prerequisite: 241 Miss Teters. 
Examination of the governmental processes, political parties and electoral systems of the United Kingdom and Dominion of Canada, Australia and New Zealand. Comparative treatment with the United States.

441. Governments of Western Europe. (3-0) Cr. 3 W. 
Prerequisite: 241. Mr. Theen. 
Comparative examination of the governments of France, Germany, Italy and the Soviet Union; their governmental processes, political parties, electoral systems, political problems. Comparisons with the United States.

442. Governments of Asia. (3-0) Cr. 3. S. 
Prerequisite: 241. Miss Teters. 
Comparative examination of the governments of China, Japan, India, Southeast Asia; their governmental processes, political parties, electoral systems, political problems. Comparison with Western government.

443. Latin American Governments. (3-0) Cr. 3 S. 
Prerequisite: 241 Mr. Haduguer. 
Political processes, political institutions and problems of the Latin American republics.

444. Governments of the Soviet Union and Eastern Europe. (3-0) Cr. 3. S. 
Prerequisite: 241. Mr. Theen 

464. Political Parties. (3-0) Cr. 3. F. 
Prerequisite: 305. Mr. Haduguer. 
Origin and development; relation to democratic process; membership and organization; nominations and elections; persistence of spoils system; campaign strategy; party finance; machine and bosses; party realignment.

466. Public Opinion and Pressure Politics. (3-0) Cr. 3. W. 
Prerequisite: 305. Mr. Haduguer. 
Nature of public opinion in a democracy; relationship of public opinion and public interest; various agencies and pressure groups influencing public opinion; their effect upon governmental policies and governmental personnel; importance of political education.

471. Public Administration. (3-0) Cr. 3. F. 
Prerequisite: 305. Mr. Dose. 
Principles applied to national, state, and local governments; problems of organization, personnel, purchasing and supply; financial procedure; problems and tendencies in the national and Iowa governments.

472. Government and Industry. (3-0) Cr. 3. S. 
Prerequisite: 215, 305 recommended. 
Theories of constitutional protection; governmental assistance to business and agriculture; government and labor; corrective legislation in corporate organization; unfair practices; securities issues; business and taxation; bankruptcy; business with a public interest.

473. Government and Agriculture. (3-0) Cr. 3. F. 
Prerequisite: 215, 305 recommended. Mr. Talbot. 
Agriculture as a major interest in American life; tasks of government as umpire of conflicts among pressure groups; organization and operation of governmental administrative agencies serving agriculture; examination of court decisions involving agriculture; analysis of farm programs.

474. Government and Conservation Policies. (3-0) Cr. 3. W. 
Prerequisite: 215. 305 recommended. Mr. Talbot. 
The political process in the area of public and private land, forest, water and recreation policies. National legislative, executive and administrative processes as they apply to federal grant-in-aid programs. State policies.

495. Special Problems. Cr. 2 to 5. F. W. S. Staff 
National, state, and local governments; governmental reorganization; tax revision, congressional investigation; labor relations; regulation of commerce, industry and agriculture; current party problems. 
H. Honors Program.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Governments of States and Metropolitan Areas.
(3.0) Cr 3 S
Prerequisite 310
Special problems confronting state and metropolitan governments. Changing ecology of urban areas. National-state urban governmental coordination.

511. Public Policy and Rural Government.
(1.0) Cr 3 W
Prerequisite 310 Mr. Boles.
Analysis of structure, administration and legal basis of the county, township, and special districts such as school and drainage districts. Evaluation of rural governmental functions such as education, welfare, highways, including problems of taxation and finance. Effects of population shifts on future of rural governments.

520. Public Law and Public Policy.
(3.0) Cr 3 S
Prerequisite: 420 Mr. Boles.

(History 526) See History

(History 527) See History

530. Advanced Political Thought.
(1.0) Cr 1 S
Prerequisite 431 Mr. Talbot
Selected major political philosophers and their contributions to modern political theory.

(3.0) Cr 3 S
Prerequisite 241 3 credits in 440-444 series Mr. Talbot
A comparative method of analysis of political systems used to study the politics of selected developing nations in Asia, Africa and South America. Foreign aid programs of the United States will be analyzed regarding their impact upon these political systems.

541 Soviet Political Institutions and Thought.
(3.0) Cr 3 S
Prerequisite 444 Mr. Theen
Soviet political and governmental institutions, with primary emphasis upon the decision-making process. The impact of various philosophic and ideological perspectives upon the development of modern Russia.

542 Japanese Political Thought and Institutions.
(3.0) Cr 3 S
Prerequisite: Hist. 450 and 460; Govt. 442 Miss Teters
Japanese theories of the state and government development of Japanese political institutions. Particular attention to period since 1945.

554. Foreign Relations of the United States, 1775-1898.
(History 554) See History

555. United States as a World Power since 1898.
(History 555) See History.

556. International Relations.
(History 556) See History.

560. The Legislative Process.
(3.0) Cr 3 S
Prerequisite: 460 or 461 Mr. Hadwagner.
Principles, procedures, and problems of the legislative process. Structure and organization of state legislatures and the United States Congress.

561 The American Presidency.
(1.0) Cr 3 F
Prerequisite: 460 or 461. Mr. Hadwagner.
Office and powers of the Presidency. The President as political leader, legislator, initiator of foreign policy, administrative leader, commander-in-chief, and head of state.

570. Social Order and Social Conflict.
(Soc 570) See Sociology

571. The Administrative Process.
(3.0) Cr 3 W
Prerequisite 471
Civil service systems in the United States—national, state and local, history of civil service; development of the merit principle; administration of recruitment, selection, classification, promotion, service ratings, discipline, retirement and employee organization.

572 Public Policy and Science.
(1.0) Cr 3 W
Prerequisite. 3 credits in 470 series Mr. Talbot
Public program in the areas of research and development such as those of the Department of Defense, HEW, Agriculture and Interior, as well as AEC, NASA, and the NSF. Impact of such programs upon our federal system, and the universities

590 Special Topics.
Cr 2 to 5 each time taken F.W.S.
Prerequisite 15 credits in Govt. Staff approval
A American Political Institutions Mr. Boles
B Public Law Mr Boles
C Political Theory and Political Behavioralism Mr. Talbot
D Comparative Government Miss Teters,
E Misses Hadwagner, Theen
F International Relations and American Foreign Policy Mr. Smith
G Political Parties and Policy Formation Mr. Hadwagner

Courses in Philosophy

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

260. Introduction to Philosophy.
(4.0) Cr 4 F.W.S
General introduction to philosophy both for those desiring a single terminal course and for those intending to proceed further. Systematic examination of some main problems in metaphysics, theory of knowledge and ethics. Emphasis upon our philosophical tradition and upon critical standards of judgment.
321 The Old Testament.  
(3.0) Cr 3. F.W Mr Shideler.  
Major books in the Old Testament within the framework of their historical background with particular attention to the development of the great religious and ethical ideas.

(3.0) Cr 3. F.W Mr Shideler.  
The development of Christian thought and organization to the close of the New Testament period.

331 Introductory Ethics.  
(3.0) Cr 3 F  
Historical and critical introduction to principal ethical systems. Concepts of the nature of good, right and duty Standards of public and private action.

350. Introductory Logic.  
(3.0) Cr 3 F W S  
The nature of critical thinking including the function of language, deductive logic, inductive and scientific methods.

370. Symbolic Logic.  
(3.0) Cr 3 F W S Mr Harrison.  
Introduction to propositional and predicate calculus as well as intuitive set theory. Some applications to philosophy and the foundations of mathematics.

430 Aesthetics.  
(4.0) Cr 4. S  
Prerequisite: 260 or basic courses in either art, music or literature; permission of the instructor Mr Hartman.  
An examination of some philosophical problems that arise in interpreting and evaluating the arts with particular attention to some representative theories of the nature of art, artistic creation, aesthetic experience, standards of taste and criticism.

431 Contemporary Ethical Theory.  
(3.0) Cr 3 W  
Prerequisite: 311.  
Various ethical systems and the problems of right conduct. Hedonism. Idealism, Christianity. Discussion on the problem of moral choice in contemporary American life.

441. Ancient and Medieval Philosophy.  
(4.0) Cr 4 W.  
Prerequisite: 260 Mr Hartman.  
An account of the rise of critical thought in early Greek and Christian schools of philosophy. Readings from Plato, Aristotle, the Stoics and Epicureans. Augustine and Aquinas.

442. Modern Philosophy.  
(4.0) Cr 4 W  
Prerequisite: 260 Mr Hartman.  
The historical development of philosophical thought from the Renaissance through the eighteenth century. Readings from Bacon, Hobbes, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume and Kant.

443 Recent and Contemporary Philosophy.  
(4.0) Cr 4 S  
Prerequisite: 442 Mr Hartman.  
Philosophical developments in the nineteenth and twentieth centuries. Principal movements in idealism, realism, pragmatism, positivism, existentialism and logical analysis.

455 Christian Thought.  
(4.0) Cr 4 W  
Prerequisite: 260 or 322 Mr Shideler.  
The historical development of Christian philosophy and theology; significant issues in the formulation of the creeds, the continental and English reformation, the Counter Reformation, and modern sectarian attacks upon religion. Distinctive features of Roman Catholicism, Eastern Orthodoxy, Protestantism. Emphasis upon the interaction between Christian thought and secular, cultural and philosophic movements to show significance and influence of Christianity in the formation of Western culture and philosophy.

(4.0) Cr 4. F.S.  
Prerequisite: 260 or 321 or 322 Mr Shideler.  
Origin and historical development of the chief oriental religions. Hinduism, Buddhism, Zoroastrianism, Confucianism, Taoism, Shintoism, Islam. Significance of religious thought in understanding oriental culture; contrast between Oriental and Western views of man, God, nature, history, ethics. Pre-historic and prehistoric religions; the religions of the ancient Near East.

457. Philosophy of Religion.  
(3.0) Cr 3. F.S.  
Prerequisite: 260 or 321 or 322 Mr Shideler.  
Application of principles of philosophical method to basic issues of religious belief, emphasizing problems in religious knowledge, theistic claims, relation of religion and science, skeptical attacks upon religion. Illustrative material drawn from both Christianity and non-Christian world religions.

460. Continental Rationalism.  
(3.0) Cr 3 W.  
Prerequisite: 441 or 442. Mr Van Iten.  
Critical exposition of seventeenth century rationalism as developed by Descartes, Spinoza and Leibniz.

461. The Empiricist Tradition.  
(3.0) Cr 3 S.  
Prerequisite: 441 or 442. Mr Van Iten.  
Critical exposition of British empiricism as developed by Locke, Berkeley and Hume.

462 Epistemology and Metaphysics.  
(3.0) Cr 3 W  
Prerequisite: 441 or 442 or 443 Mr Van Iten.  
Some central problems in epistemology and metaphysics. Concepts, meaning, truth, logical and causal necessity, substance, mind and space and time, determinism and free will.

470 Intermediate Symbolic Logic.  
(Math. 470) 4-0  
Prerequisite: 470. Permission of instructor.  
Propositional and predicate calculus viewed as formal systems; their completeness, consistency and independence. Tarski's definition of truth and Goedel's incompleteness results. Skolem-Lowenheim Theorem.

471. Advanced Symbolic Logic.  
(3.0) Cr 3 W  
Prerequisite: 470.  
Introduction to formal systems and recursive function theory. Church's undecidability results for formal systems. Extensions and generalizations of Goedel's results.

480. Philosophy of Science.  
(4.0) Cr 4 F  
Prerequisite: 260 or 150.  
Central problems in the philosophy of science; determinism and chance in physics, geometry and relativity, various views of the meaning of probability statements; counterfactual conditionals.

481. Advanced Philosophy of Science.  
(4.0) Cr 4 S  
Prerequisite: 480.  
Specific topics in the philosophy of science: space and time; operationalism, the role of formalisms in scientific theories.

495 Special Problems.  
Cr 2 to 5 each time elected.  
Prerequisite: Permission of instructor.  
Staff Reading course in special topics to meet the individual needs of advanced students.
HOME ECONOMICS

Helen R. LeBaron, Ph.D., Dean of Home Economics
Julia M. Faltinson, M.S., Assistant Dean
Ercel S. Eppright, Ph.D., Assistant Dean
Irene Haynes Buchanan, M.S., Placement Director

Courses Administered by the College of Home Economics

Courses listed below are offered for undergraduate students in all curricula of the College of Home Economics. See also individual curricula in the section Colleges and Curricula.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

105. Orientation to Home Economics. (2-0) Cr. 1. F.W.S.S.S1.
   History and scope of home economics; planning a college program; information regarding various majors and professions.

240. Introduction to Family Housing. (3-0) Cr. 3. F.W.S.
   Criteria for evaluating aspects of family housing environment in the United States. Factors related to differences in housing needs. Problems and programs for housing improvement.

400. Professional Relations. Cr R. F.W.
   Prerequisite: Senior classification.

420. Senior Seminar. (1-0) Cr. 1. S.
   Prerequisite: Junior or senior classification.

A. Home Economics for General Education.
B. Home Economics Journalism.

440. Interdepartmental Seminar.
   Cr 1 to 4. F.W.S.
   Prerequisite: Junior or senior classification.
   A. Issues.
   B. Field Trip.
   C. International.
   D. Sophomore.
   H. Honors.

490. Special Problems. Cr arr F.W.S.
   Prerequisite: Junior or senior classification.

540. Interdepartmental Seminar.
   Cr. arr F.W.S.
   Prerequisite: Graduate or special classification.

590. Special Topics. Cr. arr. F.W.S.

HOME ECONOMICS EDUCATION

Marguerite Scruggs, Ph.D., Head of Department

Professors: Hester Chadderdon, Ph.D.; Florence Fallgatter, D.Sc., (Emeritus); Mattie Pattison, Ph.D.

Associate Professors: Alberta D. Hill, Ed.D.; Eleanore L. Kohlmann, Ph.D.

Assistant Professors: Celia M. Andrew, M.S.; Dorothea W. Gienger, M.S.; Blanche R. Miller, M.S.; Merlene E. Nelson, M.S.

Instructors: Margaret J. Arends, B.S.; Gretchen H. Bonnewell, M.S.; Dorothy G. Brown, M.S.; Marcene B. Eshelman, M.S.; Jean A. Hanson, B.S.; Carol Jeske, M.S.; June E. Kreutzkampf, B.S.; Lillie E. Magilton, M.S.; Ardys E. Petersen, B.S.; Barbara B. Rougvie, M.S.; Charlotte D. Schweiger, M.S.; Susan P. Thompson, B.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in home economics education leading to the degree Bachelor of Science, see Home Economics Education Curriculum.

The curriculum in home economics education is planned for those who wish to prepare for teaching in junior and senior high schools. By utilizing some elective credits for certain courses, this curriculum also prepares for home economics extension service.

Students may enroll in the department as sophomores but must apply to and be accepted by the departmental committee on selection and the University Committee on Teacher Education in order to advance to the teacher education program or preparation for the Extension Service. For the teacher education program, including requirements for teaching certification, see Teacher Education.

Vocational Education Qualifications

The Department of Home Economics Education is approved by the State Board for Vocational Education for the preparation of teachers of homemaking who desire to teach in approved vocational homemaking programs.
PREPARATION FOR HOME ECONOMICS EXTENSION SERVICE

Students in Home Economics Education will have a strong basic background for home economics extension service. For specific preparation see Curricula in Home Economics. Ed. 466 and 467 should be included. In addition electives should be considered in consultation with the assistant director in charge of home economics, the training specialist, or a district home economics supervisor. See also Extension Services and Home Economics, Curricula.

Summer employment as assistants to county extension home economists provides valuable experience for potential extension workers. It should be considered between the junior and senior years.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in home economics education and minor work to students taking major work in other departments.

A student expecting to do major work should have fundamental knowledge of psychology, education, sociology and home economics. The exact requirements will depend upon the field of work the student expects to pursue.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head. German, French, Russian or Spanish may be used to meet the language requirement for the degree Doctor of Philosophy. See Graduate College

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

406. Observation and Methods of Teaching Home Economics.
   (3-3) Cr. 4. F.W.S.
   Prerequisite: Ed 305, admission into teacher preparation program. Misses Gienger, Nelson.
   Responsibilities of the homemaking teacher in applying principles of learning and of adolescent development to instruction. Philosophy of home and family life education. Guided observation of teaching. Field trips to typical homemaking departments.

407. Supervised Teaching in Home Economics.
   Cr. 9. F.W.S.
   Prerequisite: 406. A.A. 261, C.D. 236, C.D 270, F and N 303, H Eq. 154, Sp. 311, T. and C 223 or 225 and cumulative grade point average of 2.3. Staff.
   Supervised teaching in public schools. Advance reservation required.

408. Methods in Adult Homemaking Education.
   (2-2) Cr. 3. W.S.SSI.
   Prerequisite: Credit or classification in 407. Miss Nelson.
   Organization of material, selection, use and evaluation of teaching techniques suited to group work with adults and to media of informal education in homemaking. Observation of adult classes. Participation in organizing and teaching adult groups.

409. Planning and Evaluating the Homemaking Program
   (3-0) Cr. 3. W.S.SSI.
   Prerequisite: 407. Staff.
   Plans for secondary school homemaking programs for adolescents of varied ages and capabilities. Special emphasis on curriculum, evaluation and Future Homemakers of America. Professional ethics and organizations. Appropriate educational resource materials.

   (2-0) Cr. 2. F.
   Prerequisite: F. and N. 305, Miss Nelson.

490. Special Problems.
   Cr. arr F.W.S SSI, II

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

505. Workshop.
   Cr. 1 to 5. S.S.
   Prerequisite: Permission of instructor.
   Concentrated group study of problems in fields of home economics education indicated in sections A to E. Sections offered will vary from year to year.
   A. Adult Education
   B. Evaluation. Miss Chadderdon
   C. Home Economics Curriculum. Miss Kohlmann
   D. Supervision and Administration. Miss Hill
   E. Special

   (2-0 or 3-0) Cr. 2 or 3. SSI, II.
   Prerequisite: Teaching experience. Staff.

Developments in organization and methods of teaching homemaking and family life in junior and senior high schools. The vocational homemaking program, organization, curriculum and methods. Especially designed to meet the needs of those returning to teaching.

590. Special Topics.
   Cr. arr F.W.S SSI, II
   Prerequisite: 486
   A. Adult Education.
   B. Administration.
   C. Curriculum. Miss Kohlmann
   D. Evaluation. Miss Chadderdon.
   E. Extension.
   F. Supervision. Miss Hill.
   G. General.
COURSES FOR GRADUATE STUDENTS, major or minor

605. Home Economics Curricula.
(3-0) Cr. 3. F.S.S.I.
Prerequisite: 15 credits in Ed. and teaching experiences or permission of instructor Miss Kohlmann.
Bases and techniques of curriculum building applied particularly in home economies for secondary schools and colleges.

606. Techniques of Supervision.
(3-0) Cr. 3. S.S.S. I, II.
Prerequisite: 5 credits in graduate courses in H Ec Ed. Miss Hill.
Functions of home economics supervision in a student teaching center, a city system and a state department of education. Objectives, techniques and evaluation of supervision.

609. Adult Education in Family Life.
(3-0) Cr. 3. W.S.S. I, II.
Prerequisite: 404 or experience in adult education, 8 credits in Psych. permission of instructor. Staff.
Philosophy of family life education for adults. Interests and needs of various age and social groups. Methods and materials effective in group work and in educational media such as radio and television. Findings of latest research in the field of adult and family life education.

HOME MANAGEMENT
Margaret I. Liston, PhD, Head of Department

Professor: Marie A. Budolfson, M.S.
Instructors: Selma Duncan, B.S.; Edith Hewitt, B.S.; Jeannette Korslund, B.S.

Opportunities for Undergraduate Study
Home management is concerned with achievement of goals by individuals and families through thoughtful use of time, money, property, information, human resources and community facilities. Concepts and principles from several social sciences are used for description and analysis of decision-making involved in achieving standards of living.

A student who is interested in developing a program with emphasis on home management may do so as a major in home economics for general education. Such a program prepares for employment in home economics extension service, social welfare, and consumer marketing or other business positions for which backgrounds in home management and social science are desired. Valuable preparation also may be gained for graduate study leading to college teaching and research.

Those interested in further information about employment opportunities and programs of study should consult the head of the department.

Opportunities for Graduate Study
The department offers major work for the degree Master of Science and minor credit to students with majors in other departments.

Prerequisite to major graduate work is the completion of at least 15 hours in each of the following areas: communicative arts; humanities; natural sciences; social and behavioral sciences, including at least one course each in principles of economics, psychology, and sociology; home management; other fields of home economics.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

375. Management in the Family.
Prerequisite: CD 270, Econ. 242, junior classification.
Management related to functions of the family in society. Comparison of families with respect to goals sought, resources available, and managerial behavior. Changes within the family and its environment which necessitate management. Decision and choice as aspects of individual and group adjustment to changed situations.
415. Consumers in the Market.
(Econ. 415) (3-0) Cr. 3. F. SSI, 1966; SSII, 1967.
Prerequisite: Econ 242, Psych 101, Soc 134.
Consumers' roles in the marketing system; market organization and its impact on consumers; consumer decision-making with respect to market goods and services; evaluation of information sources for consumer buyers; analysis of programs for consumer protection.

475. Home Management House.
Cr. 4. F.W.S.SSI.
Prerequisite: 375, Psych. 101, Soc. 134, F. and N. 303, classification in 488 or permission of instructor. Miss Korslund, house adviser.
Residence for one-half quarter with actual experience in decision making, homemaking and group relationships; arranged individual and group conferences. Advance reservation with department required.

488. Family Finance.
(Econ. 488) (3-0) Cr. 3. Half-quarter sections, F.W.S.SSI. One full quarter section F.W.S.
Prerequisite: Econ. 242, Psych. 101, Soc. 134.
Miss Budolfson.
Half-quarter sections limited to those with approved plan for blocking or less than 18 Cr. Hr. schedule.
Managerial approaches to financial problems of families in contemporary society. Factors influencing decisions on acquiring and using income. Concepts and techniques related to consumer credit, savings and investment, insurance, home ownership, and estate programming.

490. Special Problems.
Cr. arr. F.W.S.SSI.
Prerequisite: 375, permission of instructor.
A. Senior Seminar.
B. Field Experience.
C. Senior Project.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

520. Food Economics.
(Econ. 520) (3-0) Cr. 3. S.SSI, 1966; SSII, 1967.
Prerequisite: 9 credits in Econ., Psych. 101, Soc. 134.
Analysis of factors related to trends in world population growth and food consumption. Economic, psycho-social and managerial aspects of food in family life. Evaluation of public policies and programs with respect to food consumption.

521. Social and Economic Aspects of Family Housing.
(3-0) Cr. 3. SSI, 1966.
Prerequisite: Econ. 242, Psych. 101, Soc. 134.
Selected managerial, legal, economic and public policy aspects of family housing.

522. Management of Time and Human Resources.
(3-0) Cr. 3. SSSI, 1967.
Prerequisite: Econ. 242, Psych. 101, Soc. 134.
Miss Liston.
Perspectives concerning time and human beings as resources in family life. Social and technical concepts and principles related to use of these resources for furthering attainment of family goals. Special consideration of management related to such problems as tension and fatigue, physically handicapped, employment of wives, and leisure.

575. Supervision.
(3-0) Cr. 3. F.
Prerequisite: 475. Miss Budolfson.
Objectives and methods for home management residence programs.

588 Advanced Family Economics.
(Econ. 588) (3-0) Cr. 3. S.SSI, 1966.
Prerequisite: Econ. 242, Psych. 101, Soc. 134.
Miss Liston.
Problems of measuring family income, wealth and welfare. Factors which influence income-expenditure relationships. Programs for improving adequacy and security of income during family life cycle.

590. Special Topics.
Cr. arr. F.W.S.SSI,II.
Prerequisite: 3 credits in H.Mgt., permission of instructor.
A. General Management. Misses Budolfson, Liston.
B. Family Housing. Miss Liston.
C. Family and Consumer Economics. Miss Liston.
D. Time and Human Resources. Miss Liston.
E. Laboratory Supervision. Miss Budolfson.
F. Family Finance. Miss Budolfson.
G. Professional Services.

COURSES FOR GRADUATE STUDENTS, major or minor

614. Research.
F.W.S.SSI,II Miss Liston.

619. Social Science Methods in Home Economics Research.
(3-0) Cr. 3. W
Prerequisite: 15 credits in Soc Sci., credit or classification in Stat 401. Miss Liston.

667. Seminar.
Cr. arr. F.W.S.

HORTICULTURE

John P. Mahlstede, Ph.D., Head of Department


Social science principles as tools of home economics research. Methods and techniques of investigation. Design and interpretation of studies in fields related to students' interests.
ASSOCIATE PROFESSORS: Griffith J. Buck, Ph.D.; Benjamin F. Vance, B.S.
ASSISTANT PROFESSORS: Carroll C. Doll, M.S.; Charles H. Sherwood, Ph.D.; Frank L. Schulte, Ph.D.; Jack L. Weigle, Ph.D.
INSTRUCTOR: Fredrick D. Rauch, M.S.

Opportunities for Undergraduate Study
For undergraduate curriculum in horticulture leading to the degree Bachelor of Science, see Horticulture, Curriculum.

The curriculum in horticulture is designed for students interested in fruit growing, vegetable growing, flower growing, vegetable and flower seed production, nursery management, landscape nursery management, arboriculture and turfgrass management. Horticulture is a career for city as well as rural youth. A farm background is not necessary.

The four-year curriculum has six areas of specialized training: (1) fruit crops, (2) vegetable crops, (3) floriculture, (4) nursery management, (5) arboriculture and (6) turfgrass management. The curriculum is designed to prepare the student for work as an owner, operator or manager of an orchard, vegetable or flower growing enterprise, florist shop, nursery, or arboriculture firm; field man or production supervisor for a canning company, seed company, nursery or florist; plant breeder for a seedsmen or canner; greenskeeper or turfgrass consultant for golf courses, playing fields and parks; research worker in commercial work, such as a canning company, seed company, nursery or floral enterprise; utility line clearance foreman, supervisor of tree care in parks, highways, college campuses or grounds of other public institutions; teacher, research and extension worker in a college or university and in government work; or for graduate work leading to advanced degrees in horticulture and related fields.

The curriculum provides a liberal allowance of elective credits to be filled with courses selected by the student.

Opportunities for Graduate Study
The department offers major work for the degrees Master of Science and Doctor of Philosophy in horticulture with the option of specializing in fruit crops, vegetable crops, floriculture, nursery crops, arboriculture and turfgrass and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of courses covering the general field of horticulture or botany and the underlying sciences.

Students with major interest in fruit crops, floriculture, vegetable crops, nursery crops, arboriculture or turfgrass should present the equivalent of 15 quarter credits (10 semester hours) of undergraduate work in horticulture, botany, landscape gardening or agronomy. The student also should have a working knowledge of inorganic and organic chemistry, general botany and soils equivalent to the requirements outlined in the general curriculum for horticultural students at this institution.

Students taking major work in horticulture usually will take minor work in agronomy, genetics, botany (physiology, pathology, cytology, or morphology), entomology, statistics or chemistry.

Open to graduate students for minor only. 446, 447, 467.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Introduction to Horticulture.
(1-0) Cr. R F
Introduction of first-year students to horticulture field; assistance in learning how to use facilities of the University and department to advantage.

A. (3-0) Cr. 3. F W.S.; B. (0-2) Cr. 1. F S.
Horticulture in daily living; plant growth, environment, propagation, cultivation, pruning, irrigation, protection, harvesting, quality control and selection; home grounds development and maintenance. Laboratory optional.

146. Home Floriculture.
(0-4) Cr. 2. F W.S. Not open to horticulture majors.
Principles and methods of growing house plants and garden flowers.

(2-2) Cr. 3. W.
Principles and methods of plant-growing under glass; nutrient solution culture of greenhouse plants.

164. Vegetable Crops.
(3-0) Cr. 3. S.
Principles of vegetable production. Culture of the more important vegetables.

(2-2) Cr. 3. W. 
Prerequisite: 114 or Bot. 101 
Fundamental principles underlying sexual and asexual propagation of plants and practice in reproducing plants by use of seeds, leaves, stems and roots.

224. Small Fruits. 
(2-2) Cr. 3. S. 
Principles and practices involved in handling home and commercial plantings of vineyards and plantations of strawberries, bush fruits and miscellaneous small fruits.

244A. 244B. Garden Flowers. 
(3-0) Cr. 3. A· F.; B: S 
A: Open to horticulture majors. B: Not open to horticulture majors. Description, nomenclature, classification and culture of important garden flowers including annuals, perennials, bulbs, flowering vines, rock and water garden plants.

247A. 247B. Floral Design. 
A: (1 2) Cr. 2 F.W.S. B: (1 4) Cr. 3. Alt. W. Offered 1966. 
Prerequisite: A: Not open to horticulture majors without permission of the instructor. B: Open only to horticulture students specializing in floriculture.
Principles, mechanics and uses of flower arrangements; conditioning and preparation of floral arrangement material exhibiting and judging of flowers and flower arrangements.

305. Landscape Service. 
(2-2) Cr. 3. F. 
Planting, maintenance operations and estimating practices, including handling of labor and equipment on landscape operations.

313. 314. Turfgrass Management. 
(Agron. 313, 314) (3-0) Cr. 3. S F 

316 Nursery Management. 
(2-2) Cr. 3. S. 
Prerequisite: 214, Mr. Mahlstede. 
Equipment, including land, packing sheds, storage sheds, frames, glass houses, irrigation devices; large scale propagation; trans-planting and management of plants; relations to other fields of horticulture; protection of nursery plants from climatic, disease and insect difficulties.

321. Orcharding. 
(2-2) Cr. 3. F. 
Prerequisite: 114. 
Varieties, pest control, harvesting, grading, packing and storage of orchard crops.

324. Grading and Judging Horticultural Products. 
(0-4) Cr. 2 each time elected. F.W. Mr. Buck. 
Open to senior students only. Grading and judging horticultural crops and products; requirements of produce inspection services; staging horticultural exhibits.

401. 402. 403. Seminar. 
(1-0) Cr. 1 each Yr. 

414. Marketing Horticultural Products. 
(4-0) Cr. 4. W. 
Prerequisite 114. Areas of production of horticultural crops, standardization, inspection, transportation, storage, price trends, agents of distribution, market news service, foreign markets, cooperative markets.

422. Advanced Orcharding. 
(2-2) Cr. 3. Alt. S. Offered 1967. 
Prerequisite: 321. 
Propagation, planting, pruning, maintenance, physiology of growth and storage of orchard crops.

446. 447. Advanced Floriculture. 
(2-2) Cr. 3 each. 446: F.; 447: Alt. W. Offered 1967. 
Prerequisite: 446: 154, 244; 447: 446. 
446: Culture and propagation of florist bench crops and potted plants. 447: Culture of tender bedding plants; marketing cut flowers; organization and management of greenhouse and retail store.

467. Horticultural Technology. 
(3-0) Cr. 3. S. 
Prerequisite: Bot. 310, Agron. 354. Application of new technology to the production and handling of horticultural crops, including current aspects of soil fertility, variety development, post-harvest physiology, and mechanization.

491. Systematic Horticulture. 
(3 4) Cr. 5 each. Alt F. Offered 1965, 1966. 

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Special Topics. 
Cr. arr. 
Prerequisite: A major or minor in horticulture.

(3-0) Cr. 3 Alt. W. Offered 1967.

COURSES FOR GRADUATE STUDENTS, major or minor

600. Research. 
A. Floriculture. Mr. Buck. 
B. Fruit Crops. Mr. Denisen. 
C. Vegetable Crops. Mr. Weigle. 
D. Nursery Crops. Mr. Mahlstede. 
E. Arboriculture. Mr. Mahlstede. 
F. Turfgrass. Mr. Roberts.

604. Graduate Conference. 
Cr. 1 each time elected. F.W.S. Mr. Mahlstede.

618. Genetics and Breeding of Horticultural Plants. 
(3-0) Cr. 3. Alt. W. Offered 1966.

Prerequisite: 3 credits Gen., 3 credits plant physiology; Agron. 354, Stat. 201A. Mr. Weigle.

The physiological and genetic bases for horticultural techniques or practices and the effect of environment in modifying these techniques.
Opportunities for Graduate Study

Opportunities for Undergraduate Study

For undergraduate curricula in household equipment and in household equipment and related science leading to the degree Bachelor of Science, see Home Economics, Curricula

The Household Equipment Department offers courses designed to develop understanding of modern home appliances, their contribution to effective family living and certain fundamental principles of housing. Basic concepts and principles from the physical, biological and social sciences are applied, through the study of equipment, to the health, comfort and safety of the family, to the intelligent use of family resources and to performing household tasks in ways which contribute to furthering individual and family goals.

The household equipment curriculum prepares primarily for work in business positions. There are two broad types of work to which this major leads: (1) the preparation and dissemination of consumer information about equipment and physical aspects of housing and (2) research and development work. Students interested in consumer information aspects are employed by home service departments of appliance manufacturers, gas and electric utility companies and consumer magazines. Those interested in the technical aspects of equipment find their opportunities in research, testing and development departments of appliance manufacturers and in government or commercial laboratories; in these positions they work with other technical people.

The household equipment and related science curriculum leads to positions in laboratory research or development work, or to graduate study. Any student interested in graduate work should choose this curriculum or include statistics and additional mathematics in the regular household equipment curriculum.

Household equipment provides a broad base for work in Home Economics Extension. See Curricula in Home Economics. Students preparing for extension work through other curricula or those preparing for such professions as teaching or television will find 208; 308 and 445 valuable. For emphasis in housing 308, 445 and 446 are suggested.

Opportunities for Graduate Study

The department offers major work for the degree Master of Science and minor work to students taking major work in other departments. Work may be taken for the degree Doctor of Philosophy as a divided major with certain departments offering work for this degree in home economics, physical or social sciences or engineering. The department cooperates in the Water Resources Program. See Water Resources.

Prerequisite to major graduate work is the completion of basic course work in household equipment and food preparation and a fundamental knowledge of chemistry, physics, and mathematics. It is recommended that a student have a background in home economics but training in physical, chemical or biological sciences may be suitable. Basic courses considered as prerequisites may be taken during the first year of graduate study but without graduate credit.
The exact requirements for an advanced degree will depend upon the field of work the student wishes to pursue and are subject to approval by the student’s advisory committee. Open to graduate students for minor only: 421, 445, 446, 490.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

154. Introduction to Equipment in the House
   (3-0) Cr. 3. F.W.S.SSI.
   Application of basic principles of electricity and gas; characteristics, use and care of materials used in the house and its equipment; principles of selection, use and care of major home appliances.

208. Small Equipment
   (2-4) Cr. 3. F.W.S.SSI.
   Prerequisite: 154. Miss Inman, Mrs Van Zante
   Study of electric and non-electric appliances for food preparation, cooking, cleaning and sewing.

304. Equipment Technology
   (3-3) Cr. 4. F.
   Prerequisite: Credit or classification in 154, Phys 106, Math 101 Mrs Van Zante.
   Advanced study of electricity and gas as applied to appliances; safety in use of fuel gas and electricity, use of laboratory instruments for determining operating characteristics of appliances.

308. Home Lighting and Kitchen Planning
   (2-6) Cr 4. F.W.
   Prerequisite: 154. Miss Beveridge, Mrs. Pickett.
   Factors affecting efficiency of light sources; lighting design for the home. Planning of kitchens and work areas for convenience, comfort and contribution to family living, problems of installation and remodeling.

315. Television Demonstration Techniques
   (2-4) Cr 3. S
   Prerequisite: Sophomore classification, Sp 311, T.C.A 206A.
   Experience in planning and presenting demonstrations for television audiences. Reservation required.

400. Senior Observation Trip
   Cr. R. Alt yrs offered 1965-66
   Prerequisite: Junior classification.
   Observation in manufacturing plants, testing laboratories, home service departments, and lighting institutes.

407. Gas and Electric Ranges
   (2-4) Cr 3. W
   Prerequisite: 304, F and N 208 Miss Inman, Mrs. Van Zante.
   Range fuels, range parts and principles of operation. Standard tests. Surface, oven and broiler cookery. New developments in controls and special features; electronic range.

408. Laundering and Other Water-Using Equipment
   (2-6) Cr 4. S
   Prerequisite: 154, T and C 104 Mrs Pickett.
   Principles of home laundering. Study and use of equipment important to effective laundering, dishwashing and food waste disposal.

409. Home Refrigeration
   (2-4) Cr. 3. F
   Prerequisite: 304. Miss Inman, Mrs. Peet.
   Physical principles of heat as applied to refrigeration; operating characteristics, use and management of refrigerators and freezers.

415 Household Equipment Field Work
   Cr. 3-8 arr.
   Prerequisite: Junior classification, permission of department head.
   Professional work in household equipment or industry. Special report required.

421 Training in Demonstration Techniques
   (2-4) Cr 3. F.W.
   Prerequisite: 154, Sp 311. credit or classification in F and N. 303, senior classification.
   Misses Beveridge, Inman.
   Experience in planning and presenting direct audience demonstrations. Techniques for presentation before various size groups. Reservation required.

422. Professional Orientation
   (3-0) Cr. 3. W
   Prerequisite: Junior classification in H.Eq. Miss Beveridge, Mrs. Pickett.
   Opportunities for professional work in household equipment; the home economist in the business organization; human and public relations; professional responsibilities and ethics; personal growth and social responsibility.

425. Seminar
   (2 0) Cr 2. S
   Prerequisite: Senior classification. Misses Beveridge, Inman.

445. House Utilities
   (3 2) Cr. 3. S.SSI.
   Prerequisite: 154. junior classification. Mesdames Pickett, Van Zante.
   Basic principles related to comfort, health and safety in plumbing, home heating and cooling; home communication systems.

446. House Evaluation
   (3 2) Cr. 3. F
   Prerequisite: 154. Mrs. Van Zante.
   A course emphasizing important points in house selection. Special attention is given to the structural quality, safety, comfort and convenience of new houses and older houses.

490. Special Problems
   Cr arr. F.W.S.
   Prerequisite: 12 credits in H.Eq., permission of department head.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

505. Research Methods in Household Equipment
   (2-4) Cr. 3. W
   Prerequisite: 304. Mrs. Van Zante.
   Research methods and techniques, instrumentation, data analysis.

590. Special Topics
   Cr. arr. F.W.S.
   Prerequisite: 305 or concurrent registration; permission of department head. Misses Beveridge, Inman, Mesdames Peet, Pickett, Van Zante.
A series of non-sequence courses in which graduate students do individual investigations relating to different areas of the equipment and housing fields.
A. Gas and Electric Ranges.
B. Refrigeration.
C. Lighting.
D. Laundering Equipment.
E. Small Equipment.
F. Advanced Laboratory.
G. Housing.

COURSES FOR GRADUATE STUDENTS, major or minor

604. Seminar.
(1-0) Cr. 1. S. Misses Beveridge, Inman, Mmes. Pickett, Van Zante

Applications of principles of heat and light and associated research techniques.

605. Advanced Equipment Technology.
Cr. arr. Offered on demand
Prerequisite: 505. Mrs. Van Zante.

690. Research.
Misses Beveridge, Inman, Mmes. Pickett, Van Zante.

HYGIENE

Gail McClure Proffitt, M.D., Head of Department

Professor: John G. Grant, M.D.
Assistant Professors: C. Raymond Bickerstaff, M.Ed.; Cecil V. Hamilton, M.D.

Opportunities for Undergraduate Study

For the Student Health Service of the Department of Hygiene, see Health Service.
The Department of Hygiene offers such training and instruction as will enable students to maintain high health standards for themselves and the community in which they live.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

104. Health Education.
(3-0 or 3:1) Cr. 3 or 4 F
Personal, family and community health. Advanced first aid laboratory required for certain students, optional for others.

304. School Health Problems.
(3:0) Cr. 3 S

INDUSTRIAL ADMINISTRATION

William H. Schrampfer, J.D., Head of Department

Associate Professor: Bruce T. Kruse, Ph.D.
Instructors: Thomas K. Andison, M.A.; George L. Grovert, M.A.; Frederick D. Pease, M.A.

Opportunities for Undergraduate Study

For the undergraduate group requirements in the curriculum in the College of Sciences and Humanities, major in industrial administration leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.
The Department of Industrial Administration provides training for those who are interested in business and industry, having as their goals either private business enterprise or ultimate business management positions. It is the purpose of the department to provide interrelated training in the basic recognized business areas of accounting (managerial, cost and tax), business law, business forecasting, business organization, finance, industrial risks, marketing and procurement, regulation of business, transportation and traffic management. The Departments of Economics, Industrial Engineering and Psychology offer supplementary instruction in the areas of industrial relations, employer-employee relations, production management and personnel supervision.
The department presents the opportunity of preparation for the study of law by completion of three years of this curriculum, followed by one year in a recognized college of law, after which the degree Bachelor of Science with a major in industrial administration will be awarded by Iowa State University. Those interested in this cooperative program should contact the head of the department early in the sophomore year to assure an appropriate sequence of course work.

In cooperation with the Department of Architecture a program of study is provided for those who are interested in business as related to the building industries. This program leads to the degree Bachelor of Science, with a major in industrial administration and minor in architecture. For particulars, the head of either department should be consulted.

In cooperation with the Department of Institution Management, College of Home Economics, a program of study is provided for those students interested in business as related to the food service industry. Students will prepare for positions in restaurant management, college food and housing administration, and other similar managerial positions. For particulars, the head of either department should be consulted.

Students who wish to specialize in the study of international affairs may do so through the International Service Programs while majoring in Industrial Administration. See International Service Programs for additional information regarding this program.

**COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS**

75. Survey of Accounting.  
(2-3) Cr. 3 F.W.S.  
Accepted for credit in Technical Institute programs only. A survey of the purposes and procedures of general accounting; introductory survey of cost accounting objectives and procedures. The course is designed to introduce students to the effective use of accounting information.

99. Introduction to Business and Industrial Organization.  
(3-0) Cr. 3 F.W.S.  
Accepted for credit in Technical Institute programs only. An introduction to the broad field of business and industry; its organization, functions and administration.

150. Introduction to Industrial Administration.  
(4-0) Cr. 4 F.W.S.SSI.II.  
The study of business as a part of general undergraduate education with emphasis on the business firm as a social institution and as a functioning unit within the economic, social and political environment in which it is managed and in which it operates.

340. Industrial Marketing I.  
(3-0) Cr. 3 F.W.S.SSI.  
Prerequisite: Econ. 242 Messrs. Pease, Zober.  
Marketing functions, institutions and policies as applied to the industrial market.

(3-0) Cr. 3 F.W.S.SSI.  
Prerequisite: Econ. 241, one course in accounting. Mr. Anderson.  
Principles of financial organization and management. Types of corporate securities; financing and management of new corporations and reorganizations.

365. Business Law I.  
(3-0) Cr. 3 F.W.S.SSI. Mr. Schrampfer.  
A. For students in engineering.  
C. For students in agriculture.  
D. For students in science and home economics.  
Fundamental principles of law as applied to business transactions and business relationships. Affords the student opportunity to appreciate our legal system as an agency of social control as well as to observe good business technique and practice.

366. Business Law II.  
(3-0) Cr. 3 F.W.S.SSI.  
Prerequisite: 365. Mr. Schrampfer.  
Sales and negotiable documents of title; security relationships; credit instruments.

(3-0) Cr. 3 F.W.S.  
Prerequisite: 3 credits in Principles of Economics Mr. Powers.  
Ownership and management organization; relationship between government and business.

*371. Industrial Accounting.  
(3-0) Cr. 3 F.W.S.SSI.  
Survey of theory and procedure of general accounting; introductory survey of cost accounting objectives and procedures. A terminal course for engineers not planning further study in accounting. This course does not meet prequisite for 385 or 480.

*372. General Accounting.  
Cr. 4: (2-3) SSI.II; B: (4-0) F.W.S.; C: (12) F.  

*384. Accounting I.  
(2-4) Cr. 4 F.W.S. SSI.II.  
Introduction to theory and procedure of general accounting. Emphasis upon development of accounting reports on an accrual basis through transaction analysis and summarization. Introduction to controlling accounts and special journals. Designed primarily for students who contemplate completing the basic accounting sequence.

385. Accounting II.  
(3-0) Cr. 3 F.W.S.SSI.  
Prerequisite: 384 or 372, permission of instructor.  
Capital and surplus analysis: introduction to

*Only one of the following courses may count toward graduation: 371, 372, 384.
valuation concepts as they relate to receivables, inventories and fixed assets; partnership accounting techniques and problems.

386 Intermediate Accounting. (3-0) Cr 3. F.W.S.S.S. Prerequisite 385
Accounting functions and introduction to accounting principles; application of valuation principles; interpretation of financial statements.

Survey of income tax problems with emphasis upon transaction planning and return-preparation for individuals.

440. Industrial Marketing II. (3-0) Cr 3, F.
Prerequisite 340 Mr. Zober
Extension of 340 with emphasis upon procurement in the industrial market; application of principles to selected cases.

443. Marketing Management. (3-0) Cr 3 S
Prerequisite 340 Mr. Zober
Formulation of marketing policies; administration of marketing operations; application of principles to representative problems of selecting, training, organizing and managing personnel. Field trip.

445. Investments. (4-0) Cr 4 F.W.S S.
Prerequisite Econ 242, I.Ad. 350, 384 recommended. Mr. Shadle
Security prices and yields, essential investment features of various corporate securities—risk, income, control; methods of testing bonds and stocks; individual investment programs.

449. Real Estate Finance (Arch 440) (3-0) Cr 3 F.W
Prerequisite Arch 343 or I.Ad. 350 Mr. Shadle
An analysis of current real estate problems and practices from the standpoint of the businessman and the property owner. The financial, economic and social aspects of real estate investment decisions are emphasized, with considerable attention to impact upon the construction industry.

460. Principles of Transportation. (3-0) Cr 3 F.W
Prerequisite Econ 242 Messrs. Melody Thompson
Historical development and current role of transportation in the United States. Analysis of the economic problems and public policy pertaining to all agencies of transportation with emphasis directed toward the railroad industry.

463. Highway Transportation. (3-0) Cr 3, W.
Prerequisite Econ. 242 Mr. Thompson
Types and character of the present commercial highway services. Appraisal of the competitive relationships between the different classes of motor carriers and other agencies of transportation. Current problems in the administration and financing of the national highway system.

465. Traffic Management. (4-0) Cr 4 F.W.
Prerequisite 460 Mr. Thompson
Organization, functions and duties of the traffic management departments in small and large industries: Shipper-carrier relationships; shipping procedures; selection of transporta-

tion media; freight classification; freight rate tariffs. Economic implications of transit privileges, routing, warehousing and demurrage. Includes transportation by rail, motor, air, water, pipeline, express and parcel post. Field trips to industrial and carrier installations.

467. Public Utilities. (3-0) Cr 3 F.
Prerequisite Econ 242. Mr. Melody.
Nature of the public utility concept. Theories of valuation and rate of return, plant operation and utilization; capital structures. Division of regulatory control between state and national government. Private and public ownership of utilities in the United States.

469. Transportation Seminar. (3-0) Cr 3 S
Prerequisite 400 463. Mr Thompson
Research and discussion on contemporary problems in the field of transportation, particularly in the areas of (a) coordination and consolidation of the major agencies which comprise the transportation system, and (b) changing regulatory policies of the state and federal government and their impact upon the nation's economy.

470. Business Forecasting. (3-0) Cr. 3. F.W.S.S.
Prerequisite 350, 384, Econ. 242 Mr Zober
Methods employed in estimating the probable degree of direction of business change with a view to reducing business risk.

474. Advanced Business Finance. (3-0) Cr. 3 W
Prerequisite 350, 384 Mr Andson.
Promotion and expansion of business enterprise. Procedure and planning of the internal financial control of business. Field trip.

477. Business Finance Seminar. (3-0) Cr. 3 S
Prerequisite 350, 445, 474 Mr Shadle
A consideration of contemporary problems, pertinent topics and current research in the areas of business, finance, investments and investment analysis. Broad reading and individual investigation of specific financial problems and policies required.

480. Cost Accounting. (2-4) Cr 4 F.W.S S
Prerequisite 372A or 384, or 372C. Mr Handy
Elements of cost in industrial accounting; preparation of cost reports; job order and process cost accounting methods, introduction to standard costs. Field trip.

481. Advanced Cost Accounting. (3-0) Cr. 3 S
Prerequisite 386, 480 Mr Handy
Development of standard production cost systems, including typical managerial reports. Study of distribution costs, manufacturing budgets, incremental profit and profit/ volume analysis. Introduction to direct costing. Field trips.

486. Industrial Market Analysis. (3-0) Cr 3 W.
Prerequisite 340 Mr Zober
Development of procedures and analysis techniques for a quantitative and qualitative determination of market potentials through selected projects. Field trip.

490. Industrial Risks. (3-0) Cr. 3 F.S.S.S. 1066
Prerequisite 365 Mr. Shadle
Risks of modern industry; shifting of industrial risks through the insurance technique. Characteristics of mutual and stock companies. Estimations of insurable costs.
495. Advanced Accounting I.  
(3-0) Cr. 3. F.  
Prerequisite 386. Mr. Brown.  
Advanced accounting theory and its application; accounting systems and machine techniques; presentation of managerial importance of future planning through accounting. Field trips.

496. Advanced Accounting II.  
(3-0) Cr. 3. W  
Prerequisite 495 (may be taken concurrently with 495). Mr. Brown.  
Principles and procedures involved in the accounting for the expansion, contraction and reorganization of business units. Branch operations, consolidated financial statements, purchase of business units, pooling of interests, quasi reorganization, reorganization. Field trips.

497. Auditing.  
(3-0) Cr. 3. W  
Prerequisite 495. Mr. Brown.  
Internal control procedures in modern business; the development of auditing standards and procedures as applied by Certified Public Accountants; a review of internal auditing activities. Field trips.

498. Accounting Seminar.  
(3-0) Cr. 3. S  
Prerequisite 481, 496, 497. Mr. Brown.  
An integration and expansion of accounting theory and practice as they relate to the operation of both the Controllership function in business and the public accounting profession. Field trips.

499. Special Problems.  
Cr. 1 to 5 each time elected. F.W.S.SSI, II.  
Prerequisite: Senior classification, permission of department head.

INDUSTRIAL EDUCATION

For description of courses, see Education.

INDUSTRIAL ENGINEERING

Joseph K. Walkup, B M. E., I. E., Head of Department


Associate Professors: Daniel L. Griffin, Jr., M.S.; J. D.; Clifford E. Smith, Ph.D.; Gerald W. Smith, Ph.D.; Victor M. Tamashunas, M.S.; Richard C. Vaughn, M.I.E.

Assistant Professors: William C. Arnwine, M.S.; Edward J. Carney, M.S.; Robert D. Love, M.S.; Keith L. McRoberts, M.S.; Loran F. Mohr, B.S.; Franklin L. Wolf, M.S.

Instructors: Jerome C. Glaser, M.S.; Herbert H. Harmison, B.S.; Richard O. Hoffman, B.S.; George F. Lamp, M.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in industrial engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula

The industrial engineering curriculum affords essential training to those who have strong aptitude and interest in engineering and a potential capacity for management. An industrial engineer is concerned with the design, improvement and installation of integrated systems of men, materials and equipment; drawing upon specialized knowledge and skill in the mathematical, physical and social sciences together with the principles and methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained from such systems. The professional services performed by industrial engineers include plant layout and design, methods planning, work measurement, quality control, production control, cost analysis, sales engineering, personnel supervision and management. These services are rendered in fields including all types of manufacturing industries, service industries, distribution organizations and governmental service.

The curriculum includes in addition to the fundamental engineering sciences, a carefully selected sequence of courses in electrical engineering, mechanical engineering, mechanics, industrial administration, and industrial engineering. Limited opportunities through elective courses are available for further study in other fields of engineering or management.

A five-year cooperative work-study program is available in the Industrial Engineering Department. See College of Engineering, Cooperative Programs.
Opportunities for Graduate Study

The department offers major work for the degree Master of Science in industrial engineering and in engineering valuation and for the degree Doctor of Philosophy in engineering valuation and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this institution.

Open to graduate students for minor only: 362, 404, 407, 415, 416, 421, 422, 425, 426, 441, 442, 443, 462, 475.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100 Technical Lecture.  
(1-0) Cr. R S  
Lectures and conferences designed to aid the freshman student to adjust himself both in his course and in college environments.

104. Engineering Problems.  
(1-2) Cr. 1 F W  
Prerequisite: Credit or classification in Math. 101 or 101C.  
Applications of algebra; development of computing skills and orderly methods of solving problems, engineering forms and standards. Uses of slide rule, logarithms, graphs and tables.

105. Engineering Problems.  
(1-2) Cr. 1. W.S.  
Prerequisite: 104, credit or classification in Math. 102.  
Development of skills and orderly methods of solving problems involving computations of an engineering character. Basic calculating techniques; longhand, slide rule and logarithms. Application of trigonometry and background mathematics to the solution of engineering problems.

(0-3) Cr. 1 F W  
Prerequisite: Math. 102.  
Training in skills, standards and methods essential for engineering computations.

(Math 109) (1-1 or 0-3) Cr. 1 F.W.S.  
Prerequisite: 2 credits of Mathematics, engineering students required to have credit in 105 or 108.  
Elementary programming techniques including the use of interpretive routines. Fundamentals in and appreciation of high-speed electronic digital computer including laboratory exercises on the computing center equipment.

250. Introduction to Industrial Engineering.  
(4-0) Cr. 4 W.S.  
Prerequisite: Credit or classification in Econ 241.  
Growth, development, ownership, organization, management and control of industrial structures. Relation of the industrial engineer to his industrial environment. Introduction to the functional activities of industrial engineering.

(3-0) Cr. 5 W.S.  
Prerequisite: 250.  
Principles and practice in motion economy, time-study and other approaches to work-measurement; micromotion analysis, memo-motion and random filming techniques. Consideration of human factors and economic factors in methods engineering and work-center design; work-simplification and production system development. Introduction to standard data and predetermined standard times.

293. Seminar.  
(1-0) Cr. R. F.W.S.  
Required of all third-quarter sophomore students. Required of senior college transfer students in their first quarter after transfer to the Industrial Engineering Department. May be taken concurrently with 391.

304. Analysis for Engineering Economy.  
(3-0) Cr. 3. F.W.S.  
Derivation of formulas used in theory of investment of engineering enterprises, economy studies applied to original and alternative investments in engineering, replacement problems, relationship to accounting.

315. Industrial Engineering Analysis.  
(3-0) Cr. 3. F.W.  
Prerequisite: 250, Math 212, 305.  
Introduction to quantitative analytical techniques for industrial operations. Development of elementary models for use in the analysis of industrial systems considering typical problems of waiting lines, inventory systems, and distribution of production materials and facilities. Application of the theory of linear programming to industrial problems.

351. Industrial Organization.  
(3-0) Cr. 3. F.W.S.  
Prerequisite: Junior classification.  
Industrial tendencies, ownership, types of organization; the principles and methods of production control, inspection, motion and time study, wage systems, cost control and personnel relations in the co-ordination of an industrial organization.

362. Calculations and Graphic Methods.  
(3-0) Cr. 3. F.W.  
Prerequisite: Math. 304, junior classification.  
Selective tabulation and analysis of mass data by graphic and selected statistical methods, graphic presentations of industrial engineering and management data.

391. Seminar.  
(1-0) Cr. R. F.

393. Industrial Inspection Trip.  
Cr. R. S  
Prerequisite: Junior I.E. classification.  
One week spent in industrial centers visiting and inspecting industrial plants.

395. Summer Work.  
Cr. 3 each.  
Prerequisite: Advance approval of department head.  
Approved summer work in industrial plants.

404. Engineering Economy.  
(2-2 or 3-0) Cr. 3. F.W.S.  
Prerequisite: Econ. 242, 1 Ad 371.  
Application of fundamentals of economics to engineering alternatives in planning, developing and managing industrial projects.

(3-0) Cr. 3. F.W.S.  
Prerequisite: Econ. 241, 3 credits of accounting.
Concepts of value, original cost, and reproduction cost, property records, methods of estimating depreciation for valuation and accounting; intangible values, cost values, earning values, rate base, and valuation for taxation, rates, financing, insurance and sales.

(3-0) Cr. 3 W.S.
Prerequisite: 315.
History and growth of operations research in industry. Applications of methods and techniques to industrial situations.

416 Production Analysis.
(3-0) Cr. 3 S.
Prerequisite: 415.
Specialized mathematical techniques applied to industrial production management.

421. Safety Engineering.
(3-0) Cr. 3 F.S.
Prerequisite: 250 or 351.
Principles of accident prevention in industry; training for and selling safety. Safe machine design and guarding, industrial compensation and safety legislation.

(2-3) Cr. 3 F.S.
Prerequisite: 273 or 475.
Determining requirements of jobs, analysis for degree and extent of major job factors, weighing of factors, development of basic hourly rate curves, salary classifications, administrative procedures. Practice in description and evaluation.

Cr. 3 each. 424: (3-0) F.W.; 425: (2-2) W.S.
Prerequisite: 424: 250 or 351, Psych. 101, 425: 424
Employer-employee problems and desirable approaches to their solution based upon the application of the principles and techniques of selection and placement of industrial manpower, personnel management and control, and wage and salary administration.

426. Personnel Management.
(3-0) Cr. 3 S.
Prerequisite: 425.
Problems relating to personnel management, stressing organization and universally significant managerial functions, procedures and relationships.

441. Industrial Engineering Design I.
(3-4) Cr. 5 S.
Prerequisite: 273, 404, M.E. 305.
Operations, machines and processes required for typical manufacturing problems; selection, specification and layout of equipment and plant facilities, balancing schedules, budget preparation.

442. Industrial Engineering Design II.
(3-4) Cr. 5 W.
Prerequisite: 441.
The development of organization charts and standard crews; the determination and the design of records of performance to be used in the administrative control of a typical manufacturing enterprise.

443. Industrial Engineering Design III.
(3-4) Cr. 5 S.
Prerequisite: 442.
The development and application of inventory records, load charts, production orders, schedules, production reports, progress reports and control reports to a manufacturing problem in such a manner as to keep a continuous comparison between planned and actual results.

462. Engineering Inspection.
(3-0) Cr. 3 S.
Prerequisite: 250 or 351, 362 or Stat. 201.
Inspection of department functions and organization, quality control procedures, acceptance sampling, and cost studies.

475. Motion and Time Study.
(2-3) Cr. 3 W.S.
Prerequisite: 351.
Principles and methods of motion and time study as employed in industrial operations.

480. Engineering Contracts.
(3-0) Cr. 3 F.W.S.
Prerequisite: Junior classification.
Engineer in business; contract essentials and principles; agent and independent contractor; contracts involving real and personal property, sale and transportation; corporation engineering; legal and equitable jurisprudence.

492. Seminar.
(1-0) Cr. R. W.

494. Special Problems.
Cr. 1 to 5. F.W.S.
Prerequisite: Senior classification, permission of department head.
Formulation and solution of theoretical or practical problems which relate to manufacturing, public utility operation, operation of communication systems or other industrial methods.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

504. Advanced Engineering Economy.
Cr. 3 to 5. F.W.S.
Prerequisite: 404. 3 credits in accounting. Mr. G. W. Smith.
Advanced engineering economic analysis; engineering, financial and intangible factors influencing management decisions for expenditure of funds. Applications of capital recovery and physical plant replacement theories.

506. Engineering Aspects of Public Utility Administration.
Cr. 2 to 5 each time elected. F
Prerequisites: 404, 407. Messrs. Cowles, Kleinschmidt.
Engineering problems arising from the regulation of service and rates, the taxation, and the operation of public utilities.

507. Depreciation Estimates.
(3-0) Cr. 3 W.S.
Prerequisite: 407. Mr. Cowles.
Collection and analysis of retirement data. Techniques required for the construction of survivor, probable life, condition percent, and accrued depreciation curves for property groups. Analysis of the effect of growing, declining and stable properties on depreciation estimates.

509. Engineering Valuation Practice.
(2-3) Cr. 3 F.S.
Prerequisite: 407. Mr. Cowles.
Application of principles of engineering valuation including field work: preparation and pricing of inventories, valuations for utility rates, security regulations, condemnations, sales, estate settlements, and for determining fixed capital costs.
328/Description of Courses

515. Management Science I.
   (3-0) Cr 3. W.
   Prerequisite 415 Mr Kleinschmidt
   Development of scientific models and analogs applicable to engineering management, investment of existing mathematical methods, operations research.

516. Management Science II.
   (3-0) Cr 3 S
   Prerequisite 515 Mr Kleinschmidt
   Case studies and industrial problems. New methods and theories in management science and operations research.

522. Engineering Aspects of Wage Determination.
   (2-3 or 6) Cr 3 or 4 S
   Prerequisite 422 Mr Walkup
   Critical survey of wage programs founded on job evaluation, merit rating, wage incentives, basic hourly wage curve, salary classifications and administrative programs.

   (Stat 540) See Statistics

545. Advanced Industrial Engineering.
   Cr 3 to 5 each time elected FWS.
   Prerequisite 441 Mr Walkup
   Planning and controlling manufacturing plant. Theory of facilities selection and layout; balancing operations and schedules, design of the manufacturing plant; structure of the organization and system control techniques, budgets and realization comparison.

   Cr 3 to 5 F
   Prerequisite 250 or 351 480. Econ 242 Messrs Kleinschmidt. Walkup
   Development in depth of theoretical and practical concepts of current industrial engineering practice.

   (2-3 or 3-6) Cr 3 or 5 S
   Prerequisite 441 Mr Kleinschmidt
   Evaluation of time study systems using predetermined elemental time standards; comparison with stop-watch time study. Applications to industrial situation. Analysis of current literature.

581 Legal Aspects of Engineering Administration.
   (3-0) Cr 3 F
   Prerequisite 250 or 351, 480 or 1 Ad 365A
   Engineering management contacts with public administrators and administrative law.

582 Taxation Aspects of Engineering Administration.
   (3-0) Cr 3 W
   Prerequisite 581, 1 Ad 371
   Concepts of advalorem, income and excise taxes and their effects on industrial operations and policy making.

   (3-0) Cr 3 S
   Prerequisite 480 or 1 Ad 365A desirable
   Management problems concerning patents, trademarks, franchises, copyrights and royalties.

594 Special Topics.
   Cr 1 to 5 each time elected FWS.
   A Management problems in engineering valuation and depreciation
   B Management problems in personnel
   C Management problems in industrial engineering
   D Management problems in regulated industries

COURSES FOR GRADUATE STUDENTS, major or minor

608. Depreciation Accountancy.
   Cr 2 to 6 each time elected F S
   Prerequisite 507.
   Unit and group methods of accounting for depreciation, reserve requirements, adjustment of depreciation rates and reserves, classification of accounts, property accounting methods, income tax regulations.

624 Factory Personnel.
   Cr 3 to 5. F.W.S.
   Prerequisite 425
   Employment departments, time and wage problems, shop committees; housing conditions, and industrial relations.

681 Court and Commission Practice.
   Cr 2 to 6 each time elected W S.
   Prerequisite 681A, 581, 608, 681B: 581.
   A Utility rates, property valuation and depreciation
   B Legal relations in industry.

690 Seminar.
   Cr R F W S Mr Walkup.

694 Engineering Valuation Research.

695 Industrial Engineering Research.
   Cr 1 to 5 F W S Mr Walkup

INSTITUTION MANAGEMENT

Marjorie M McKinley, Ph D, Head of Department

PROFESSORS: Grace M Augustine, Ph D, (Emeritus); Leonore M Sullivan, M S
ASSISTANT PROFESSORS: Doris J. Hittle, M A; Olga Madison, M S.; Grace E. Olsen, M S.; Thomas E. Walsh, M A
INSTRUCTORS: Louise M Mullan, M S.; Ivan Town, M S.

Opportunities for Undergraduate Study

For undergraduate curriculum in institution management, leading to the degree Bachelor of Science, and a certificate program in Restaurant Management, see Home Economics, Curricula.

The curriculum in institution management provides professional preparation for men and women interested in managerial positions in institution food service or residence administra-
tion. Students may elect one of three majors: college food and housing administration, restaurant management, or school food service. A certificate program in restaurant management also is available.

The major in college food and housing administration is planned to provide men and women with a general education plus professional preparation for the management of college and university student unions and residence halls. Basic courses in various aspects of administration are supplemented by laboratory experiences.

The major in restaurant management provides, in addition to a general education, basic work to prepare men and women for supervisory and executive positions in the restaurant industry. The fundamentals of large quantity food production and business management are presented.

The major in school food service offers preparation for administering school lunch programs in elementary and secondary schools. A general education and basic professional courses pertinent to this field are provided for students who wish to prepare for managing single or multiple school lunch units and to become area and state school lunch supervisors. See discussion of institution management curriculum for statement regarding certification for teaching home economics.

A cooperative Restaurant Management program is available. Six quarters of University work are combined with a specified amount of on-the-job management experience to qualify a student for a certificate in Restaurant Management. A student under such a program will receive valuable on-the-job experience and may be able to earn money to meet most educational expenses.

Training in large quantity food preparation and service is afforded through the Home Economics Tea Room. The food and house administration departments of the Memorial Union and University Residence Halls offer managerial experience to advanced students. A two- or three-day field trip to businesses related to institution food service will be offered alternate years and will be required of majors in the institution management department.

Opportunities for Graduate Study

The department offers major work for the degree Master of Science and minor work to students taking major work in other departments.

Work may be taken for the degree Doctor of Philosophy as a divided major with departments offering work for this degree in home economics, engineering, economics, or other related areas.

The usual prerequisite to major graduate work is the completion of 10 quarter credits in institution management and 6 in food and nutrition, and fundamental preparation in accounting, chemistry, and bacteriology. The exact requirements will depend upon the field of work the student expects to pursue.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head. For the language requirement for the degree Doctor of Philosophy see Graduate College.

Open to graduate students for minor only: 484, 485, 487, 489.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

280. Group Food Service. (2-3) Cr. 3. S.

Food production appropriate for camp, church, and community food service. Quantity food production demonstrated and experienced in laboratory.

287. Introduction to Food Service Management. (2-0) Cr. 2 W Mr. Walsh

Orientation to the scope of the food service industry and various aspects of management. Field trips required.

380. Quantity Food Production Management. (2-6 or 3) Cr. 3 or 4 F.W.S.S.S.

Prerequisite: F and N. 208 or 214. Mr. Town.

400. Study Tour. Cr. 1. Alt. S. Offered 1966

Prerequisite: Junior or senior 1 Mgt classification. Mr. Walsh

Study tour of quantity food service and house administration units and of related industries.

404. Seminar (2-0) Cr. 2. S.

Prerequisite: Senior classification Miss McKinley

Standard methods of food production in quantity; menu planning for institutions; determination of food costs; experience in food service Advance reservation with department head required.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

580. Quantity Food Development.
(1-6) Cr. 3. S.
Prerequisite: 380, F. and N. 411, permission of department head.
Experimental approach to methods in quantity food production as related to time factor, institution equipment, and proportions of ingredients.

585. Catering.
(2-6) Cr. 4 F.W.S. Alt. SS.
Prerequisite: 380, senior classification.
Special food preparation and service for parties, dinners, and teas. Historical background of sectional foods in the United States and laboratory preparation of these and foreign foods. Advanced reservation with department head required.

COURSES FOR GRADUATE STUDENTS, major or minor

604. Seminar.
Cr. arr. F.W.S. Miss McKinley.

607. Institution Administration.
(3-0) Cr 3. W.S.S.S.
Prerequisite: Permission of department head Miss McKinley.
Job analysis, labor policies, labor organization, personnel problems, and financial control.

608. Administration Problems.
(1-6) Cr. arr. F.W.S.
Prerequisite: 487, Miss McKinley.
Consideration of advanced administrative problems through experience in food service and housing departments of Iowa State University and Memorial Union.

614. Research.
F W S.SSI, II. Miss McKinley.

INTERNATIONAL SERVICE PROGRAMS

University International Service Programs Committee: Julia M. Faltinson, M.S.; Alfred P. Kehlenbeck, Ph.D.; Richard Squires, M.S.; Barbara J. Teters, Ph.D.; Louis M. Thompson, Ph.D.; Erik Thorbecke, Ph.D.

The International Service Programs are designed for students who are interested in international relations or international economics as fields for academic study and for those interested in training for employment overseas in the foreign service or other government agencies, in foreign trade sections of business and industry, or in technical aid and development programs abroad. Students may participate in International Service Programs in any one of four Colleges: Agriculture, Engineering, Home Economics, or Sciences and Humanities.

International Service Program in the College of Agriculture:

Students in Agriculture remain in their chosen curriculum and use their electives to meet program requirements for International Service in Agriculture. The requirements are:
### International Service Programs

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Foreign Language</td>
<td></td>
</tr>
<tr>
<td>Spanish, French, German, or Russian</td>
<td>18</td>
</tr>
<tr>
<td>Government 351, 352</td>
<td></td>
</tr>
<tr>
<td>World Politics and International Organization</td>
<td>6</td>
</tr>
<tr>
<td>Government</td>
<td></td>
</tr>
<tr>
<td>Govt 422 International Law</td>
<td>6</td>
</tr>
<tr>
<td>Govt Electives</td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td></td>
</tr>
<tr>
<td>Econ. 455 International Economics</td>
<td>6</td>
</tr>
<tr>
<td>(Econ 512 Agrarian Reform and Economic Development, recommended)</td>
<td></td>
</tr>
<tr>
<td>Sociology 218</td>
<td></td>
</tr>
<tr>
<td>Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>World Resources</td>
<td></td>
</tr>
<tr>
<td>Agron 406 Climates of the Continents</td>
<td>6</td>
</tr>
<tr>
<td>Agron 483 World Soil Resources</td>
<td></td>
</tr>
<tr>
<td>E Sci 304 World Geography</td>
<td></td>
</tr>
<tr>
<td>E Sci 305 Economic Geography</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>45</td>
</tr>
</tbody>
</table>

A notation will appear on transcripts of students who complete all of the above requirements. Students who participate in the program and who maintain a grade point average of 2.5 or above will be eligible for a Luther Vinton Rice Estate Scholarship valued at $200 each academic year. Interested persons in Agriculture should consult their advisers.

### International Service Program in the College of Engineering:

Students in the program must meet the following minimum requirements:

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychology 101</td>
<td>3</td>
</tr>
<tr>
<td>General Psychology I</td>
<td></td>
</tr>
<tr>
<td>Industrial Administration 365A</td>
<td>3</td>
</tr>
<tr>
<td>Business Law I</td>
<td></td>
</tr>
<tr>
<td>Earth Science 100, 304, 305</td>
<td>9</td>
</tr>
<tr>
<td>Introduction to Geology</td>
<td></td>
</tr>
<tr>
<td>World Geography</td>
<td></td>
</tr>
<tr>
<td>Economic Geography</td>
<td></td>
</tr>
<tr>
<td>Government 351, 352</td>
<td>6</td>
</tr>
<tr>
<td>World Politics and International Organization</td>
<td></td>
</tr>
<tr>
<td>Government 215</td>
<td>3</td>
</tr>
<tr>
<td>American Government</td>
<td></td>
</tr>
<tr>
<td>Government Electives</td>
<td></td>
</tr>
<tr>
<td>Govt 440 British and Commonwealth Governments</td>
<td>6</td>
</tr>
<tr>
<td>Govt 442 Governments of Asia</td>
<td></td>
</tr>
<tr>
<td>Govt 443 Governments of Latin America</td>
<td></td>
</tr>
<tr>
<td>Govt 540 Politics of Developing Nations</td>
<td></td>
</tr>
<tr>
<td>Economics 241, 242, 455</td>
<td>9</td>
</tr>
<tr>
<td>Principles of Economics</td>
<td></td>
</tr>
<tr>
<td>International Economics</td>
<td></td>
</tr>
<tr>
<td>English 101, 102, 103</td>
<td>9</td>
</tr>
<tr>
<td>Principles of Composition</td>
<td></td>
</tr>
<tr>
<td>Speech 311</td>
<td>3</td>
</tr>
<tr>
<td>Fundamentals of Speech</td>
<td></td>
</tr>
<tr>
<td>Sociology 218</td>
<td>3</td>
</tr>
<tr>
<td>Cultural Anthropology</td>
<td></td>
</tr>
<tr>
<td>Modern Foreign Language</td>
<td></td>
</tr>
<tr>
<td>Spanish, French, German or Russian or demonstrated ability</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>69</td>
</tr>
</tbody>
</table>

Interested students in Engineering should consult Mr. Richard Squires for further details.

### International Service Program in the College of Home Economics:

An emphasis in International Service Programs is designed to provide students with a background for participation in government or agency programs such as Peace Corps, Voluntary International Service Assignments (VISA), etc., as well as provide an opportunity for young women to become oriented to national and international affairs as part of their responsibility of citizenship in its broadest sense.

Students in Home Economics with a concentration in International Service follow a curriculum that includes emphasis in social sciences — history, government, economics, sociology, anthropology, psychology, and languages, in addition to home economics.

See *Home Economics for General Education, Curriculum* for the specific program. Interested students in Home Economics should consult Julia M. Faltinson for further details.
International Service Program in the College of Sciences and Humanities:

Students in the International Service Program in the College of Sciences and Humanities are required to fulfill the group requirements of the College. They must major in one of four fields: economics, government, history, or modern languages. They are required to select their minors from two of the following fields: economics, government, history, industrial administration, modern languages, philosophy, sociology. In exceptional cases, with permission of the International Service Programs Committee, a student may substitute a different field for one of the minors. In completing his major, minors, and group requirements, each student in the International Service Program in the College of Sciences and Humanities must take the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics</td>
<td>15</td>
</tr>
<tr>
<td>241, 242 Principles of Economics</td>
<td></td>
</tr>
<tr>
<td>304 Money and Banking</td>
<td></td>
</tr>
<tr>
<td>306 Comparative Economic Systems</td>
<td></td>
</tr>
<tr>
<td>455 International Economics</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>6</td>
</tr>
<tr>
<td>201 Introduction to Literature</td>
<td></td>
</tr>
<tr>
<td>354 World Literature</td>
<td></td>
</tr>
<tr>
<td>Earth Science</td>
<td>6</td>
</tr>
<tr>
<td>304 World Geography</td>
<td></td>
</tr>
<tr>
<td>305 Economic Geography</td>
<td></td>
</tr>
<tr>
<td>Government Five of the following courses</td>
<td>15</td>
</tr>
<tr>
<td>351, 352, 353 World Politics and International Organization</td>
<td></td>
</tr>
<tr>
<td>422 International Law</td>
<td></td>
</tr>
<tr>
<td>440 British and Commonwealth Governments</td>
<td></td>
</tr>
<tr>
<td>441 Governments of Western Europe</td>
<td></td>
</tr>
<tr>
<td>442 Governments of Asia</td>
<td></td>
</tr>
<tr>
<td>443 Governments of Latin America</td>
<td></td>
</tr>
<tr>
<td>444 Governments of the Soviet Union and Eastern Europe</td>
<td></td>
</tr>
<tr>
<td>540 Politics of Developing Nations</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>12</td>
</tr>
<tr>
<td>Four courses including at least one from each group</td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td></td>
</tr>
<tr>
<td>357 History of England and Great Britain</td>
<td></td>
</tr>
<tr>
<td>425 Twentieth Century Europe</td>
<td></td>
</tr>
<tr>
<td>450 History of Modern Russia</td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td></td>
</tr>
<tr>
<td>459 History of the Far East to 1600</td>
<td></td>
</tr>
<tr>
<td>460 The Far East in Modern Times</td>
<td></td>
</tr>
<tr>
<td>465 History of Latin America</td>
<td></td>
</tr>
<tr>
<td>Industrial Administration</td>
<td>3</td>
</tr>
<tr>
<td>460 Principles of Transportation</td>
<td></td>
</tr>
<tr>
<td>Modern Languages</td>
<td>27</td>
</tr>
<tr>
<td>Spanish, French, German or Russian</td>
<td></td>
</tr>
<tr>
<td>Sociology</td>
<td>6</td>
</tr>
<tr>
<td>218 Introduction to Anthropology</td>
<td></td>
</tr>
<tr>
<td>425 Intercultural Relations</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
</tr>
</tbody>
</table>

In addition, to complete major and minors, he should select his courses from those most directly related to international relations and international trade. For additional details on requirements and opportunities in International Service, students should consult their advisers and the chairman of the International Service Programs Committee.

LANDSCAPE ARCHITECTURE

Thomas A. Barton, M.L.A., Chairman of Department

Professor: John R. Fitzsimmons, M.L.A.
Associate Professors: Robert W. Dyas, M.L.A.; Margherita Tarr, B.S.
Assistant Professors: Paul C. Killiam, M.C.P.; Kenneth F. Lane, M.L.A.; William A. Malone, M.S.; Burl A. Parks, B.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in landscape architecture leading to the degree Bachelor of Science, see Landscape Architecture, Curriculum.
LANDSCAPE ARCHITECTURE OPTION:

Landscape architecture is the profession concerned with the layout of land for economic use, with a definite regard for the natural and man-made beauty of the resulting landscape. It includes the study of factors affecting the characteristics of sites and design, construction and maintenance of sites. Among the types of land development normally included in professional practice are: park and recreation areas, school grounds, institutional grounds, industrial sites, commercial sites, land subdivisions, and residential properties.

The curriculum, accredited by the American Society of Landscape Architects, provides the student with an education which, combined with experience, is necessary for professional registration in several states.

Graduates are employed by professional landscape architects and by governmental agencies at local, state, and national levels.

URBAN PLANNING OPTION:

The urban planner is concerned with the economic, social and physical development of a geographic or political area. He must attain a broad comprehension of city and regional developments, their interrelationships, and the extent of their changing needs. The urban planner finds opportunities for professional service with organizations such as city, county, state, and regional planning boards and with the offices of planning consultants.

Opportunities for Graduate Study

The department offers major work for the degree Master of Landscape Architecture and minor work to students taking major work in other departments. The degree Master of Landscape Architecture is granted upon the completion of one year of satisfactory resident graduate work and the acceptance of a thesis.

Students desiring to major in landscape architecture should present credits substantially equivalent to those secured by undergraduate students in the curriculum in landscape architecture at this institution.

The department also offers work for the degree Master of Science, major in town and regional planning. A student expecting to do major work in town and regional planning should have included in his previous studies courses in the principles of economics, political science, sociology, and urban planning; and training in design and graphic presentation.

The following courses are open for major graduate credit to graduate students in town and regional planning: Arch. 600, 604 C.E. 553, 506, 656, 690; Econ. 556, 566, 630; Govt. 510; L.A. 500, 550D, 550E, 550F, 600; Soc. 570, 660C, 660F, 660G.

Open to graduate students for minor only: 334, 335, 336, 361, 372, 373, 383, 404, 411, 412, 413, 431, 432, 433, 466, 492.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

110. Technical Lecture. (1-0) Cr. R. F.
Survey of landscape architecture, urban planning and allied fields.

111, 112. Landscape Architecture Drawing 111; (6-0, Cr. 2.; F.; 112; (6-0 or 12) Cr. 2 or 4.; W.S.;
Introduction to landscape architecture and the conventional drawing practices and methods of delineation, including freehand sketching, lettering, instrumental and perspective drawing and presentation.

113. Landscape Perception. (1-0) Cr. 3. S.S.SI
Prerequisite: 112.
Understanding and appreciation of form, space and other visual aspects of the landscape. Sketching and experimentation with land and plant forms; fundamental spatial organization.

201, 202. History of Landscape Architecture. (3-0) Cr. 3 each. F.W.
The development of landscape architecture from antiquity to modern times, with its relation to and influences of allied arts and professions. Lectures, readings, abstracts and reports.

210. Elements of Landscape Architecture. (2-3) Cr. 3. W.S.SI.
Appreciation of the landscape and those elements of which it is composed. Brief of procedures in the planning and development of private property and public areas. Field trips. Not open to students majoring in landscape architecture.

213. Theory of Landscape Design. (2-3) Cr. 3.
Prerequisite: 113.
Fundamental theory and principles of design brought out in the solution of simple problems.

231, 232, 233. Plant Materials. (0-6) Cr. 2 each Yr.
Prerequisite: 231: Bot. 306; 232: 231; 233: 232.
Introduction to study of plant materials as used in landscape architecture. 232. Study of trees, shrubs and vines, with emphasis on their winter characteristics. 233. Trees and shrubs, vines, evergreens and herbaceous material. Field trips and reports.

253. Introduction to Physical Planning. (3-0) Cr. 3. W.S.
A historical survey of the nature and problems of urban areas and the goals, procedures, and results of physical planning.

301, 302, 303. Details of Construction. (1-6) Cr. 3 each Yr.
Prerequisite: C E 214
Theory and drafting room problems in landscape construction including grading, drainage and utility plans, estimates of cuts, fills, and cost data.

311, 312, 313. Landscape Design. (0.9) Cr. 3 each Yr.
Prerequisite: 213.
Design of private and public properties based on actual topographies. Drafting, field work, reports. These courses are coordinated with the Details of Construction series and the Planting Design series for the execution of complex problems.

334, 335, 336. Planting Design. (1-3) Cr. 2 each Yr.
Prerequisite: 233, classification in 311.
Arrangement and use of plants in landscape and architectural design, with drafting and field practice.


361. Urban Problems and Planning Goals. (3-0) Cr. 3. F.
Prerequisite: 253 or classification in fifth year architecture
Major urban physical problems and their relations to social, economic, and technological problems. Planning goals—both practical and theoretical and their interrelations and consequences.

372. 373. Planning Analysis and Techniques. (3-0) Cr 3 each. W S
Prerequisite: 253.
An introduction to existing and emerging techniques for the preparation of basic economic, demographic, and physical studies, and of projections of and timing for needed land uses and public services. Exercises in the use of sources and techniques.

383. Theory of the Planning Process. (3-0) Cr 3. S.
Prerequisite: 253.
The nature of physical planning and its relation to social and economic planning; levels of planning; place of planning in decision making and major decision making groups; steps in the planning process; uses and limitations of knowledge in planning; relation of facts and values.

404. Public Recreational Facilities. (3-0) Cr. 3. F.
Principles of design, construction and operation with special emphasis on national and state parks and forests.

411. 412, 413. Advanced Landscape Design. (0.12) Cr. 4 each. Yr.
Prerequisite: 313.
Design of public, semi-public, and large private properties.

431. Urban Planning. (0.12) Cr. 4. F.S.
Prerequisite: 361, 372, 373, 383 or classification in fifth year architecture.
Preparation of a comprehensive plan for a town or city within visiting distance from the school. Assembly and analysis of necessary data. Preparation of sketch plans and one or more comprehensive plans together with drafts of zoning ordinances, subdivision regulations, and a capital budget.

432. Urban Renewal. (0.12) Cr. 4. W.
Prerequisite: 431.
Preparation of a community renewal plan and one or more individual renewal projects for a town or city within visiting distance from the school—where possible, the community visited in 431.

433. Regional Planning. (0-12) Cr. 4. S
Prerequisite: 361, 372, 373; Econ. 462.
Preparation of a comprehensive plan for a metropolitan or resource region within the state—preferably one on which basic research is already being done. This course will involve supervision of visiting critics from several allied departments.

441. Professional Procedure. (2-3) Cr 3. S.
Prerequisite: 311.
Office organization, forms, field operations, professional ethics and public relations.

466. Special Problems. 2. H. Honors Program.
Cr 2 to 4. F W S S.S.T.
Prerequisite: Permission of department chairman and instructor.
Selected problems for balancing or completing individual student requirements.

492. Planning Law and Administration. (3-0) Cr. 3. W.
Prerequisite: 253.
The basis in constitutional, common, and statute law for the powers and duties of planning authorities and the powers of plan effectuation. Problems of balancing public and private interest as revealed in study of leading court cases. The administration of planning agencies and programs.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

500. Seminar. (1-0) Cr 1 W S

550. Special Topics. Cr 2 to 5 each time elected. F W S
Prerequisite: Permission of department chair man and instructor

552. Field Trip.

COURSE FOR GRADUATE STUDENTS, major or minor

600. Research.
LIBRARY

Robert W. Orr, M.S., Head of Department

ASSOCIATE PROFESSORS: John E. Galejs, M.A.L.S.; John C. McNee, A.M.L.S.; Margaret H. Orr, B.L.S.; Fred M. Peterson, M.A.; Evelyn G. Wimersberger, M.S.; Elizabeth A. Windsor, M.S.

ASSISTANT PROFESSOR: Matyne H. Easton, B.A.


Opportunities for Undergraduate Study

Courses are designed to increase facility in the independent use of libraries and books.

106 is required of all freshman and transfer students in the following colleges without credit: Engineering and Home Economics.

116 is required of all sophomore and transfer students in the following colleges with one hour of credit: Agriculture and Sciences and Humanities.

Opportunities for Graduate Study

The library offers facilities for bibliographic research in the scientific and technical literature of the departments giving graduate instruction. The course “Bibliographic Research” (Lib. 614) may be taken for either major or minor credit in any department.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

106. Library Instruction.
Cr. R. 5 weeks. Mrs. Easton.
For students in Home Economics. F.
For students in Engineering. W.
Use of libraries and books.

116. Library Instruction.
Cr. 1. 10 weeks. Mrs. Easton.
For students in Agriculture. F.
For students in Sciences and Humanities. S.
Use of libraries and books, including a survey of literature of major curricula.

COURSE FOR GRADUATE STUDENTS, major or minor

614. Bibliographic Research.
(1-0) Cr. 1. F.W.SS
Prerequisite: College degree. Mr. Orr.
Lectures and practice on location of printed and manuscript materials and preparation of bibliographies on technical and scientific subjects.

MATHEMATICS

George Seifert, Ph.D., Acting Chairman of Department


ASSOCIATE PROFESSORS: Frank E. Bottte, Ph.D.; Roger H. Homer, Ph.D.; Jerold C. Mathews, Ph.D.; Robert K. Meany, Ph.D.; George W. Peglar, Ph.D.


Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in mathematics, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum

The curriculum in science with a major in mathematics is flexible. It is designed to give the student a thorough foundation in mathematics and to prepare him for (1) work in a computation, research or engineering laboratory, (2) graduate study in mathematics leading toward advanced degrees, or (3) teaching at the secondary school level.

Undergraduate majors in this department usually have included the following basic courses in their programs: 110, 211, 212, 213; 21 credits beyond 213 which should include 301, 414, 415 and one from the pair 330, 436. In addition he should complete at least one of the following sequences or groups: 301, 302, 404; 304, 305; 321, 322; 414, 415, 416; 330, 436; 437; 404, 407, 408. Phil. 370 is recommended as supporting work. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in mathematics and in applied mathematics and minor work to students taking major work in other departments.

Students desiring to do graduate work with a major in this department should present at least 15 quarter credits of work in mathematics beyond calculus. It is desirable that this should include advanced calculus.

Additional work usually is required in physics, chemistry, engineering, statistics or certain other fields.

Open to graduate students for minor only: 301, 302, 304, 305, 321, 322, 323, 330, 331, 332, 333, 404, 407, 408, 414, 415, 416, 436, 437, 499

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

35. High School Geometry.
   (5-0) S S
   Satisfies requirement for unit of entrance geometry.

50, 51, 52. Applied Mathematics I, II, III.
   (5-0) Cr. 5 each F W S.
   Prerequisite: One and one-half units of high school algebra.
   Accepted for credit in Technical Institute programs only.
   51. Simultaneous linear equations, coordinate systems, logarithms and exponentials, trigonometric functions. 52. Analytic geometry of simple cones, differential and integral calculus.

100. Mathematics for Two Year Students in Agriculture.
   (5-0) Cr. 5 W.
   Prerequisite: One unit of high school algebra, use of slide rule, graphical methods, simple equations, exponents and radicals, logarithms, progressions, interest, numerical trigonometry, applications to agriculture.

101. Algebra and Trigonometry I.
   (5-0) Cr. 5 F W S S S.
   Prerequisite: One and one-half units of high school algebra.
   Linear, quadratic and higher degree polynomial functions, exponential and logarithmic functions, trigonometric functions and identities.

101B. Algebra and Trigonometry IB.
   (5-0) Cr. 3 F W S S S.
   Prerequisite: One unit of high school algebra.
   Linear, quadratic and higher degree polynomial functions, exponential and logarithmic functions, trigonometric functions and identities.

101C. Algebra and Trigonometry IC.
   (3-0) Cr. 3 F W S S S.
   Prerequisite: 101B.
   Exponential and logarithmic functions, trigonometric functions and identities. Same material as second half of 101.

102. Algebra and Trigonometry II.
   (5-0) Cr. 5 F W S S S.
   Prerequisite: 101 or equivalent.
   Combinatorial formulas and probability, determinants and systems of linear equations, inverse trigonometric functions, trigonometric equations.

104. Finite Mathematics.
   (5-0) Cr. 5 W.
   Prerequisite: 101B or equivalent.
   Logical statements, introduction to theory of sets, probability, systems of linear inequalities, applications in the social sciences.

   (1 E 109) 1.1 or 0.3 Cr. 1. F W S.
   Prerequisite: 3 credits of college Math. (Engineering students required to have credit in F E 105 or 108).
   Offered twice per quarter meeting twice a week for 5 weeks. Elementary programming techniques up to and including the use of interpretive routines. Fundamentals in and appreciation of high-speed electronic digital computers, including laboratory exercises on the Computing Center equipment.
110. Analytic Geometry and Calculus I. (5-0) Cr. 5. F.W.S.S.S.
Prerequisite: 102.
Graphs and equations of loci, lines, conics, limits, elementary differentiation and integration, differentials.

190. Theory of Arithmetic. (3-0) Cr. 3. F.W.S.S.S.
Prerequisite: One and one-half units of high school algebra.
Structure and arithmetic of the real numbers, developed from natural numbers, rationals.

206. Mathematical Theory of Investments. (5-0) Cr. 5. W.
Prerequisite: 102 or equivalent.
Interest, annuities, sinking funds, building and loan associations, bonds, use of tables.

207. Mathematics of Life Insurance. (3-0) Cr. 3. S.
Prerequisite: 102 or 104.
Probability, mortality tables, life insurance; life annuities, endowments, computation of net premiums, evaluation of policies, construction and use of tables.

211, 212, 213. Analytic Geometry and Calculus II, III, IV.
211, 212: (5-0) Cr. 5 each. 213: (3-0) Cr. 3. F.W.S.S.S.
Prerequisite: 110.
211: Integration of definite integrals, polar coordinates; 212: Solid analytic geometry, partial differentiation, multiple integrals, series.
213: Elementary theory and applications of ordinary differential equations.

215. Introduction to Numerical Techniques for Computers. (2-0) Cr. 2. F.W.S.
Prerequisite: Classification in 213.
Topics in elementary applied numerical analysis leading to problem formulation for digital computer solution. Topics will include roots of equations, interpolation, linear equations, series summation, numerical integration and ordinary differential equations.

Prerequisite: 109 or equivalent.
Offered twice per quarter meeting twice a week for 5 weeks. Programming techniques using compiler languages. Laboratory exercises on the Computing Center equipment.

301, 302. Introduction to Higher Algebra. (3-0) Cr. 3. each. 301: F.W.; 302: W.S.
Prerequisite: 212. Staff.
301: Introduction to number theory, fields, groups, rings of polynomials, theory of equations. 302: Elementary theory of finite groups.

304. Finite Mathematical Structures. (3-0) Cr 3 each. W.S.
Prerequisite: 102. Staff.
Compound statements, sets and functions, probability theory, linear algebra, convex sets and linear programming. Credit will not be allowed for both 104 and 304.

321, 322, 323. Introduction to Applied Mathematics. (3-0) Cr 3 each. F.W.S.S.S.
Prerequisite: 213. Staff.
323: Vector analysis. May be taken after 213.

330. Solid Analytic Geometry. (3-0) Cr. 3. S.
Prerequisite: 213. Staff.
Analytic geometry of three dimensions. Particular emphasis on surfaces of the second degree.

331, 332, 333. Topology. (3-0) Cr. 3. F.W.S.
Prerequisite: 212.
Topological properties of the line and plane. Metric spaces and continuous transformations. Abstract spaces, continua, convergence, and fixed point theory.

Prerequisite: 15 credits in Math. or Stat. Staff.

404. Theory of Matrices. (3-0) Cr. 3. F.S.S.S.
Prerequisite: 213 or 304. Staff.
Matrices and quadratic forms in the real and complex number fields.

407. Finite Difference Calculus. (3-0) Cr. 3. W.
Prerequisite: 213. Staff.
Difference operators, linear differences equations, summation of finite and infinite series, divided differences, interpolation.

408. Introduction to Numerical Analysis. (3-0) Cr. 3. S.
Prerequisite: 407. Mr. Lambert.
Interpolation, numerical quadrature, numerical solution of ordinary differential equations, roots of polynomial and transcendental equations, harmonic analysis. Examples using University computers.

414, 415, 416. Advanced Calculus. (3-0) Cr. 3 each. 414: F.W.S.S.S.; 415: W.S.-S.S.; 416: S.
Prerequisite: 213. Staff.
Partial differentiation and applications; multiple, line, surface integrals; indeterminate forms, infinite series and improper integrals.

436. 437. Projective Geometry. (3-0) Cr. 3 each. W.S.
Prerequisite: 213, 301. Messrs. Peglar, Sprague.
Projective properties studied by synthetic and analytic methods.


490. History of Mathematics. (3-0) Cr. 3. F.
Prerequisite: 212, junior classification. Mr. Peglar.
Sources of mathematical principles, growth of mathematical knowledge, contributions of outstanding mathematicians.

497. Teaching of Secondary School Mathematics. (3-0) Cr. 3. W.
Prerequisite: 22 credits in college Math. Mr. Kreidt.
Organization of subject matter, methods of presenting particular topics, evaluation of results.

499. Special Problems. Cr. arr. F.W.S.
Prerequisite: 213 or 304. Staff.
H. Honors Program.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

504, 505, 506. Abstract Algebra.
   (3-0) Cr. 3 each. Yr.  540.
   Prerequisite: 301. Messrs. Head, Peglar.
   Groups, integral domains and fields, modules and
   linear transformations, Boolean algebra and
   lattices.

507, 508. Numerical Solution of Ordinary
   Differential Equations.
   (3-0) Cr. 3 each. F.W.  527.
   Prerequisite: 408 or 415. Mr. Lambert.
   One-step methods for initial value problems,
   one-step methods for systems, multi-step meth- 529.
   ods, boundary value problems. Examples using
   University computers.

509. Computational Methods of Linear Algebra.
   (3-0) Cr. 3. S.  528.
   Prerequisite: 404. Mr. Lambert.
   Numerical methods involved in the solution of
   linear systems, matrix inversion, eigen- 531.
   value problems (symmetric and non-symmetric);
   completion method, ill-conditioned ma-
  trices; linear inequalities. Examples using
   University computers.

511. Introduction to Functions of a Complex
   Variable.
   (3-0) Cr. 3. F.S.S.  529.
   Prerequisite: 413. Mr. Wright.
   Complex numbers; analytic functions; inte-
  grals; derivatives; power series; residues; 532.
   conformal mapping; applications.

514. 515, 516. Functions of Real Variables.
   (3-0) Cr. 3 each Yr.  530.
   Prerequisite: 416. Messrs. Mathews, Meany.
   Partial differential equations of first order,
   classification of partial differential equations
   of second order, separation of variables, gen-
  eralized Fourier series, eigen-value problems,
   potential theory maximum principle, Dirichlet
   principle, Green's functions, Cauchy problems
   for hyperbolic equations, Riemann function,
   heat equations, integral transforms.

   (3-0) Cr. 3. Yr.  527.
   Prerequisite: 322, 416. Messrs. Homer, Lam-
   bert.
   Partial differential equations of first order,
   classification of partial differential equations
   of second order, separation of variables, gen-
  eralized Fourier series, eigen-value problems,
   potential theory maximum principle, Dirichlet
   principle, Green's functions, Cauchy problems
   for hyperbolic equations, Riemann function,
   heat equations, integral transforms.

526. 527. Integral Equations.
   (3-0) Cr. 3 each. W.S.  528.
   Prerequisite: 511. Mr. Kegley.
   Linear integral equations, classification, solu-
   tions and applications.

528. 529. Special Functions.
   (3-0) Cr. 3. F.W.  531.
   Prerequisite: 511. Staff.
   Infinite products, asymptotic series, Gamma
   and Beta functions, hyper-geometric functions,
   generalized and confluent hyper-geometric
   functions, Bessel and Legendre functions,
   generating functions, orthogonal polynomials,
   elliptic functions.

531. 532. Introduction to Functional Analysis.
   (3-0) Cr. 3. W.S.  533.
   Prerequisite: 416. Mr. Homer.

COURSES FOR GRADUATE STUDENTS, major or minor*

601. Special Topics.
   C. 3 each time elected.
   Prerequisite: Permission of instructor.
   Graduate staff.
   A. Algebraic Geometry.
   B. Field Theory.
   C. Group Theory.

D. Calculus of Variations.
E. Functional Analysis.
F. Measure Theory.
G. Approximation Theory.

*These courses are offered on sufficient demand
604. 605. Advanced Topics in Modern Algebra. (3-0) Cr. 3 each. W.S.
Prerequisite: 506. Mr. Vinograd.
Associative algebras and rings, local algebras, homological algebra.

607. Advanced Topics in Numerical Analysis. (3-0) Cr. 3. S.
Prerequisite: 408 or 508, 509, 523. Mr. Lambert.
Stability and error analysis, numerical solution of partial differential equations, successive over-relaxation methods, research work using University computers.

610. Seminar on Graduate staff.

611. 612. 613. Theory of Analytic Functions of One Complex Variable. (3-0) Cr. 3 each. Yr.
Prerequisite: 536. Mr. Wright.
Fundamental concepts, integral theorems, series, expansion of analytic functions in series, singularities, single-valued and multiple-valued functions.

621. 622. 623. Advanced Topics in Partial Differential Equations. (3-0) Cr. 3 each. Yr.
Prerequisite: 511, 521. Mr. Maple.
Maximum principles, pointwise bounds, conservation equations, distributions, Hilbert Space.

636. Advanced Topics in Topology. (3-0) Cr. 3. S.
Prerequisite: 536. Mr. Sanderson.
Dimension theory, topology of manifolds, homotopy and homology theory, structure of continua.


651. 652. 653. Mathematical Theory of Fluid Dynamics. (E.M. 651, 652, 653) (3-0) Cr. 3 each. Yr.
Prerequisite: 323, 511, or classification in 500. Mr. Weiss.


657. 658. 659. Advanced Topics in Ordinary Differential Equations. (3-0) Cr. 3 each. Yr.
Prerequisite: 511. Mr. Seifert.
Existence, uniqueness, stability and asymptotic behavior of solutions of systems of ordinary differential equations; perturbation theory.

661. 662. 663. Advanced Topics in Elasticity. (E.M. 661, 662, 663) (3-0) Cr. 3 each. Yr.
Prerequisite: 511 and 561 or E.M. 595. Mr. Weiss.
Two and three dimensional problems, variational and energy principles, finite deformation theory, anisotropic materials.

666. 667. Theory of Plates and Shells. (E.M. 666, 667) (3-0) Cr. 3 each. W.S.
Prerequisite: 500, permission of instructor. Mr. Weiss.
Thin plate analysis; three-dimensional plate problems; shells, stability and vibration of plates and shells.

671. 672. Mathematical Theory of Plasticity. (E.M. 671, 672) (3-0) Cr. 3. W.S.
Prerequisite: 561 or E.M. 568. Mr. Weiss.
Mathematical analysis of plastic deformation of materials.


699. Research.
Graduate staff.

MECHANICAL ENGINEERING

Henry M. Black, S.M., Head of Department

PROFESSORS: Mark P. Cleghorn, M.E.; Robert C. Fellinger, M.S.; Eugene S. Ferguson, M.S.; Charles R. Mischke, Ph.D.; George K. Serovsky, Ph.D.
ASSOCIATE PROFESSORS: Robert W. Breckenridge, M.S.; Ray W. Fisher, B.S.; Marvin Gould, B.S.; Bruce L. Johnson, Ph.D.; Kermit B. Myers, M.S.
INSTRUCTORS: John M. Green, B.S.; Jerry L. Hall, M.S.; Benny Hillberry, M.S.; Alfred W. Joensen, B.S.; Neil H. Schilmoeller, Ph.D.

Opportunities for Undergraduate Study

For undergraduate curriculum in mechanical engineering leading to the degree Bachelor of Science, see College of Engineering, Curricula.
Mechanical engineers comprise more than one-fourth of all engineers today; they work in every major industry. The professional work performed by mechanical engineers ranges through research, development, design, production, construction, operation, management, and sales. Their services are generally involved with the production, processing, and control of energy in its countless applications in fields of transportation, manufacturing, power, agriculture, defense industries, and others.

The curriculum includes a strong foundation in the fundamental sciences of mathematics, chemistry, and physics. The engineering sciences include metallurgy and metal processing, mechanics of solids, mechanics of fluids, thermodynamics, heat transfer, electrical theory and application, and a strong sequence in analysis and design. Social sciences, humanities, and English are required. Opportunity is offered senior students to specialize through electives in one of the many applied fields in mechanical engineering such as design, automatic control, power generation, automotive, air conditioning and production engineering. Students who plan to continue in graduate study use these electives for substantial preparation for advanced study.

A five-year cooperative work-study program is available in the Mechanical Engineering Department. See *College of Engineering, Cooperative Programs.*

**Opportunities for Graduate Study**

The department offers major work for the degree Master of Science and Master of Engineering in mechanical engineering and minor work to students taking major work in other departments. Work may be taken for the degree Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Students desiring to major in this department should have completed an undergraduate curriculum equivalent to that required of undergraduate students in mechanical engineering at this institution.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the department head.


**COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS**

100. Technical Lecture.  (1-0) Cr. R. S.  Field of mechanical engineering, its opportunities and requirements.


211. Engineering Metallurgy.  (3-0) Cr. 3. F.W.S.SI.  Prerequisite: Chem 102.  Basic principles of physical metallurgy, structure and solidification; mechanical and chemical properties, phase diagrams, heat treatment, ferrous and non-ferrous alloys.

232. Metal Processing I.  (2-2) Cr. 3. F.W.  Prerequisite: Chem 102.  Principles of metalurgy applicable to manufacturing processes; heat treatment, machining processes.

233. Metal Processing II.  (2-2) Cr. 3. W.S.S.SI.  Prerequisite: 211 or 232.  Application of principles of metalurgy to the fields of casting, mechanical working, welding, and powder metallurgy.

235. Mechanical Behavior of Metals.  (3-0) Cr. 3. F.S.  Prerequisite: 211 or 232 or A.E. 359; E.M. 324.  Plastic deformation, fracture, fatigue, creep and wear of metals. Mechanical and metallurgical aspects.

300. Inspection Trip.  Cr. R. S.  Prerequisite: Junior M.E. classification.  Inspection trip to industrial centers.

305. Tool Engineering.  (1-6) Cr. 3. W.S.  Prerequisite: E.M. 324, credit or classification in 233, Mr. Peters.  Design and application of special tools, jigs, and fixtures.

316. Machine Design I.  (4-0) Cr. 4. F.W.  Prerequisite: Credit or classification in 235, credit in Math. 321, E.M. 344, Mr. Kavanagh.  Study of motion and forces in machines. Analysis of displacements, velocities and accelerations in mechanisms; steady and varying forces and their influence on proportioning of parts; design of simple mechanisms.

317. Machine Design II.  (4-0) Cr. 4. W.S.S.SI.  Prerequisite: 316.  Extension of 316; design of more complex mechanisms; stresses, vibrations, deflections and critical speeds of shafts; gears, cams, springs, bearings and fasteners.
318. Machine Design III.
(4-0) Cr. 4. F.S.SSI.
Prerequisite: 317. Mr. Johnson.
Introduction to system design concepts; power and motion transmission devices and their relation to the complete system; analysis of mechanical transients.

321. Thermodynamics I.
(4-0) Cr. 4. F.W.
Prerequisite: Math. 213, Phys. 222, junior classification. Mr. Fellingar.
Properties and fundamental equations for states and processes involving gases, vapors and gas mixtures.

322. Thermodynamics II.
(4-0) Cr. 4. W.S.
Prerequisite: 321. Mr. Fellingar.

325. Heat Transfer.
(3-0) Cr. 3. S.
Prerequisite: 344 or 321. Mr. Knight.
Solution of practical engineering problems involving transfer of heat by conduction, radiation and convection.

(1-6) Cr. 3. W.
Prerequisite: Junior classification, Math. 212, Phys. 223. Mr. Hall.
Engineering measurement systems, basic measurement standards. Measurement accuracy. Types of errors and error propagation.

341. Engineering Instrumentation and Measurement.
(2-3) Cr. 3. F.S.
Prerequisite: Credit or classification in 317, E.E. 442.

(1-2) Cr. 1. F.S.
Prerequisite: Credit or classification in 321 or 341. Mr. Hall.

343. Mechanical Engineering Laboratory.
(0-6) Cr. 2. F.W.
Prerequisite: 341, credit or classification in 424 and 440. Mr. Van Meter.
Laboratory investigation of selected experiments in thermodynamics, fluid and machine dynamics. Nozzles, fluid meters, calorimetry, psychrometry, boundary layer, fluid flow and viscosity.

344. Thermodynamics.
(5-0) Cr. 5. F.W.S.S.
Prerequisite: Math. 212, Phys. 222. Mr. Van Meter.

400. Professional Conduct.
(1-0) Cr. R. F.
Prerequisite: Senior classification.
Engineering ethics, engineering registration. Professional organizations. Professional growth of the engineer.

401. History of Engineering.
(3-0) Cr. 3. 401: F.W.; 402: W.S.
Prerequisite: Junior classification. Mr. Ferguson.

(4-0) Cr. 4. W.
Prerequisite: 15 credits in Arch. 310. Mr. Jones.
Elements of heat transfer, thermodynamics, and fluid flow as applied to heating, ventilating, and air conditioning. Design of duct and piping systems.

(2-6) Cr. 4. S.
Prerequisite: 406. Mr. Jones.
Heat loss and gain calculations. Analysis of system types. Design and layout of heating, air conditioning, and plumbing systems in buildings.

411. Industrial Automatic Controls.
(3-0) Cr. 3. S.
Prerequisite: 318, E.E. 442. Mr. Johnson.
Methods and principles of automatic control. Pneumatic, hydraulic and electrical systems. Representative applications of automatic control systems. Mathematical analysis of control systems.

(3-3) Cr. 4. S.
Prerequisite: 318, 425, E.E. 442. Mr. Kaufman.
The application of fundamental concepts from several areas to the solution of engineering problems. Mathematical statement of the problem. Introduction to analogies and dimensional analysis in problem solution. Analog and digital computing methods.

(1-9) Cr. 4. W.S.SSI.
Prerequisite: 318. Solution of total design problems involving the use of basic engineering concepts and industrial practices. Design of complete machines.

424. Heat and Mass Transfer I.
(3-0) Cr. 3. F.S.SSI.
Prerequisite: E.M. 344, Math. 323, credit or classification in 322. Mr. Serovy.

425. Heat and Mass Transfer II.
(4-0) Cr. 4. F.W.S.SI.
Prerequisite: 424. Mr. Serovy.

426. Refrigeration and Air Conditioning.
(3-0) Cr. 3. F.W.
Prerequisite: 325 or 425. Mr. Knight.
Principles of refrigeration; analysis of refrigeration cycles. Principles of air conditioning with emphasis on thermodynamic processes involving air-water vapor mixtures.
342/Description of Courses

427. Heating and Air Conditioning Design. (2-6) Cr. 4. S. 
Prerequisite: 426, Mr. Myers. 
Design and layout of heating, ventilation and air conditioning systems.

428. Refrigeration. (3-0) Cr. 3. S. 
Prerequisite: 426, Mr. Knight. 

429. Internal Combustion Engine Design. (2-6) Cr. 4. S. 
Prerequisite: 423, 445, Mr. Myers. 
Design and layout of a high-speed internal combustion engine of carburetion or deisel type.

431. Physical Metallurgy. 
(Met. 431) See Metallurgy.

440. Fuels and Combustion. (4.0) Cr. 4. F.W.S.S. 
Prerequisite: 322, Chem. 381. Mr. Fellinger. 

442. Heat Power Laboratory. (1-6) Cr. 3. W.S. 
Prerequisite 343, 425, 440. 
Determination of the performance characteristics of boilers, turbines, engines, refrigeration and air conditioning equipment using standard test code procedures.

444. Steam Power Plants. (3-0) Cr. 3. W.S. 
Prerequisite: 425, 440. Mr. Joenssen. 
Thermodynamics and performance of boilers, turbines, pumps, heat exchangers, and other power plant equipment. Efficiency and economy of modern stations and their cycles.

445. Internal Combustion Engines. (3-0) Cr. 3. W.S.S. 
Prerequisite: 440, Mr. Junkhan. 

448. Steam Power Plant Design. (2-6) Cr. 4. S. 
Prerequisite: 444. 
Principal and auxiliary equipment for power, heating, and pumping plants. Cooling towers, boiler water treatment, principles of plant design.

487. Special Problems. 
Cr. 3 to 5. F.W.S. 
Prerequisite: Senior classification. 
Investigation of topic holding special interest of student. Comprehensive report required. Ejection of course and topic must be approved by department head.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates*

(3-0) Cr. 3. F. 

(2-2) Cr. 3. W. 
Prerequisite: 501. 
Instrumentation and auxiliary equipment for the measurement of experimental quantities. Application of mechanical, electrical and optical systems in obtaining accurate and reliable results.

513. Lubrication and Friction. 
(4-0) Cr. 4. W. 
Prerequisite: 317, 424. 
Theories of lubrication and friction and their application to design.

515. Advanced Design. 
(4-0) Cr. 4. W. 
Prerequisite: E.M. 514. 
Experimental, empirical and rational methods of analysis and synthesis in the solution of advanced design problems.

516. Advanced Kinematics of Mechanisms. 
(3-0) Cr. 3. F. 
Prerequisite: 318. 

(3-0) Cr. 3. S. 
Prerequisite: 322 or 344 Mr. Fellinger. 
Students may not receive credit in both 521 and 621. General equations for properties of the pure substance. Third Law and absolute entropy. Real gas equations of state. Processes involving real gas effects.

523. Thermodynamics of Compressible Flow I. 
(4-0) Cr. 4. F. 
Prerequisite: 321 or 344, 424 or E.M. 378. Mr. Fellinger. 
Thermodynamics of high velocity flow within enclosed channels. Basic one-dimensional flow relations. The Mach parameter. Effects of friction and plane shocks. Fanno and Rayleigh lines, diabatic flow. Theory and use of Gas Table.

524. Thermodynamics of Compressible Flow II. 
(Aero. E. 524) (4-0) Cr. 4. W. 
Prerequisite: 523. 
Two- and three-dimensional compressible internal flow. Analysis and design of ducts, annuli, nozzles and cascades. Real fluid effects including boundary layer separation.

525. Heat Transfer. 
(4-0) Cr. 4. W. 
Prerequisite: 425 or equivalent. 
Intermediate-level treatment of heat transmission by conduction, convection and radiation. Intended for those who require a general coverage of theory and methods but whose primary research interests are in other areas.

532. Structure and Properties of Steel. 
(Met. 532) See Metallurgy.

533 Principles of Metal Processing. 
(Met. 533) See Metallurgy.

(3-0) Cr. 3. Alt. S. Offered 1966. 
Prerequisite: 440, Mr. Fellinger. 
COURSES

541, 542, 543. Advanced Aerodynamics.
(AeroE. 541, 542, 543) See Aerospace Engineering.

544. Principles of Turbomachinery.
(4-0) Cr. 4. S.
Prerequisite: 523. Mr. Serovy.
Energy transfer, flow of fluids in turbomachinery. Application of the principles of fluid mechanics, thermodynamics, and aerodynamics to the design and analysis of pumps, compressors, and turbines.

(AeroE 545) (3-0) Cr. 3. F.
Prerequisite: 523, 544 or AeroE. 413.
Analysis and selection of propulsion systems for flight vehicles. Optimization of components and design parameters for atmospheric flight and for power and thrust generation in space.

COURSES FOR GRADUATE STUDENTS, major or minor

Cr. 3. S.
Mathematical and experimental analysis of problems in field of dynamics of machinery, stress analysis, and vibration. Choice of work any quarter determined by aptitudes and interests of class.

610. Dynamics of Automatic Control Systems.
Cr. 3. S.
Dynamical characteristics of the elements for measurement and automatic control of variables in mechanical, thermal and fluid systems and devices.

620. Seminar.
(1-0) Cr. 1. F Mr. Black.

621. 622. Advanced Engineering Thermodynamics.
(4-0) Cr. 4 each. 621: W.; 622: Alt. S
Offered 1967. Mr. Fellinger.
Fundamental concepts of thermodynamics, thermodynamic laws, temperature, entropy, general thermodynamic equations, properties of steam, availability, equilibrium. Thermodynamics and thermoelectricity. Special topics.

(AeroE. 623, 624) See Aerospace Engineering.

625. Advanced Heat Transfer I.
(3-0) Cr. 3. Alt. F Offered 1966.
Prerequisite: 425 or equivalent. Mr. Serovy.
Techniques for the analysis of problems involving steady-state and transient heat conduction.

626. Advanced Heat Transfer II.
(3-0) Cr. 3. Alt. W. Offered 1967.
Prerequisite: 425 or equivalent. Mr. Serovy.
The boundary layer concept and its relation to convective heat transfer. Methods for analysis of the convection process in closed conduits and in flow past immersed bodies.

627. Advanced Heat Transfer III
(3-0) Cr. 3. Alt. S. Offered 1967.
Prerequisite: 425 or equivalent. Mr. Serovy.
Transfer of energy by thermal radiation.

628. Advanced Problems in Turbomachinery.
(3-0) Cr. 3. Alt. W. Offered 1965.
Prerequisite: 542. Mr. Serovy.

655. Research.
Messrs. Black, Fellinger, Serovy.

METALLURGY

O. Norman Carlson, Ph.D., Chairman of Department

PROFESSORS: Premo Chiotti, Ph.D.; David T. Peterson, Ph.D.; John F. Smith, Ph.D.; Frank H. Speding, Ph.D.; Harley A. Wilhelm, Ph.D.

ASSOCIATE PROFESSORS: Karl A. Gschneidner, Jr., Ph.D.; William L. Larsen, Ph.D.; Marion J. Marcinkowski, Ph.D.

ASSISTANT PROFESSORS: Francis X. Kayser, Sc.D.; Tom E. Scott, Ph.D.; John D. Verhoeven, Ph.D.

Opportunities for Undergraduate Study

A student interested in the area of metallurgy can pursue studies leading to the degree Bachelor of Science in either the College of Engineering or the College of Sciences and Humanities.

For an undergraduate curriculum in metallurgy, see College of Engineering, Curricula.

To best prepare the student to meet the challenges of this broad field the engineering curriculum in metallurgy is based on a core of courses in chemistry, physics, mathematics and
metallurgical engineering principles. A wide choice of electives makes it possible for the student, in consultation with his adviser, to develop a program which best fits his particular interests and aptitudes. The curriculum is designed to permit specialization in mechanical, chemical, or physical metallurgy through the choice of electives in the third and fourth years. Elective programs should complement the core curriculum avoiding undue specialization or aimless diversification. The physical metallurgy electives usually are selected by those interested in basic or applied research while the chemical or mechanical electives are taken by those primarily interested in the application of metallurgical principles to production processes or other industrial problems.

The metallurgist finds opportunities in many industries such as the metal producing, refining and processing industries or those which utilize metals such as the automotive, aircraft, utilities, electronic, oil refining and farm implement industries. He may choose to work in the areas of production, sales or research. The demand is particularly high for metallurgists with training beyond the Bachelor's degree. Students interested in teaching or research in metallurgy should seriously consider graduate study.

For an undergraduate curriculum in sciences and humanities, with a major in metallurgy see Sciences and Humanities, Curriculum. Students in this curriculum usually will include the following basic courses: 201, 202, 203, 301, 302, 303, 305, 306, 307, 401, 402, 403, 421 and 9 additional credits in courses numbered 400 or above. As supporting work undergraduate majors find the follow courses desirable: Math. 110, 211, 212, 213, 321, 322, 323, Physics 221, 222, 223, 301, 302, 303, Chem. 101, 102, 103, 321, 322, 323. These lists of courses are not regarded as statements of fixed requirements or as complete outlines of work necessary for the major. Students will plan their complete programs according to their individual needs with the help of their advisers.

Opportunities for Graduate Study

Advanced work leading to the degrees Master of Science and Doctor of Philosophy in metallurgy is provided, and minor work is offered students taking major work in other departments.

Prerequisite to graduate study in metallurgy is completion of an undergraduate curriculum in metallurgy or metallurgical engineering or in a closely allied field such as materials engineering or science, physics, chemistry, ceramic engineering, chemical engineering, or mechanical engineering. Students majoring in metallurgy will usually choose supporting course work in these or similar allied fields. Excellent facilities are provided by the Department of Metallurgy and the Institute for Atomic Research for investigations in theoretical and applied fields of metallurgy.

Courses open to graduate students for minor credit only: 301, 302, 303, 305, 306, 307, 401, 402, 403, 408, 421, 431.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Technical Lecture.
(1-0) Cr. R. S
Introduction to the metallurgical profession. Career opportunities and requirements.

(3-0) Cr. 3 each. 201. F; 202. W S.; 203: S
Prerequisite: Chem. 101. 201 is not prerequisite to 202.
201: Occurrence and preparation of metals, stoichiometry, and material balances. States of aggregation and microstructure. 202: Introduction to types of bonding, crystal structure of solids, crystalline imperfections and their effect on properties. Mechanisms of deformation. 203: Mechanical properties of metals and testing procedures, metal processing techniques, alloying principles and engineering applications.

(3-0) Cr. 3 each. Yr
Prerequisite: 203, classification in Chem. 321. Basic principles of X-ray diffraction, relation of crystal structure and imperfections to elastic, plastic and general physical and chemical properties; binary and introduction to ternary phase diagrams, relation of microstructure to the phase diagram and effects of heat treatment; diffusion and kinetics of phase transformations; corrosion.

(0-6) Cr. 2 each Yr
To be taken concurrently with sequence 301, 302, 303. Experiments in X-ray diffraction, measurement of physical properties, pyrometry, heat treatment, metallography, mechanical testing.

(3-0) Cr. 3 each. Yr
Prerequisite: 303. Application of theories of flow and fracture to mechanical behavior of metals; relationship of design, materials, processing, and operating conditions to service behavior; service failure analysis; metallurgical design of alloys, and materials selection for specific applications.
408. **Metallurgy**. *(1-0) Cr. 3. S.*
**Prerequisite:** 305.
Optical principles and use of the metallurgical microscope. Theory and practice of specimen preparation. Qualitative and quantitative interpretation of observed structures.

421. **Metallurgical Thermochemistry**. *(3-0) Cr. 3. F.*
**Prerequisite:** Chem. 323.
Application of thermodynamics to metallurgical processes.

**COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates**

510. **511. Advanced Physical Metallurgy**. 
**510:** (4-0) Cr. 4. F; **511:** (3-0) Cr. 3. W.
**Prerequisite:** Chem. 323.
Crystallography, stereography, crystal geometry and metal structures, diffusion mechanisms and phenomenology, phase transformations, phase equilibria, recrystallization and growth.

512. **Introductory Metal Theory**. *(3-0) Cr. 3. S.*
**Prerequisite:** Credit or classification in Math. 323.

532. **Structure and Properties of Steel**. *(M.E. 532) (3-0) Cr. 3. S.*
**Prerequisite:** 303 or 431.
Application of fundamental concepts of phase transformations, mechanical behavior and heat flow to the problems of heat treatment and selection of steels.

533. **Principles of Metal Processing**. *(M.E. 533) (3-0) Cr. 3. Alt. W Offered 1966*
**Prerequisite:** 303 or 431.
Fundamental metallurgy and physical aspects of metal casting, mechanical deformation and welding processes.

540. **Theory of Dislocations**. *(3-0) Cr. 3. W.*
**Prerequisite:** 510. Credit or classification in Math. 323.
Theoretical analysis of whole, partial, and twinning dislocations; relations to stacking fault energy. Interactions of dislocations with dislocations and point imperfections. Low and high angle boundaries. Formation and multiplication of dislocations. Dislocations in crystal structures and crystal growth. Elementary strengthening mechanisms.

541. **Applications of Dislocation Theory**. *(3-0) Cr. 3. S.*
**Prerequisite:** 540.
Application of Thompson tetrahedron to dislocation interactions during plastic flow of crystals. Dislocation theories of work hardening in single and polycrystals as related to strain, strain rate, temperature and structure. Mechanisms of fracture, fatigue and creep. Effect of dislocations on internal friction pre-

431. **Physical Metallurgy**. *(M.E. 431) (4-0) Cr. 4. F.W.*
**Prerequisite:** Chem. 323 or 381.
Fundamentals of physical metallurgy; atomic and crystal structure, phase diagrams, physical and mechanical behavior, corrosion, diffusion, recrystallization, solid state phase transformation. Not open for credit for students majoring in metallurgy.

450. **Special Problems**.
**Cr. arr. F.W.S.*
**Prerequisite:** Junior classification.
Investigation of individual research problems or special topics with approval of adviser.

**COURSES FOR GRADUATE STUDENTS, major or minor**

610. **Alloy Theory**. *(3-0) Cr. 3. Alt. F. Offered 1966.*
**Prerequisite:** 512.
Cohesion and bonding in matter; their relationship to structure, thermodynamics, other physical properties, and the factors affecting alloying behavior of metals such as formation of solid solutions, immiscible liquids, and intermetallic phases.
Opportunities for Undergraduate

346/Description of Courses

(3-0) Cr. 3. Alt. F. Offered 1966.
Prerequisite: 541.
Quantitative application of kinematic and dy-
namic theories of electron diffraction contrast
to the study of defect substructures such as
various dislocation, stacking fault and mag-
netic domain configurations as well as precipi-
tion, order-disorder, and recrystallization
phenomena. Other techniques for
observation of imperfections Emphasis
will be placed on metals and alloys.

655. X-ray Scattering from Crystals.
(3-0) Cr. 3 each time taken. F
Prerequisite: Math. 322, 323.
Absorption, dispersion, polarization, refraction,
and scattering of X-rays. Application in
studies of metals. Selected topics, including
temperature diffuse scattering, short- and long-
range order, faulting in cold-worked metals,
extinction effects, dynamical theory of diffrac-
tion.

(2-0) Cr. 2 each time taken. Offered on
request.

MODERN LANGUAGES

Alfred P. Kehlenbeck, Ph.D., Head of Department

PROFESSORS: Don M. Anderson, Ph.D.; Cecil D. McVicker, Ph.D.; Frederick Schwartz, Ph.D.

ASSOCIATE PROFESSOR: Tereze Michelsons, M.A

ASSISTANT PROFESSORS: Robert Bernard, M.A.; Floyd Pace, M S; Franz Pfister, M.A.;
Fred Pohorille, M.A; Osvaldo Soto, Dr en Der.

INSTRUCTORS: Charlotte H. Bruner, M.A.; Maria E. Fouad, B.A.; Josette Haskell, B A.;
Margaret Johnson, B.A.; Harry A. Kahn, M A.; Judith Noble, B S.; Susan Pfister, B A.;
Praxedis Sanchez, B.A.; Frances Seigler, B.A.; Helga Van Iten, B A.; Ann Vinograde,
M.A.; Beverly Ziv, M.A.

Opportunities for Undergraduate Study

The instruction offered in the Department of Modern Languages is designed to give the
student the basic fundamentals in the languages offered and to introduce the students to the
culture of the people whose language is being studied.

The department offers a regular academic major with a minimum of 30 credits and two
minors in other departments with a total of 30 credits. A minor in modern languages may
be taken with 15 credits beyond 9 credits of the elementary course. However, if the major
student wishes to qualify for a teacher's certificate in modern languages he must take a
minimum of 45 credits in one language for full-time certification. A student may qualify
for full-time certification in two languages with 36 credits in one and 36 credits in the other
if these are French and Spanish. For certification in modern languages, half time or less,
30 credits in one language will be required.

Courses at the 200 level are for undergraduates who have had no previous instruction in the
language at the college level. The 300 series is for those who have had a full year of
college instruction or two years of high school work in the language concerned. The 400
series is for those who wish advanced or special training. Students from foreign countries
may take only 400-numbered courses in their native languages. Students entering Iowa State
with as much as two years of instruction in a foreign language may not register for a 200-
level course in that language without the consent of the Department of Modern Languages.

Opportunities for teaching foreign languages in public schools are excellent at this time.
Students who wish to prepare themselves for this field should plan to take four years of one
language, two of a second and a concentration in one other field; for example, English,
social studies, general science or mathematics.
For secondary school teaching certification the student should take Psych. 101 in the freshman year; Ed. 204 in the fall quarter, Psych. 230 in the winter quarter and Psych. 333 in the spring quarter of the junior year; Ed. 305 A and B in the fall quarter, M. L. 476 in the winter quarter of the junior year; Sci. 417G, Student Teaching, the first half, Gov. 215 the second half, and Ed. 426, the second half of the fall quarter of the senior year.

201A, 202A, 231A, 232A, and 233A primarily are designed to provide a reading knowledge of scientific French and German for graduate students.

Students who wish to specialize in international affairs may do so through the International Service Program while majoring in modern languages. See International Service Program.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

Courses in French

*201, 202, 203. Elementary French.
(2-2) Cr. 3 each. 201: F.W.; 202: W.S.; 203: S.
Prerequisite: 201: No previous college credit in French; 202: 201; 203: 202.
Introduction to French with emphasis on development of aural-oral skills with intensive use of the language laboratory.

*201A, 202A. Reading Knowledge of Scientific French.
(3-0) Cr. 3 each or R. 201A: F W.; 202A: W.S.
Essentials of French grammar to permit use of the language as a research tool with aid of dictionary. Primarily for graduates. Emphasis on problems of translation. Limited for credit to undergraduate students in the physical and biological sciences.

(3-0) Cr. 3 each yr.
Prerequisite: 301. 203 or equivalent; 302. 301 or equivalent; 303. 302 or equivalent.
Review of the basic principles of French grammar. Continued emphasis on development of aural-oral skills. Selected reading texts for continued vocabulary building. Simple composition exercises and selected subjects for conversation practice.

304. French Pronunciation.
(3-0) Cr 3 F.
Prerequisite: 203 or equivalent.
Diction and intonation. Development of proper French accent through phonetics, mechanics of sound formation, syllabification, inflection and intonation. Should be taken concurrently with 301.

(3-0) Cr. 3 each W.S.
Prerequisite: 305: 203 or equivalent; 306: 305.
305: Origins of the French nation from ancient Gaul through seventeenth century. History, art, architecture, music and social institutions. Required of majors. 306: Continuation of 305 covering cultural growth of France from seventeenth century to the present day.

401, 402, 403. Advanced French Composition and Conversation.
(3-0) Cr 3 each yr.
Prerequisite: 401: 303 or equivalent; 402: 401 or equivalent; 403: 402 or equivalent.
Continuing review of grammar. Free composition practice and student-selected topics for conversation practice.

Courses in German

*231, 232, 233. Elementary German.
(2-2) Cr. 3 each. 231: F.W.; 232: W.S.; 233: S.
Prerequisite: 231: No previous college credit in German; 232: 231; 233: 232.
Introduction to German through the aural-oral approach with intensive use of the language laboratory.

(3-0) Cr. 3 each or R. 231A: F.W.; 232A: W.S.; 233A: S.
Essentials of German grammar to permit use of the language in research with aid of dictionary. Primarily for graduates. Emphasis on problems of translation. Limited for credit to undergraduate students in the physical and biological sciences; open to all graduate students.

331. 332. Scientific German.
(3-0) Cr. 3 each F.W.
Prerequisite: 331: 233 or 233A or equivalent; 332: 331 or equivalent.
Review of grammar necessary for reading scientific literature. Extensive reading from the physical, biological, and social sciences.

333. 334. 335. German Prose.
(3-0) Cr. 3 each yr.
Prerequisite: 333: 231, 231A or equivalent; 334: 333 or equivalent; 335: 334 or equivalent.
Systematic review of first year grammar. Extensive reading in German short stories, dramas, and novels. Further practice in oral communication.

*A student may earn credit in only one sequence of the same language.
Courses in Russian

336, 337, 338. German Civilization.
(3-0) Cr. 3 each. Yr.
Prerequisite: 233, 233A or equivalent.
Readings from a cultural history of Germany for gaining practice in reading and accumulating factual data on German Civilization.

(3-0) Cr. 3 each. Yr.
Prerequisite: 431: 18 credits in German; 432: 431; 433: 432.
Practice in writing and speaking German.

434, 435, 436. Eighteenth Century German Literature.
(3-0) Cr. 3 each. Yr.
Prerequisite: 18 credits in German.
Lessing, Goethe, Schiller, and others of the classical period of German literature.

437, 438, 439. German Literature from 1800 to the Present.
(3-0) Cr. 3 each. Yr.
Prerequisite: 18 credits in German.
Readings from the works of representative poets and writers of the time.

440. Goethe's Faust, Part I.
(3-0) Cr. 3 F.
Prerequisite: 439.
Reading of Faust, Part I, with discussions in German only.

Courses in Spanish

221, 222, 223. Elementary Russian.
(3-0) Cr. 3 each or R. Yr.
Prerequisite: 221. No previous college credit in Russian; 222: 221; 223: 222.
Brief summary of essentials of construction necessary for reading knowledge. Optional one-hour laboratory without credit.

(3-0) Cr. 3 each. Yr.
Prerequisite: 321: 223 or equivalent; 322: 321 or equivalent; 323: 322 or equivalent
Reading of modern Russian prose.

494. Advanced Russian.
Cr. 1 to 3 each time elected. F.W.S.
Prerequisite: 18 credits in Russian or equivalent.
Oral approach: Practice in conversation and composition; reading of Russian literature.

Courses in Spanish

261, 262, 263. Elementary Spanish.
(2-2) Cr. 3 each. 261: F.W.; 262: W.S.; 263: S
Prerequisite: 261: No previous college credit in Spanish; 262: 261; 263: 262.
Essentials of construction and vocabulary with an oral approach and with use of the language laboratory.

(3-0) Cr. 3 each. Yr.
Prerequisite: 361: 263 or equivalent; 362: 361 or equivalent; 363: 362 or equivalent.
Review of the basic elements of the Spanish language. Further intensive practice in oral communication.

Courses in Spanish

(3-0) Cr. 3 each. Yr.
Prerequisite: 263 or equivalent.
From earliest times to the present. Survey of the art, architecture as well as the social structure of Spanish Life.

461, 462, 463. Introduction to Spanish Literature.
(3-0) Cr. 3 each. Yr.
Prerequisite: 363 or equivalent.
461: Drama of the Golden Age. Reading of one play each of Calderon and Lope de Vega in class with selected collateral readings. 462: Prose and poetry of the nineteenth century. Reading of selected prose and poetry from the romantic period to Galdos. 463: Prose and poetry of the twentieth century. Selected readings from the Generation of 98 to the present.

464, 465, 466. Introduction to Latin American Literature.
(3-0) Cr. 3 each. Yr.
Prerequisite: 36 credits in Spanish or equivalent.
464: The Colonial Period. Selected readings in historical and literary materials from the time of the conquest to the period of struggle for independence. 465: The Nineteenth Century. Selected readings from the postcolonial period to include realism and modernism. 466: The Contemporary Period. Selected readings from prose and poetry of the twentieth century.

471. Introduction to Cervantes.
(3-0) Cr. 3. S.
Prerequisite: 36 credits in Spanish or equivalent.
Reading of selected illustrative parts of the Quixote and minor works of Cervantes.

472. Spanish Drama of the Nineteenth and Twentieth Centuries.
(3-0) Cr. 3. S.
Prerequisite: 36 credits in Spanish or equivalent.
Reading of selected illustrative material from the drama of the period.

Special Courses

476. Methods of Teaching Modern Languages.
Cr. 3. W
Prerequisite: 15 credits in modern languages.

499. Special Problems.
Cr. 1-9 each time elected. F.W.S.
Prerequisite: Permission of department head.
Designed to meet the needs of (1) students who seek work in areas other than those in which courses are offered; (2) students who desire to integrate a study of literature or language with special problems in major fields. H. Honors Program.
MUSIC
Lawrence Hart, D.Mus.A., Head of Department

ASSISTANT PROFESSORS: Carl O. Bleyle, M.M.; Max V. Exner, M.A.; David N. Kaiserman, M.S.; Weston Douglas Pritchard, M.M; James M. Stroud, Jr., M.M.
INSTRUCTOR: Jane Ann Henry, M.M.

Opportunities for Undergraduate Study

Courses in music offer training in the skills of musical performance and seek to cultivate an understanding of the theoretical and historical aspects of music. Credits in music may be applied as an area of concentration in distributed studies or as electives in this and other colleges. Students are urged to seek advice of the Department of Music before selecting music courses. Performance skill is considered an important guide in this decision.

All university students are eligible for membership in bands, choruses and orchestras. Selection is based upon requirements of the particular organization and the qualifications of the individual. Students may also participate in the various workshops which the Department presents on the campus.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

Iowa State University Festival Chorus.
F. Members of student body and faculty are eligible. Interpretation of choral work, secular and sacred.

(2-0) Cr. 1 each. Yr. Mr. Piersol.
Open to all students who qualify. Concerts and annual tour in addition to the playing for convocations and athletic events.

1 or 2 credits each time elected.
1 credit, one 30-minute lesson per week, minimum weekly practice 5 hours. 2 credits, two 30-minute lessons per week, minimum weekly practice 10 hours. Course number indicates proficiency level. Course number and amount of credit will be assigned by the Department of Music.
Private instruction in instrument or voice. See Fees and Expenses.
A Voice.
B. Piano.
C. Organ.
D. String Instruments.
E. Band Instruments.

(1-0) Cr. 1 each time elected. F.W.S. Staff.
Prerequisite: Permission of Head of Department of Music.
Class study in instrument or voice. See Music 119, etc. for letter designation for various instruments.

141, 142, 143. Glee Clubs
(2-0) Cr. 1 each. Yr.
Glee clubs are open to all students by application to the director. Rehearsals twice weekly, plus Festival Chorus.

151, 152, 153. Orchestras.
(1-0) Cr. 1 each. Yr Mr Stroud.
Open to all students who qualify. Concerts presented each quarter; annual tour fall quarter.

161, 162, 163. Iowa State Singers
(3-0) Cr. 1 each. Yr.
Open to all students who qualify.

201. Harmony I
(4-0) Cr. 4. F. Mr. Kaiserman.
Prerequisite: Permission of Instructor.
Scale structure. Chord spelling. Keyboard facility required.

202. Harmony II.
(4-0) Cr. 4. W. Mr. Kaiserman.
Prerequisite: 201.
Harmonization and analysis. Continuation of Music 201.

203. Harmony III.
(4-0) Cr. 4. S. Mr. Kaiserman.
Prerequisite: 202.
Continuation of Music 201, 202. Includes creative writing.

304. Musical Forms.
(3-0) Cr. 3. F.
Prerequisite: 203.
Harmonic and formal analysis of the smaller forms in music; practical adaptation in composition.

305. Choral Arranging.
(3-0) Cr. 3. W.
Prerequisite: 203.
Principles of harmonic distribution applied to choral music; melodic and rhythmic problems in choral writing; practical arranging.

306. Instrumentation.
(3-0) Cr. 3. S.
Prerequisite: 203.
Transposition, ranges and use of orchestral instruments; practical application to compositions for single and combined instrumental choirs.

(3-0) Cr. 1 each. Yr.
Prerequisite: Permission of director and department head.
Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. Designed to give the advanced student opportunity to perform in ensembles which demand a high degree of proficiency.
354. Music Appreciation.  
(2-1) Cr 2. F.W.S Mr Schroeder  
Designed to acquaint students with form and meaning of good music. Lectures demonstrated by musical selections.

(3-0) Cr 3 each Yr  
Prerequisite: 354 Should be taken in sequence. Mr. Stroud  
355: The history of music from ancient times and extending through the renaissance and baroque practice. 356: The music of Bach and Handel, the classics, Beethoven and the romantics. 357: Late romantic development and its influences in shaping contemporary styles. Contemporary music

361. Conducting I.  
(1-1) Cr 1 F  
Prerequisite: Permission of department head  
Basic training in conducting and rehearsal techniques. Emphasis on vocal practice and choral literature.

362. Conducting II.  
(1-1) Cr 1 W Mr Stroud  
Prerequisite: 361  
Score reading. Emphasis on instrumental techniques. Continuation of Music 361.

364. Creative Activities in Music.  
(3-3) Cr 4 F  
Practical acquaintance with instruments and music for creative learning in music. Emphasis on working with small children, but not limited to this age group. Includes practical observation.

(3-0) Cr 3 W  
Basic techniques and material for teaching school music, with emphasis on elementary grades. Keyboard ability required.

(3-0) Cr 3 S  
Methods and materials for teaching and supervision of music in the junior and senior high schools. Preparation for direction of music as an activity

390. Special Topics.  
Cr. Var F.W.S  
Prerequisite: Permission of department head  
A. Music education.  
B. Music theory.  
C. Music literature.  
D. Music history.  
H. Honor’s Program.  
Courses are designed to meet special interests of students and to fulfill individual requirements in specific areas, such as elementary education. Current topics include history and philosophy of music education, music for the classroom teacher, fundamentals of music, organ literature and performance, history of church music, history and performance of opera. Schedule available from Department of Music.

NUCLEAR ENGINEERING

Glenn Murphy, Ph.D., Head of Department

Professor: Donald M. Roberts, Ph.D  
Assistant Professors: Howard Bell, Ph.D; Richard A. Danofsky, Ph.D.; Benjamin M. Ma, Ph.D.; Alfred F. Rohach, Ph.D.; Richard E. Turley, M.S.; Agust Valfells, Ph.D.  
Instructors: Richard A. Hendrickson, M.S; Knud B. Pederson, M.S.

Opportunities for Undergraduate Study

Nuclear engineering is considered to be primarily a graduate program, hence the baccalaureate degree is not offered in this field. The undergraduate interested in a career in nuclear engineering is encouraged to complete a curriculum in one of the available fields in engineering in preparation for graduate studies in this department.

A survey course, Nuc E 474, is available at the undergraduate level.

Opportunities for Graduate Study

Major work is offered for the degrees Master of Science and Doctor of Philosophy in nuclear engineering, and minor work in nuclear engineering and in engineering similitude is offered to students taking major work in other departments.

Prerequisite to major work is the completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this institution. It is recommended that students contemplating graduate studies in nuclear engineering include courses in modern physics, heat transfer, chemistry beyond freshman chemistry, and mathematics beyond differential equations as part of their undergraduate preparation.

The modern language requirement for the degree Master of Science may be waived upon recommendation of the head of the department.

COURSE PRIMARILY FOR UNDERGRADUATE STUDENTS

474. Introduction of Nuclear Engineering.  
(3-0) Cr. 3. F.W.S  
Prerequisite: M.E 344, Math 321 or permission of instructor.  
Basis and problems of nuclear power development; considerations in nuclear reactor design; radiation hazards and shielding; use of radioisotopes in industry.
COURSES FOR 502.

COURSES PRIMARILY FOR 500.

undergraduates

500. Special Topics.
   (2 to 5-0) Cr. 2 to 5 F W S

501. Elements of Nuclear Engineering
   (3-0) Cr. 3 F
   Prerequisite: 515, E.M. 324, M.E. 344

   (3-0) Cr. 3. W
   Prerequisite: 501, M.E. 325.
   Mechanical and nuclear properties of solid and fluid reactor materials. Thermal and structural problems in reactors.

504. Elements of Nuclear Reactor Design.
   (1-6) Cr. 3 S.
   Prerequisite: 536.
   Engineering aspects of reactor design and use of nuclear power.

   (3-0) Cr. 3. F.
   Prerequisite: Math. 321, Phys. 113.
   Influence of structure and environment on the mechanical properties of engineering materials. Types of imperfections and their effects. Control of properties.

   (1-4) Cr. 3. W.

511. Nuclear Fuels and Wastes.
   (Chem. E. 511) (3-0) Cr. 3. S.
   Prerequisite: Permission of instructor.
   Preparation of reactor fuels and handling of radioactive wastes.

512. Reprocessing Nuclear Fuels
   (Chem. E. 512) (3-0) Cr. 3. SS.
   Prerequisite: 511.
   Principles of nuclear reprocessing methods.

534. Reactor Stress Analysis.
   (3-0) Cr.
   Prerequisite: E.M. 324, Math. 321.
   Analysis of stresses in reactor elements and structures. Thermal stresses in fuel elements and reactor vessels. Design of containment structures.

535. Nuclear Physics for Engineers.
   (4-0) Cr. 4. F.
   Prerequisite: Math. 321, Phys. 223.
   Atomic and nuclear structure, introduction to quantum theory, fundamental particles; isotopes; alpha, beta and gamma radiation.

536. Elementary Reactor Theory
   (3-0) Cr. 3 each. W.S.
   Prerequisite: 535 or Phys. 483 or 593, Math. 322.
   Diffusion of neutrons, homogeneous and heterogeneous reactors, reactor control, perturbation theory and transport theory.

   (3-2) Cr. 4. F.
   Prerequisite: E.M. 344, Math. 321.
   Dynamic performance of engineering systems with emphasis on aperiodic conditions. Transient response of open-loop and closed-loop systems. Dynamic performance of mechanical, fluid and electrical components. Use of analog computer to obtain dynamic response.

541. 542, 543. Reactor Laboratory.
   (1-6) Cr. 3 each. F.W.S.
   Prerequisite: 510.
   Laboratory problems involving the nuclear reactor.

554. Radioisotopes in Engineering
   (2-4) Cr. 4. F.
   Prerequisite: Permission of instructor.
   Principles of industrial utilization of radioisotopes and applications in engineering.

   (2-2) Cr. 3 each. W.S.
   Prerequisite: 537, 540.
   Principles of reactor control and operation. Reactor kinetics with time varying inputs, the reactor as a control element, reactor performance in a power plant system, stochastic methods for measurements of reactor parameters.

571. 572. Thermonuclear Theory.
   (3-0) Cr 3 each. W.S.
   Prerequisite: 536.

581. 582, 583. Reactor Analysis.
   (3-0), (2-2), (2-2) Cr. 3 each. F.W.S.
   Prerequisite: 537, Math. 408.
   Application of numerical analysis techniques to thermal and fast reactors.

COURSES FOR GRADUATE STUDENTS, major or minor

600. Research.
   Messrs Danofsky, Murphy, Roberts, Rohach, Valuffs

602. Radiation Shielding.
   (3-0) Cr.
   Prerequisite: 504, 510, 536.
   Design of shielding systems for protection against gamma rays and neutrons. Applications to nuclear reactors, cooling systems, processing equipment and other engineering units.

611. 612, 613. Advanced Reactor Theory.
   (3-0) Cr 3 each. Yr.
   Prerequisite: 536.
   Advanced theory of nuclear reactors.

620. Seminar.
   (2-0) Cr. 2. F.
   Prerequisite: Permission of instructor Mr Murphy.
   Current literature in nuclear engineering.

624. Advanced Nuclear Engineering.
   (2-2) Cr. 3. F.
   Prerequisite: 504 or permission of instructor.
   Exploitation of new concepts in nuclear engineering. Reactor systems, thermonuclear developments, fission, fusion and mass-energy transducers.

651, 652, 553. Interaction of Materials and Radiation.
   (3-2) Cr. 4 each. Yr.
   Prerequisite: 502, 536.
   Interaction between alpha, beta, gamma and neutron radiation and materials; absorption and scattering processes, influence on properties, shielding.

   (2-2) Cr. 3 each. F.W.S.
   Prerequisite: Permission of instructor.
   Principles of dimensional analysis and their application to design of models. Design, testing, and interpretation of models. True and distorted models, linear and non-linear models, analogies. Applications.
OFFICER EDUCATION PROGRAMS

Iowa State University has Officer Education Programs in the following branches of the military service: Army, Navy, and Air Force.

The University changed from compulsory ROTC to voluntary ROTC when it was recognized that the philosophy toward ROTC had changed through the years. Basic ROTC was no longer considered by the Department of Defense as needed to help prepare a large number of men for military service in the event of emergency. The concept of basic ROTC had changed to be a prerequisite for officer education. The present purpose of advanced ROTC is that of preparing officers to serve in military forces following graduation rather than merely holding a reserve commission in the event of emergency. The Navy and Air Force in particular are requiring a period of commission service long enough to encourage the officers to make a career of military service. Although the Army continues to require only two years of active duty, it still expects to recruit a high proportion of its career officers from ROTC graduates. Consequently, Iowa State University views ROTC as preparation for a career, or partial preparation for a career, since each graduate will spend two or more years of his career work on military service.

ROTC is recognized as a subject matter area of specialization because of its growing importance in career planning. Three categories of credit allocation are now recognized:

I. A student may major in NROTC in the College of Sciences and Humanities by applying 30 credits toward the major. Six credits of basic ROTC may be applied toward the elective requirement.

II. In colleges where minors are part of the curriculum 18 credits of ROTC may be applied toward the minor. Six credits of basic ROTC may be applied toward the elective requirement.

III. If a student does not select ROTC as a major or a minor, ROTC credits may, at the discretion of the college and the department, be applied toward the elective requirement.

AIR FORCE AEROSPACE STUDIES

Lt. Col. Joseph F. Sage, LLB., Head of Department

ASSOCIATE PROFESSOR: Maj. Paul W. Von Wiedenfield, B.A
ASSISTANT PROFESSORS: Capt. James L. Lee, Jr., B.A.; Capt. Duane L. Thenhaus, B.A.

Opportunities for Undergraduate Study

Iowa State University, a land-grant institution, has offered courses in AFROTC since 1946. It is a voluntary program. All physically qualified male students are eligible and encouraged to enroll toward gaining an officer’s commission.

The mission of the AFROTC is to produce officers of appropriate quality to satisfy stated Air Force Officer requirements. The objectives of the AFROTC are:

a. To provide education that will develop skills and attitudes vital to the career professional Air Force officer.

b. To qualify for commissions those college men who desire to serve in the United States Air Force.

The first two years of AFROTC consists of the general military course and the last two years the professional officer course. The general military course places special emphasis on personal development and practical military instruction (Leadership Laboratory) to develop qualities that are essential to the professional Air Force officer. A six-week Officer Basic Military Training Course (OBMT) conducted at an Air Force base between the sophomore and junior years may be substituted for the two-year general military course on campus. Students who desire to substitute the six-week OBMT for the general military course on campus will be given physical and mental examinations by the Air Force during their soph-
om more year in order to qualify for this training. While undergoing OBMT cadets are paid $78 per month plus travel expenses and are furnished housing and meals. General military training, either on campus or OBMT at an Air Force base, must be completed as a prerequisite for entry into the professional officer course.

All cadets must meet certain mental, physical and moral standards before they are selected for the professional officer course. Dependent upon physical qualification, advanced cadets may elect a flying or non-flying category, the latter in either a technical or non-technical field. The increasing demand for highly technical positions in the United States Air Force Aerospace Program principally is being met through the AFROTC. The physical standards for non-flying officers are lower than those for pilots and navigators so that students who cannot meet the physical requirements for flying still may be accepted for training within the non-flying categories. Regardless of category, an opportunity is afforded each cadet to fly in USAF aircraft and to go on field trips to various installations throughout the United States. In addition, there is a cadet Flight Instruction Program for seniors in the pilot category conducted at the Ames Airport. Upon satisfactorily passing the FAA requirements, a cadet completing this program is eligible for a private pilot’s license.

The student is furnished a complete uniform and books while enrolled in the program. In the professional officer course, he is paid a retainer fee of $40 per month for a period of 20 months and must attend a summer training period of four weeks' duration, normally between his junior and senior years. The government pays for travel and provides housing and meals in addition to paying $115 per month during this training period.

The AFROTC does not replace, supplement or parallel any other military training normally associated with enlistment or induction into the armed services. It is a program that is designed to provide a professional education for the career Air Force officer and to qualify for commissioning those college men who desire to serve in the United States Air Force. Students who successfully complete the program and attain a degree will receive a commission as a second lieutenant in the United States Air Force.

Additional information concerning Air Force ROTC may be obtained by writing the Professor of Air Force Aerospace Studies, Iowa State University

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

141, 142, 143. World Military Systems. (1-1) Cr 1 each. Yr.
Causes of present world conflict, the role and relationship of military power to that conflict and the responsibility of an Air Force officer. Factors from which differing political philosophies have evolved. Analysis of the three prime political philosophies which have guided segments of society in the twentieth century. Means that nations develop to pursue their objectives and how they confront each other in the use of these means. Individual military systems with emphasis upon the U. S. Department of Defense and the U. S. Air Force

Prerequisite: 143.
World military forces and the political-military issues surrounding the existence of these forces, including the United States Army and the United States Navy, their doctrines, missions and employment concepts; military forces of NATO, CENTO, SEATO, and their role in free world security; and military forces of the USSR, Soviet Satellite Armies, and the Chinese Communist Army. Analysis of the trends and implications of world military power.

341, 342, 343. Growth and Development of Aerospace Power. (3-1) Cr 3 each. Yr.
Prerequisite: 243.
The nature of war; development of air power in the U. S.; mission and organization of the Defense Department; Air Force concepts, doctrine and employment; astronautics and space operations; and future development of aerospace power.

441, 442, 443. The Professional Officer. (3-1) Cr 3 each. Yr.
Prerequisite: 343.
Professionalism, leadership, and management, including the meaning of professionalism, professional responsibilities, the military justice system, leadership theory, functions, and practices, management principles, and functions, problem solving, and management tools, practices and controls.

MILITARY SCIENCE

Col. Vern L. Joseph, B.A., Head of Department


INSTRUCTORS: SSgt. Harry E. Blakeslee; MSgt. Thomas E. Fry; SFC Peter P. Ignaszewski; SMJ. David R. Rach.
Since before the establishment of our national government, reliance has been placed upon citizen armies for defense, rather than upon a large standing army of professional soldiers. It is part of the American tradition that citizenship carries with it certain obligations, as well as privileges. The founders of Iowa State University early recognized the need for a citizenry trained in military matters. From the date Iowa State University was established, the University has conducted training in Military Science and Tactics.

The United States Army ROTC Program is designed to prepare college students for positions of leadership and responsibility in the U.S. Army. This instruction is divided into the basic course, Military Science I and Military Science II; and the advanced course, Military Science III and Military Science IV.

Military Science I provides instruction in the organization of the National Defense Establishment, use of individual weapons and rifle marksmanship. Military Science II provides instruction in map reading, basic tactics, American military history, and counter-insurgency operations. Uniforms for the basic course are furnished upon payment of a $15 deposit, which is refunded when the uniform is returned in good condition. The basic courses, Military Science I and II are prerequisites for the advanced courses; however, students who have not completed the basic course may apply for the advanced program and will be accepted upon completion of a qualifying medical examination and completion of a six weeks' basic training summer camp, this camp taking the place of the basic course. The basic training summer camp is conducted at an active Army installation during the summer prior to entrance into the advanced program. All travel and living expenses are paid by the U.S. Army along with a monthly stipend of $78 per month while attending summer camp. This method of entering into advanced ROTC program is open to all students who have two years' academic work remaining before attaining their undergraduate degree.

The advanced course is offered to qualified students who have completed the basic course or have fulfilled the alternative requirements listed above, and who are taking third and fourth year work in college. The student must volunteer and be accepted for this course. The advanced course is designed to prepare students for positions as commissioned officers, either in the U.S. Army Reserve or in the Regular Army. Instruction is based upon a general military science curriculum which prepares the student for any branch of the U.S. Army. An on-campus flight program is also offered which qualifies the student for a private license at no expense to the student.

Advanced course students attend a six weeks' summer camp during the summer after their first year in the advanced course. This camp is required of all students, including those who entered directly into the advanced program. This camp provides the opportunity for application of the subject matter learned during the campus phase of ROTC. Students are furnished travel expenses, uniforms, food, and billeting at no cost to themselves and in addition are paid $120.60 per month during the camp.

Advanced course students receive officer-type uniforms tailored to individual measurements. These are provided by a monetary allowance paid to the University by the U.S. Army. A uniform deposit is required of each student upon his entry into the advanced course. This deposit is refunded upon completion of the course, and the student is permitted to retain the uniform.

Retainer pay of $40 per month is paid to all advanced course students for a total of 20 months including quarter breaks and holidays. This pay begins on the date classes start for the first quarter in which a student commences the advanced course.

### BASIC COURSE, SENIOR DIVISION ROTC

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>111, 112, 113. Military Science I.</td>
<td>(1-1) Cr. 1 each.</td>
<td>Leadership; individual weapons and marksmanship; organization of the Army and ROTC; United States Army and national security</td>
</tr>
<tr>
<td>211, 212, 213. Military Science II.</td>
<td>(1-2) Cr. 1 each.</td>
<td>Prerequisite: Military Science I or approval of professor of Military Science. Leadership; map and aerial photographic reading; introduction to basic tactics, American military history and counter-insurgency operations.</td>
</tr>
</tbody>
</table>
ADVANCE COURSE, SENIOR DIVISION ROTC

301, 302, 303. Military Science III.
(3-1) Cr. 3 each.
Prerequisite: Military Science I and II or completion of six weeks' basic training summer camp, approval of Professor of Military Science.
Leadership; military teaching principles; small unit tactics and communications; branches of the Army; and counter-insurgency operations.

401, 402, 403. Military Science IV.
(3-1) Cr. 3 each.
Prerequisite: Military Science III
Leadership; logistics; military administration; military law; United States and world affairs; services orientation; map reading.

NAVAL SCIENCE

CAPT. JOHN E. COSTE, USN, B.S., Head of Department


INSTRUCTORS: Richard M. Moser, FTG1, USN; E. J. Pickering, GySgt, USMC; Robert C. Poremski, GMC, USN; John E. Stuart, QMC (SS), USN.

The first Naval Reserve Officers Training Corps units were established in 1926. There are now 53 units in various colleges and universities throughout the United States. Iowa State University is the only institution of higher learning in the state of Iowa which has an NROTC unit.

The function of the Naval Reserve Officers Training Corps is to provide, by a permanent system of training and instruction in essential naval subjects at civil educational institutions, a source from which qualified officers may be available for the Navy and the Marine Corps and the Naval Reserve and the Marine Corps Reserve.

There are two types of NROTC enrollees, the Regular and the Contract. The Programs are similar in that all students pursue studies of their choice leading to a baccalaureate degree and in addition take one naval science course each quarter; however, limited quotas are established by the Department of the Navy for both programs. Candidates for the Regular program are selected in the spring preceding the freshman year after having passed a nationwide aptitude test and physical examination. Contract students normally apply after graduation from high school and are selected during fall orientation days.

In addition to completing the prescribed naval science course, each midshipman enrolled in the NROTC must fulfill the following additional course requirements:

a. By the end of the sophomore year, every Regular NROTC student must have satisfactorily completed one year of college physics and one year of college mathematics.
b. By the end of the sophomore year Contract students must have satisfactorily completed one quarter of college mathematics or mathematics courses through trigonometry in secondary school.
c. Every student must achieve proficiency in written and oral expression in accordance with the standards prescribed by the University.

It is desirable that every student complete the following:

a. A sequence in mathematics, extending through calculus, and including spherical trigonometry.
b. A second year of physical science, such as advanced electricity and elementary electronics, for other than engineering students.
c. A one-year sequence in personnel management and administration.
d. A one-year course in world politics and international organization.
e. Two years of foreign language or demonstrate by examination that he possesses a good reading knowledge and can make an acceptable written translation of one of the languages.
f. A course in public speaking.

NROTC students are not required to major in naval science. Regular NROTC students may take any course leading to a baccalaureate or higher degree except the following: agronomy, animal science, dairy science, dairy manufacturing, dairy production, entomology, general
agriculture, horticulture, hotel administration, industrial arts, landscape architecture, music, physical education, poultry science, pre-dental, pre-medicine, pre-veterinary, veterinary medicine, wildlife management.

Contract students may take any course leading to a baccalaureate degree. However, this program is not recommended for medical, dental or theological students. Recommended fields of study for NROTC students are: engineering, mathematics, physical or social sciences and industrial administration.

The general objectives of the program are:
1. To provide the student with a well-rounded course in basic subjects which, in conjunction with a baccalaureate degree, will qualify him for a commission in the United States Naval Service.
2. To develop a knowledge of, and interest in, naval customs and traditions.
3. To develop a capacity for leadership.

Opportunities for Undergraduate Study

For basic undergraduate curriculum in sciences and humanities, major in naval science, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

Required and supporting courses for the major in naval science in the curriculum in science: Completion of Naval Science 211, 212, 213, 321, 322, 323, 421, 422 and 423 with minors in mathematics and choice of physics or engineering curricula. Marine Corps Option students majoring in naval science will elect 300 and 400 series Marine Option courses in lieu of 300 and 400 series Naval Science courses. Three quarters of physics and Psych. 101 must be included, and the following courses should be included in group requirements or electives: Geol. 320; E.E. 341, 342; Hist. 311, 312, 313; Govt. 556; Engr. Gr 131, 132; Chem. 101, 102, 103.

Naval Science courses are primarily for those students enrolled in the NROTC program. Other students may enroll for Naval Science courses with the approval of the head of department.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

111, 112, 113. Evolution of Sea Power and Naval Orientation. (3-2) Cr. 3 each. Yr.
111: Naval orientation. Naval customs, organization, and basic seamanship. 112: Influence of sea power upon history from early Mediterranean civilization to World War I. 113: Influence of sea power upon history from World War I to the present.

211, 212, 213. Naval Weapons. (3-2) 211, 213: Cr. 3 each. 212: Cr R. Yr. 211: Basic principles of naval weapons and fire control, antisubmarine warfare. 212: Naval Weapons Laboratory. Psych. 101 will be taken in lieu of lecture periods. However, NROTC students will enroll for the standard laboratory periods. 213: Basic principles of guided missiles, nuclear weapons, space technology.

311M. History of the Art of War. (3-2) Cr. 3. Alt. F. Offered 1965.
The study of the history of the development of the art of land warfare from Alexander the Great to the Civil War.

312M. United States Military History and Policy. (3-2) Cr. 3 Alt W. Offered 1966.
The study of United States military history from the Civil War to the present with special emphasis on the evolution of United States military policy.

The study of the principles of strategy and tactics with emphasis on their relationship to military and national policy followed by a more detailed consideration of small unit field tactics.


The study of United States amphibious warfare from the founding of our country to the present with emphasis on the evolution of equipment and techniques.

412M. Analysis of Amphibious Forces. (3-2) Cr. 3 Alt W. Offered 1967.
The study of the various arms composing amphibious forces and the planning and execution of an amphibious operation.

The study of the Uniform Code of Military Justice and the use of the Manual for Courts-Martial followed by a consideration of administrative, psychological and sociological techniques of value in assisting an officer in the fulfillment of his responsibilities.
(3-2) Cr. 3 each. Yr.
421: Theory, construction and typical operation of modern naval engineering installations; introduction to thermodynamics.
422: Theory and construction of nuclear marine propulsion systems; construction and operation of diesel engines; principles of ship stability. Naval use of the principles of human relations, human management practices and leadership.
423: A brief study of the Uniform Code of Military Justice. The administrative duties and responsibilities of the naval officer as they relate specifically to problems incident to duty with the Navy.

PHILOSOPHY
For description of courses, see History, Government and Philosophy.

PHYSICAL EDUCATION FOR MEN
Gordon H. Chalmers, B.S., Head of Department


Opportunities for Undergraduate Study
For undergraduate curriculum in physical education, administered under the College of Sciences and Humanities, leading to the degree Bachelor of Science, see Sciences and Humanities Curriculum.

The curriculum in physical education prepares the student to teach physical education, to coach athletics or to direct recreational programs for schools, camps, industries or communities. Professional students in physical education for men usually choose minors from the fields of general science, agriculture, industrial education, mathematics, and social sciences as teaching areas, or from technical journalism and radio. Each student's program is designed to fit his particular needs and interests. Specific inquiries should be directed to the department head.

The work of the department also includes basic instruction for freshmen and sophomores and competitive programs in intramural and intercollegiate athletics.

In the basic instruction program, it is the aim of the department to promote the health, organic vigor and good physical habits of the student. To accomplish this, a program is offered which will afford the student the opportunity to participate in and to develop a reasonable degree of skill in a variety of leisure time activities for immediate and later recreational appreciation and enjoyment.

Through the intramural program, every man is given an opportunity to participate in competitive sports. The intramural program includes football, touch football, softball, basketball, volleyball, wrestling, tennis, indoor and outdoor track, handball, horseshoe pitching, baseball, golf, archery, fencing, hockey, table tennis, and swimming. The facilities of the department includes an 18-hole golf course, new tennis courts, an ice skating area, playfields, State Gymnasium with pool, and Beyer Hall with gymnasium, pool, handball courts, squash courts, wrestling room, gymnastic room, and individual exercise room.

Intercollegiate athletics are under the direction of the faculty. Iowa State University is a member of the Missouri Valley Intercollegiate Athletic Association and is subject to the rules of this conference. The University is also a member of the National Collegiate Athletic Association and is committed to tolerate only clean and wholesome sport and to promote
good sportsmanship among contestants and spectators. The University is represented by intercollegiate teams in football, cross country, basketball, wrestling, swimming, indoor track and outdoor track, baseball, tennis, golf, and gymnastics.

### Basic Instruction Program Courses

**Requirement:**

All male students except those exempted are required to take a one-credit activity course in each of their first six quarters of student residence.

**Exemptions:** The following students are exempt from this requirement:

1. Those certified as physically unfit by the Student Health Service.
2. Those who, at the time of matriculation, have passed their twenty-third birthday.
3. Other exemptions at the discretion of the department head, such as proven proficiency in sports as demonstrated by examination.

#### COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requirements</th>
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<tbody>
<tr>
<td>101</td>
<td>Freshman Physical Education.</td>
<td>0-2</td>
<td>F.W.S.</td>
</tr>
<tr>
<td>102</td>
<td>Freshman Physical Education.</td>
<td>Cr. 1.</td>
<td>F.</td>
</tr>
<tr>
<td>103</td>
<td>Freshman Physical Education.</td>
<td>Cr. 1.</td>
<td>S. Staff.</td>
</tr>
<tr>
<td>110</td>
<td>Individual Prescribed Activities.</td>
<td>Cr. 1.</td>
<td>F.W.</td>
</tr>
<tr>
<td>111</td>
<td>Beginning Swimming I.</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
<tr>
<td>112</td>
<td>Beginning Swimming II.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
<tr>
<td>113</td>
<td>Advanced Swimming.</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
<tr>
<td>114</td>
<td>Life Saving.</td>
<td>Cr. 1.</td>
<td>F.</td>
</tr>
<tr>
<td>115</td>
<td>Water Safety.</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
<tr>
<td>116</td>
<td>Skin and Scuba Diving.</td>
<td>Cr. 1.</td>
<td>W. Staff.</td>
</tr>
<tr>
<td>122</td>
<td>Basketball.</td>
<td>Cr. 1.</td>
<td>W. and examination.</td>
</tr>
<tr>
<td>125</td>
<td>Volleyball and Softball.</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
<tr>
<td>133</td>
<td>Fencing I.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
<tr>
<td>134</td>
<td>Fencing II.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
<tr>
<td>135</td>
<td>Wrestling I.</td>
<td>Cr. 1.</td>
<td>F.W.</td>
</tr>
<tr>
<td>136</td>
<td>Wrestling II.</td>
<td>Cr. 1.</td>
<td>F.W.</td>
</tr>
<tr>
<td>137</td>
<td>Golf I.</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
<tr>
<td>138</td>
<td>Golf II.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
<tr>
<td>141</td>
<td>Archery</td>
<td>Cr. 1.</td>
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<tr>
<td>144</td>
<td>Baitcasting.</td>
<td>Cr. 1.</td>
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<tr>
<td>147</td>
<td>Bowling.</td>
<td>Cr. 1.</td>
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<tr>
<td>149</td>
<td>Golf I.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>151</td>
<td>Gymnastics I.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>152</td>
<td>Gymnastics II.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>153</td>
<td>Handball I.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Handball II.</td>
<td>Cr. 1.</td>
<td></td>
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<tr>
<td>155</td>
<td>Tennis I.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>156</td>
<td>Tennis II.</td>
<td>Cr. 1.</td>
<td></td>
</tr>
<tr>
<td>162</td>
<td>Sports Officiating.</td>
<td>Cr. 1.</td>
<td>F.W.S.</td>
</tr>
<tr>
<td>163</td>
<td>Teaching in Sports.</td>
<td>Cr. 1.</td>
<td>F.W.S.</td>
</tr>
</tbody>
</table>

#### Leadership Activities

These courses are designed to provide leadership experiences under staff supervision in areas as indicated by name.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>162</td>
<td>Sports Officiating.</td>
<td>Cr. 1.</td>
<td>F.W.S.</td>
</tr>
<tr>
<td>163</td>
<td>Teaching in Sports.</td>
<td>Cr. 1.</td>
<td>F.W.S.</td>
</tr>
</tbody>
</table>

#### Co-Educational Activities

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>173</td>
<td>Square Dancing I.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
<tr>
<td>174</td>
<td>Square Dancing II.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
</tbody>
</table>

Aquatics

This group of courses is graduated to accommodate teaching the student the skills of swimming on the basis of his individual ability classification.

Team Sports

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>Basketball.</td>
<td>Cr. 1.</td>
<td>W. and examination.</td>
</tr>
<tr>
<td>125</td>
<td>Volleyball and Softball</td>
<td>Cr. 1.</td>
<td>S.</td>
</tr>
</tbody>
</table>

Combatives

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>133</td>
<td>Fencing I.</td>
<td>Cr. 1.</td>
<td>W.</td>
</tr>
</tbody>
</table>
Varsity Sports

190. Sports Participation. 
(1-1) Cr. 1 each. 
Transfer to freshman and varsity sport squads upon permission of coach. Identify by use of suffix. 
A. Band. F. 
B. Baseball. F.S. 
C. Basketball. F.W. 
D. Football. F.S. 
E. Golf. F.S. 
F. Gymnastics. F.W. 
G. Swimming. F.W. 
H. Tennis. F.S. 
I. Track. F.W.S. (permit maximum of 2 per year) 
J. Wrestling. F.W. 

Professional Program

212. Gymnastics. 
(1-4) Cr. 3. F.W. Mr. Gagnon. 
Techniques and theory of gymnastic activities, including tumbling and apparatus. 

213. Introduction to Physical Education. 
(3-0) Cr. 3 F. 
An introductory course designed to develop leadership techniques, measure aptitudes, and orient each student in the general areas of physical education. 

(1-4) Cr. 3. F.W. 
Instruction and practice in fundamental skills of football. 

(1-4) Cr. 3. W. 
Instruction and practice in fundamental skills of basketball. 

216. Track and Field Techniques. 
(1-4) Cr. 3. S. 
Instruction and practice in fundamental skills of track and field events. 

(1-4) Cr. 3. S. 
Instruction and practice in fundamental skills of baseball. 

218. Advanced Swimming Techniques. 
(1-4) Cr. 3. F.W.S. 
Prerequisite: Ability to pass First Grade summer's test. 
Instruction and practice in all swimming skills, life saving and methods of teaching such skills. 

(1-4) Cr. 3. W. 
Instruction and practice in the skills of wrestling and methods of teaching those skills. 

220. Physical Education Activities. 
(1-4) Cr. 3. S. 
Prerequisite: 102 or equivalent. 
Instruction in the skills and methods of teaching a series of physical education activities. 

301. Football Officiating. 
(1-2) Cr. 1 or 2. F. Mr. Moore. 
Rules and practice. 

302. Basketball Officiating. 
(1-2) Cr. 2. S. Mr. Sutherland. 
Rules and practice. 

303. Baseball Officiating. 
(1-2) Cr. 2. S. Mr. Moore. 
Rules and practice. 

309. Athletic Training. 
(3-0) Cr. 3. W.S. 
Prerequisite: Zool. 155, Mr. Buckerstaff. 
Principles governing conditioning for various sports; diet, sleep, bathing, massage; over-training; prevention and care of injuries. 

(3-0) Cr. 3 each. 314: W.; 315: F.; 316: W.; 317: S. 
314. Football. Mr. Stapleton. 
315. Basketball. Mr. Anderson. 
316. Track. Mr. Lawson. 
History, rules, theory, coaching methods. 

318. History of Physical Education. 
(3-0) Cr. 3. F. Mr. Nichols. 
Evolution of modern physical education, its many activities, its place in the educational pattern of each period. 

319. Organization and Administration of Intramural Athletics. 
(3-0) Cr. 3. W. Mr. Reading. 
Conduct and direction with special emphasis on place at the secondary level. 

384. An Introduction to Supervised Recreation. 
(3-0) Cr. 3. F. Mr. Reading. 
An introductory course designed to develop leadership techniques, measure aptitudes, and orient the student in the general area of recreation. 

411, 412, 413. Supervised Teaching in Physical Education. 
(0-3 or 6) Cr. 1 or 2. Yr. Mr. Dickinson. 
Practice with school and college groups. 

481, 482, 483. Leadership in Supervised Recreation. 
(0-3 or 6) Cr. 1 or 2. Yr. Mr. Reading. 
Prerequisite: Open to juniors or seniors preparing in the Supervised Recreation Program for leadership of community groups. 

484. Supervised Recreation Program Development. 
(2-2) Cr. 3. W. Mr. Reading. 
Prerequisite: Open only to senior majors enrolled in the Supervised Recreation Program. 
To study the importance of continual development of activities and the breadth of the program in order to meet the needs of specific types of communities. 

485. Organization and Administration of Supervised Recreation. 
(3-0) Cr. 3. S. Mr. Reading. 
Prerequisite: Open only to senior majors preparing in the Supervised Recreation Program. 
Organizational and administrative procedures in practice in community and industrial programs. 

490. Special Problems. 
(Arr.) Cr. Var. F.W.S. 
Prerequisite: Open to major students in Physical Education, Mr. Schmidt. 
Investigating, analyzing and reporting on a problem in the areas of physical education or supervised recreation selected in conference with instructor. 

491. Principles of Physical Education. 
(3-0) Cr. 3. F. Mr. Schneider. 
Prerequisite: Ed. 204. 
Interpretation of objectives of physical education and health education. Analysis of activities in terms of developmental objectives. 

492. Human Relationship Aspects of Coaching. 
(3-0) Cr. 3. F.
Prerequisite: Senior classification in P.E.M. curriculum. Mr. Timm.
Factors necessary to effective human relations in successful coaching.

493. Organization and Administration.
3-0 Cr. 3. S. Mr. Schneider.
Organization and administration of physical education and athletics. Program for required and elective courses; intramural and interschool athletics.

495. Program Development in Physical Education.
2-2 Cr. 3. W. Mr. Schneider.
Prerequisite: Senior classification in P.E.M. curriculum.
A study of ideal programs at all school levels and how they are developed to meet changing needs.

PHYSICAL EDUCATION FOR WOMEN
Barbara E. Forker, Ph.D., Head of Department

PROFESSORS: Germaine G. Guiot, Ed.D.; Betty L. Toman, M.S.
ASSOCIATE PROFESSOR: Waldean A. Robichaux, Ph.D.
ASSISTANT PROFESSORS: Madge H. Bowers, B.S.; Betty A. Keenan, M.A.
INSTRUCTORS: Nancy Curry, M.S.; DiAnne Damro, M.A.; LuVonne Darr, M.A.; Mary Dickman, B.S.; Margaret M. Harle, Dipl.; Joann Johnson, M.S.; Verna Kern, B.S.; Margaret Ann Moore, M.S.; Donna Sansome, B.A.; Josephine Sutlive, M.S.

Opportunities for Undergraduate Study
For undergraduate curriculum in physical education for women leading to the degree Bachelor of Science, see Home Economics, Curricula. See College of Sciences and Humanities for group requirements leading to a Bachelor of Science degree through the College of Sciences and Humanities.

The curriculum in physical education for women prepares the student to teach physical education and/or dance in the public schools. Other opportunities include professional work in city recreation programs, Y.W.C.A., Girl Scouts, Camp Fire Girls and camping. Further recreation work is available with the American Red Cross and the armed services. An undergraduate degree in physical education provides the necessary background for degrees in physical therapy and occupational therapy.

Students enrolled in the department must apply to and be accepted by the departmental committee on selection in order to advance to the teacher education program. For the teacher education program, including requirements for teaching certification, see Teacher Education.

The department offers, in addition, a wide selection of activities from which freshmen and sophomores fulfill their six quarter requirement. Upperclassmen may elect additional courses in physical education. Through the intramural and club programs, every woman is given an opportunity to participate in activities throughout her college years and unusual opportunities for the development of recreational interests are provided. The indoor facilities found in the women's building include a gymnasium, dance studio, individual activity room, swimming pool, and indoor golf and archery ranges. Extensive out-of-doors facilities include a sodded 17-acre women's playfield and eight hard-surfaced tennis courts.

The purpose of the required physical education program is to aid the student in gaining an appreciation and knowledge of the importance of exercise in daily living. Participation in activities offered in the program should enable students to maintain and improve personal fitness during their college years. Through the instructional program, the student develops skill in leisure-time activities according to her choice and ability. A medical examination is required and evaluated by the medical staff of the Student Health Service. If special posture
education or a restricted activity program is found necessary for a student, the department provides activities adapted to individual needs.

Freshmen and sophomores are required to enroll in physical education for six consecutive quarters.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

Beginning Courses

AQUATICS
(0-3) Cr. 1. F.W.S.SSI,II.

RHYTHMIC
110. Beginning Modern Dance. 
(0-3) Cr. 1. F.W.S.
117. Folk Dance. 
(0-2) Cr. 1. F.W.S.
118. American Country Dance. 
(0-2) Cr. 1. F.W.S.
119. Beginning Tap Dance. 
(0-2) Cr. 1. F.W.S.

TEAM SPORTS
125. Hockey. 
(0-3) Cr. 1. F.
126. Volleyball. 
(0-2) Cr. 1. F.W.S.
127. Basketball. 
(0-3) Cr. 1. W.
128. Softball. 
(0-3) Cr. 1. s.

Intermediate and Advanced Courses

AQUATICS
201. Intermediate Swimming. 
(0-2) Cr. 1. F.W.S.SSI,II. 
Prerequisite: A presentable front crawl, elementary backstroke, ability to float and swim in deep water.

(0-2) Cr.1. F.W.S.SSI, II. 
Prerequisite: Ability to swim lengths in a good front crawl, back crawl, elementary backstroke, sidestroke and breast stroke.

203. Life Saving. 
(0-3) Cr. 1. F.S. 
Prerequisite: Minimum age 16. Ability to swim 220 yards of front crawl, trudgeron crawl, double trudgeron or trudgeron. Surface dive and swim under water, float and tread water.

204. Water Safety Instructor. 
(0-4) Cr. 1. F.W.S. 
Prerequisite: Minimum age 18. Current Senior Life Saving Certificate (advanced swimming course).

205. Synchronized Swimming. 
(0-2) Cr. 1. F.W.S. 
Prerequisite: Advanced Swimmer as determined by American Red Cross Standards, Iowa State University course and/or preliminary testing.
    Basic techniques in synchronized swimming, figures, stroking, choreography and accompaniment.

RHYTHMIC
210. Modern Dance Composition 
(0-2) Cr. 1. F.W.S. 
Prerequisite: Must have completed beginning modern dance or at least two years of high school modern dance or 6 years of ballet. 
Open to men with permission of instructor.

211. Concert Modern Dance 
(0-2) Cr. 1. W. 
Prerequisite: Must have permission of the instructor. 
Open to men.

212. Techniques of Modern Dance 
(0-2) Cr. 1. S. 
Prerequisite: 110 or at least two years of high school modern dance or six years of ballet. 
Open to men with permission of instructor. 
Instruction and practice in the techniques of primitive, contemporary jazz, and modern dance movements.

INDIVIDUAL SPORTS AND ACTIVITIES
130. Beginning Tennis. 
(0-3) Cr. 1. F.S.
133. Beginning Badminton. 
(0-3) Cr. 1. W.
136. Archery. 
(0-3) Cr. 1. F.W.S.
(0-2) Cr. 1. F.W.S.
140. Beginning Golf. 
(0-3) Cr. 1. P.S.SSI.
142. Recreational Games. 
(0-2) Cr. 1. I.
143. Posture Education. 
(0-3) Cr. 1. F.W.S.
144. Fitness Class. 
(0-3) Cr. 1. F.W.S.
145. Tumbling. 
(0-3) Cr. 1. W.
146. Fencing. 
(0-3) Cr. 1. P.W.S.
148. Riflery. 
(0-2) Cr. 1. P.W.S.
ELECTIVE COURSES OPEN TO ALL STUDENTS

326. Recreational Leadership.  
(3-0) Cr. 3. F.  
Prerequisite: 5 Cr. required P.E.  
Theory of play, organization and administration of play centers. Recreational programs studied and planned with leadership experience.

356. Camping and Outdoor Education.  
(2-1) Cr. 1. arr. Cr. 3. S.  
Prerequisite: 3 Cr. required P.E. Miss Dickman.  
An introduction to the background of camping; the camp counselor, the camp program, methods of leadership and the knowledge of camp craft skills. Emphasis on developing the skills of outdoor living.

380. History and Philosophy of Dance.  
(3-0) Cr. 3. S.  
Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators.

Professional Program Courses

150, 151, 152. Fundamentals of Physical Education Activities.  
(0-5) Cr. 1 each. F.W.S. Staff.  

190. Introduction to Physical Education.  
(3-0) Cr. 1. Misses Forker.  
Nature and scope of physical education as a profession with emphasis on the historical development.

250, 251, 252. Fundamentals of Physical Education Activities.  
(0-5) Cr. 1 each. F.W.S. Staff.  

265. Fundamentals of Modern Dance.  
(0-5) Cr. 1. S. Misses Tomman.  
Instruction and practice in the fundamental techniques of modern dance. Emphasis on developing creative skills and basic concepts involved in dance composition.

270, 271. Officiating.  
(1-3) Cr. 2 each. F.W.  
Prerequisite: 150, 151, 152. Miss Kernan.  
Techniques and practice in officiating physical education activities. 270: Volleyball, Swimming, Track and Field. 271: Basketball.

310, 311. Dance Production.  
(1-2) Cr. 1 each. F.W.  
Prerequisite: 211 or permission of instructor.  
Principles of dance concert production and performance. 310: Choreography, program planning, costuming, makeup, staging, and accompaniment for dance concerts. 311: Work in rehearsing and producing a concert.

385. Techniques and Methods in Social, Folk, and Square Dance.  
(1-4) Cr. 1. F.  
Prerequisite: 118, 265. Miss Tomman.  
Theory and practice of skills involved in executing and teaching social, folk, and square dance. An analytical study of the rhythmic structure inherent in these dance activities.

badminton course on college level or instructor's permission.

Upon completion of six quarters of physical education, any course not already used for credit or any intermediate and advanced course may be elected from the above activity courses.
C. Recreation. Staff.
D. Dance. Miss Toman.

495. Seminar in Physical Education.
   (2-0) Cr. 2. S.
   Prerequisite: Senior standing. Staff.

COURSE PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

590W. Special Topics.
   (Ed. 590W) See Education.

PHYSICS

Daniel J. Zaffarano, Ph.D., Chairman of Department

PROFESSORS: Richard G. Barnes, Ph.D.; George H. Bowen, Ph.D.; Bille C. Carlson, Ph.D.;
   Percy H. Carr, Ph.D.; Gordon C. Danielson, Ph.D.; Lester T. Earls, Ph.D.;
   Gerald W. Fox, Ph.D.; Roland H. Good, Jr., Ph.D.; Charles L. Hammer, Ph.D.;
   Robert O. Haxby, Ph.D.; Joseph M. Keller, Ph.D.;
   Don Kirkham, Ph.D.; Sam Legvold, Ph.D.;
   Derek L. Pursey, Ph.D.; Klaus Ruedenberg, Ph.D.;
   Frank H. Spedding, Ph.D.; Robert M. Stewart, Jr., Ph.D.;
   Clayton A. Swenson, Ph.D.

ASSOCIATE PROFESSORS: Barnett C. Cook, Ph.D.;
   Douglas K. Finnemore, Ph.D.;
   Andrew V. Gold, Ph.D.;
   Eastman N. Hatch, Ph.D.;
   William J. Kernan, Jr., Ph.D.;
   Samuel H. Liu, Ph.D.;
   David W. Lynch, Ph.D.;
   Allan R. Mackintosh, Ph.D.;
   Louis E. Pinney, Ph.D.;
   Herbert J. Plagge, M.A.;
   Thomas A. Weber, Ph.D.

ASSISTANT PROFESSORS: Willet I. Beavers, Ph.D.;
   Alfred J. Bureau, Ph.D.;
   C. Theodore Daub, Ph.D.;
   David E. Frederick, Ph.D.;
   Ronald Fuchs, Ph.D.;
   James E. Griffin, Ph.D.;
   Kenneth L. Kliwer, Ph.D.;
   Terry L. Loucks, Ph.D.;
   J. Ivan Rhode, Ph.D.;
   Willard L. Talbert, Jr., Ph.D.;
   Wilbur C. Thoburn, Ph.D.;
   Allen B. Tucker, Ph.D.;
   Stanley A. Williams, Ph.D.;
   Lawrence H. Willson, B.S.;
   Robert C. Young, Ph.D.

INSTRUCTOR: James E. Dixon, A.B.

Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in physics, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

The undergraduate curriculum in sciences and humanities, major in physics, offers training suitable for students planning to enter secondary school teaching, to begin work in research or development laboratories, or to continue their studies in graduate school. In general the needs of those expecting to terminate formal study with the B.S. degree are best served by the standard program outlined below. Students who expect to undertake graduate study in pursuit of higher degrees may also follow this standard program but will usually find more desirable the second program below, which includes accelerated and enriched course work during the junior and senior years.

Undergraduate majors in this department in the standard program usually will complete the following courses: 131, 132, 133, 231, 232, 233, (221, 222, 223 acceptable in place of 131 through 233); 304, 311 (at least 2 quarters), 325, 354, 355, 394 (generally scheduled during the junior year); 411, 421, 422, 423, 494, 495, 499 (generally scheduled during the senior year). Modifications in this program can be made to accommodate required education courses for those preparing to teach. Students in the enriched program usually will include 131, 132, 133, 231, 232, 233, 304, 311 (at least 2 quarters), 325, 361, 362, 363, 394 (generally scheduled during the junior year); 411, 481, 482, 483, 494, 495, 499 (generally scheduled during the senior year). As supporting work undergraduate majors find the following courses desirable: Math. 101, 102, 110, 211, 212, 213, 321, 322, 323, 404, 414, 415, 416; Chem. 101, 102, 103. Work equivalent to Math. 101 and 102 should be completed in high school if possible, so that the entering student can begin Math. 110 at once.

These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here for the use of...
students who wish to estimate the amount of basic study which may be needed. Each student’s actual degree program is planned individually with the guidance of an adviser assigned from the physics staff.

Opportunities for Graduate Study

The department offers work leading to the degrees Master of Science and Doctor of Philosophy in physics and minor work to students taking major work in other departments. Facilities of the department and of the Institute for Atomic Research, with which it is closely associated, permit theoretical and experimental investigations in many fields, including solid state physics, nuclear physics, high energy physics, and low temperature physics.

Students with bachelor’s degrees in physics from other institutions ordinarily will qualify for graduate work here provided they have done satisfactory work in courses similar to those suggested above for undergraduate physics majors. In some cases, additional training at the intermediate level may be required.

The department considers that the following undergraduate courses form suitable supporting work for graduate students majoring in other areas: 304, 311, 325, 344, 345, 346, 354, 355, 394, 411, 421, 422, 423, 490, 494, 495.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

71. Applied Physics I. (2-5) Cr. 4. P.S.
Prerequisite: Credit or classification in Math. 50.
Acceptable for credit in Technical Institute programs only. Principles of measurement, kinematics, dynamics, mechanical energy and heat, with applications to engineering situations.

72. Applied Physics II. (2-5) Cr. 4. F.W. (Not offered F. 1965)
Prerequisite: Physics 71.
Acceptable for credit in Technical Institute programs only. Principles of statics, elasticity, fluids, electricity, magnetism and geometrical optics with applications to engineering situations.

73. Applied Physics III. (2-5) Cr. 4. W.S.
Prerequisite: Physics 72 or credit or classification in E. Tech. 86.
Acceptable for credit in Technical Institute programs only. Principles of physical optics, thermodynamics, modern physics and energy conversion methods, with application to engineering situations.

106. Elementary Physics. (4-2) Cr. 4. F.W.S.S.
Primarily for home economics students. Topics in mechanics, heat, electricity, and light.

111. 112, 113. General Physics. (2-4) Cr. 4 each.
Prerequisite: Math. 101C.
For students who do not plan advanced study in physics. 111: Mechanics, heat. 112: Light, electricity, magnetism. 113: Topics from modern physics.

131. 132, 133. General Physics. (3-2) Cr. 4 each. Yr.
Prerequisite: Classification in Math. 110.
For students majoring in physics. Mechanics, heat, wave motion and sound.

221, 222, 223. General Physics. (4-2) Cr. 5 each. F.W.S.S.
Prerequisite: 221: Classification in Math 110; 222: Math. 110; 223: Math. 211.
For engineering students and others desiring a rigorous one-year course in general physics. Topics in mechanics, heat, sound, light, electricity and magnetism.
346. Introduction to Astrophysics. 
(3-0) Cr. 3. S. 
Prerequisite: 345. 
Motions and physical properties of members of the solar system; the stars, distances and motions, their physical state as derived from an analysis of radiation; structure of the galaxy; extragalactic systems.

(Math, 354, 355) (3-0) Cr. 3 each. W.S. 
Prerequisite: 223 or 233, Math. 213, 323. 
Particle dynamics, statics and dynamics of rigid bodies. Lagrange equations.

(3-0) Cr. 3. F.W. 
Prerequisite: 223 or 233, Math. 213. 
For physics majors in the enriched program.

(3-0) Cr. 3. S. 
Prerequisite: 362. 
The concepts and elementary applications of quantum mechanics.

411. Senior Research Laboratory. 
(0-6) Cr. 3. F.W.S. 
Prerequisite: Permission of instructor. 
Selected experiments designed to acquaint students with topics of current interest. Emphasis is placed on preparation of students for independent research.

(3-0) Cr. 3 each. Yr. 
Prerequisite: 223 or 233, Math. 322, 323. 

450. Undergraduate Research. 
Cr. 1 to 6 each time elected. F.W.S.S.S. 
Prerequisite: Permission of instructor. 
Experimental or theoretical research under staff supervision.

481. Statistical Physics. 
(3-0) Cr. 3. F. 
Prerequisite: 304, 363 or equivalent, Math. 322, 323. 
For physics majors in the enriched program. Probability, kinetic theory and statistical mechanics.

482. Atomic and Solid State Physics. 
(3-0) Cr. 3. W. 
Prerequisite: 481. 
Introduction to the quantum theory of atomic structure, and to the transport properties, magnetic properties, and band theory of solids.

483. Nuclear Physics. 
(3-0) Cr. 3. S. 
Prerequisite: 482. 

490. Special Topics. 
Cr. 1 to 4 each time elected. F.W.S.S.S. 
Prerequisite: Permission of instructor.

494. 495. Electricity and Magnetism. 
(3-0) Cr. 3 each. F.W. 
Prerequisite: 223 or 233, Math. 322, 323. 
494: Electrostatics, magnetostatics, potential theory. 495: Maxwell's equations, dynamic fields, generation and propagation of electromagnetic waves in dielectric and conducting media.

499. Seminar. 
(1-0) Cr. 1. F.W.S. 
Required of all physics seniors. Topics in current research are reported and discussed by members of the class.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

(4-0) Cr. 4 each. F.W. 
Prerequisite: 304, Math. 416. 
The laws of thermodynamics; thermodynamic functions; applications to various systems; phase equilibria; principles of statistical mechanics; the microcanonical, canonical and grand canonical ensembles of classical and quantum mechanics and their application to physical problems; kinetic theory and equation of state of gases; transport theory; Boltzmann transport equations; Brownian motion and noise.

551. 552, 553. Introduction to Theoretical Physics. 
(Math, 551, 552, 553) (3-0) Cr. 3 each. Yr. 
Prerequisite: Math. 322 and 323 or equivalent courses in differential equations and elementary vector analysis. 
551: Vector, matrix, and tensor analysis, with applications to potential theory and heat flow. 
552: Classical mechanics using Newton's, Lagrange's, and Hamilton's equations of motion. 
553: Elasticity, hydrodynamics, and electromagnetic theory.

(4-0) Cr. 4. S. 
Prerequisite: 355 or 362, 551 or 591, Math. 410. 
Advanced methods and problems in dynamics. Lagrange and canonical equations, normal coordinates, rigid body mechanics, canonical transformations, Hamilton-Jacobi equations, continuum mechanics.

571. 572, 573. Advanced Electricity and Magnetism. 
(3-0) Cr. 3 each. Yr. 
Prerequisite: Math. 322, 323, 416. 
Electrostatics, boundary-value problems, polarizable materials, magnetostatics, electromagnetic induction, Maxwell's equations homogeneous and inhomogeneous wave equations, cavities and wave guides, electromagnetic radiation.

591. 592, 593. Quantum Physics. 
(4-0) Cr. 4 each. Yr. 
Prerequisite: 355 and 423, or 483. 
Linear transformations. Restricted relativity and applications. Introduction to quantum mechanics. Perturbation theory. Applications to atomic structure, molecules, band theory of solids, and elementary nuclear structure.
COURSES FOR GRADUATE STUDENTS, major or minor

361, 612, 613. Solid State Physics. (3-0) Cr. 3 each. Yr.
Prerequisite: 593.
Quantum theory of solids. Topics include: x-ray and neutron diffraction in crystals; phonon and electron spectra in metals, semiconductors and insulators; calculations of band structure from atomic data; the Fermi surface; equilibrium and transport properties of solids, superconductivity, ferromagnetism and nuclear magnetic resonance.

631, 632, 633. Nuclear Physics. 631, 632: (4-0) Cr. 4 each. 633 (3-0) Cr. 3 Yr.
Prerequisite: 593.

634. Physical Optics. (3-0) Cr. 3. Alt. F. Offered 1965.
Prerequisite: 593.
Maxwell's equations, waves in conducting media; dispersion theory; interaction of radiation with matter; absorption processes in solids, luminescence, optical pumping, masers.

640. Special Topics. F.W.S.
Prerequisite: Permission of instructor.

650. Advanced Seminar (1-0) Cr. 1 each time elected. F.W.S.
Topics of current interest. 650A: Nuclear Physics. 650B: Solid State Physics. 650C: Theoretical Physics.

660. Advanced Topics in Physics. Cr. 1 to 3 each time elected. F.W.S.

681, 682, 683. Quantum Mechanics. (Math. 681, 682, 683) (3-0) Cr. 3 each. Yr.
Prerequisite: 593.
Basic theory of quantum mechanics, including discussions of collision problems, approximation methods, interaction of radiation with matter, relativistic quantum theory.

690. Research. F.W.S.SS.

PLANT PATHOLOGY
For description of courses, see Botany and Plant Pathology.

POULTRY SCIENCE
Richard H Forsythe, Ph.D., Head of Department

PROFESSORS: Stanley L. Balloun, Ph.D.; Leonard Z. Eggleton, M.S.; Chester D. Lee. D.V.M., M.S.; Arne W. Nordskog, Ph.D.
ASSOCIATE PROFESSOR: William W. Marion, Ph.D.
ASSISTANT PROFESSORS: Marvin H. Gehle, Ph.D.; William J. Owings, Ph.D.

Opportunities for Undergraduate Study
For undergraduate curriculum in poultry science leading to the degree Bachelor of Science, see College of Agriculture, Curricula.

Educational opportunities in the Department of Poultry Science include broad training in all phases of the poultry industry which relate to the production, processing, storage and distribution of poultry and egg products. Courses offered by the Department of Poultry Science include instruction in hatchery and poultry farm management and administration, poultry nutrition, housing, incubation, breeding, processing and marketing, and courses in the management phases associated with meat and egg production.

The poultry science curriculum also includes course work in the social and basic sciences in order to provide the graduating student with a satisfactory background which will qualify him for entry into either specialized commercial fields of work or advanced academic study. Elective courses are permitted in the curriculum in order that students may select, in consultation with the department staff, other fields of study of special interest to them.

Poultry graduates are employed in a wide variety of different areas. These areas include employment by hatcheries, specialized poultry farms (including breeding farms), feed manufacturing organizations, poultry and egg processing plants, poultry equipment and supply companies, publishers, and as poultry specialists by state and federal agencies for employment both in continental United States and overseas areas.
Opportunities for Graduate Study

Major work for the degrees Master of Science and Doctor of Philosophy is offered by the Poultry Science Department in the fields of nutrition, breeding, physiology and poultry products technology. Courses are offered in other departments for minor work in specialized fields to supplement the major field of study.

A strong undergraduate program is required of those students interested in undertaking graduate study in this department. Fundamental training in biology, chemistry, mathematics, statistics and other related fields is a prerequisite to a satisfactory graduate program.

Open to graduate students for minor only: 401, 402, 403, 404.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. Introduction to Poultry Science. (3-0) Cr. 3. F.W.
Principles and practices of poultry industry. Introduction to the production, processing and marketing of eggs and poultry. Study of the breeding, feeding and management practices as they affect production economics and product quality.

110. Technical Lecture. (1-0) Cr. R. F. Mr. Forsythe.
Opportunities in Poultry Science.

301. Poultry Science Techniques. (1-3) Cr. 2. F.
Prerequisite: 101 or 365. Mr. Gehle.
A laboratory course designed to supplement 101 or 365. Selection of breeding and laying stock, growing and feeding broilers, production of hatching eggs, pre-mortem and post-mortem grading of poultry, study of internal organs and their functions. Trips to nearby poultry farms.

Prerequisite: 101, Zool. 234. Mr. Nordskog. Problems in hatchery management, including the principles of artificial incubation. Trips will be made to nearby hatcheries.

305. Poultry Seminar. (1-0) Cr. 1 each time taken. W.

365. Poultry Feeding and Management. (3-0) Cr. 3. W.S.S.S.
Prerequisite: Zool. 101, junior or senior classification. Messrs. Balloun, Gehle.
Practical feeding and management of poultry flocks. Operational study of commercial poultry farms, including production and marketing practices.

401. Meat and Egg Technology. (3-3) Cr. 4. F.
Prerequisite: Bact. 304. Mr. Marion.

Prerequisite: Gen. 301. Mr. Nordskog. Inheritance of egg production, egg size, hatchability, body size, viability and plumage color; methods of poultry breeding.

Prerequisite: 101, 301. Mr. Gehle.
Development of the turkey industry and the commercial production of hatching eggs, poult and mature stock. Trips to nearby farms.

404. Poultry Nutrition. (3-2) Cr. 4. F.
Prerequisite: An.S. 318. Mr. Balloun.
Practical aspects of poultry nutrition. Ration formulation, mixing and feeding tests. Feeding programs and requirements at different ages.

490. Special Problems. Cr. 1 to 3. Yr. Mr. Gehle.
H. Honors Program. Open to junior or senior students showing satisfactory preparation for problem chosen and quality point average of 2.5 or above for two preceding quarters. Conferences and preparation of report on individual problems.

COURSE PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

590. Special Topics. Cr. arr. F.W.S. Mr. Forsythe.

COURSES FOR GRADUATE STUDENTS, major or minor

Prerequisite: 402. Mr. Nordskog.
Survey of poultry genetics. Application of systems of breeding to poultry, including in-breeding, out-breeding, hybridization and methods of selection.

Prerequisite: 401. Mr. Marion.
Qualitative and quantitative techniques for studying composition of meat and eggs. Involvement of muscle components in meat tenderness, and in other palatability factors. Functional properties of egg components. Product deterioration including physical, chemical and microbiological.


Prerequisite: Permission of instructor. Mr. Balloun.
Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in psychology, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

Psychologists are concerned with behavioral research and teaching in the areas of theoretical, comparative and physiological, psychometric, developmental, educational, differential, social, and personality psychology. Applied psychologists utilize the results of basic research in a variety of ways. Clinical psychologists work with mentally ill persons and those with personality and adjustment problems. Counseling psychologists work most often in schools and colleges with people who have personal and vocational problems to solve. Industrial psychologists work in business, industry, government, and the military to help improve the efficiency and personal satisfaction of workers. Psychologists also work in the public schools with pupil problems, especially those of exceptional (different from the average) children.

Undergraduate majors frequently are employed as employment interviewers, psychometrists, and personnel technicians. Many positions require at least the Master of Science degree.

Undergraduate majors in this department should include the following courses in their programs: 201, 230, 301, 302, 380, 440, 460.

As supporting work, undergraduate majors are urged to take the following courses: Math. 101, 104, Stat. 201, Phys. 211, 212, 213, or Chem. 101, 102, 103; Soc. 134; Zool. 303, 355; Gen. 301 or 400; Phil. 570, 480, 481. The exact program of courses will be developed by the student and his major advisor.

For students desiring a minor in personnel psychology, 440, 450, 451, 550 and 551 are recommended.

The following courses appropriately can be taken by non-majors with primary interests in social science or education: 230, 270, 353, 570, 380, 460, 440, 521, 533, and 541.

The psychology requirement for an Iowa professional teaching certificate will be met by 101, 230 and 533.

270, 570 and 571, plus 3 hours from 490, 570, 571 or 390 and Ed. 550 will meet the minimum requirements of the State Department of Public Instruction for the teaching of driver education and safety.

Several undergraduate courses provide students with the opportunity to gain first-hand experience with psychological research through participation as subjects in experimentation directed by faculty members. In some courses, particularly 101, such experience is deemed important enough to warrant requiring every student to participate. In other courses opportunities are made available to students to volunteer for research participation.
Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in certain fields of psychology and minor work to students taking major work in other departments.

Students desiring a graduate major in psychology must have been graduated from a recognized curriculum substantially equivalent to one of the undergraduate curricula of Iowa State University. Prerequisite to admission is at least 15 quarter credits of basic psychology, which normally should include a laboratory course, a quantitative or methods course, social psychology course and a course with developmental emphasis.

Open to graduate students for minor only: 430, 436, 440, 441, 451, 460.

Index to field of work is given by the second and third figures of course numbers:

- 00-09 Experimental and Statistics
- 10-19 Comparative and Physiological
- 20-29 Counseling and Clinical
- 30-39 Developmental and Educational
- 40-49 Differential and Psychometrics

50-59 Industrial
60-69 Personality and Psychopathology
70-79 Safety and Driver Education
80-89 Social
90-99 Research, Special Problems, Special Topics

COURSES FOR NONCOLLEGIATE STUDENTS

10. Academic Learning Skills.
   (2-2) Cr. 0. F.W.S.S.S., Mr. Warmann.
   Efficient methods of studying and reading.

78. Automobile Driving
   (0-2) Cr. 0. F.W.S.S. S.
   For those learning to drive an automobile.
   See Fees and Expenses.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. General Psychology I.
   (3-0) Cr. 3. F.W.S.
   Introduction to fundamental psychological concepts derived from the application of scientific method to the study of behavior. Applications of psychology.

201. General Psychology II.
   (3-0) Cr. 3. F.W.S.
   Prerequisite: 101.
   Fundamental concepts and classical experiments in thinking and learning, motivation and emotions, sensation and perception.

230. Developmental Psychology.
   (3-0) Cr. 3. F.W.S.
   Prerequisite: 101.
   Characteristic development and decline of physical traits, learning and intelligence social and emotional behavior, personality and adjustment from conception to senescence. Emphasis on childhood and adolescence.

250. Psychology of Sales and Advertising.
   (3-0) Cr. 3. W.
   Prerequisite: 101. Mr. Hannum.
   Psychological principles underlying sound salesmanship and advertising. Selection and training of salesmen in effective selling. Research on and testing of advertising. Attention, memory, readability, believability.

   (3-0) Cr. 3. F.
   Prerequisite: 101.
   Survey of highway, industrial, farm and home safety and safety organizations. Principles of accident prevention; individual and group responsibilities.

301. 302. Experimental Psychology.
   (2-2) Cr. 3 each. F.W.S.
   Prerequisite: 201. Stat. 201.
   Introduction to research methodology in psychology. The scientific study of human behavior is emphasized in psychophysics, perception, sensory processes, motivation and learning. Research techniques applied in laboratory setting.

333. Educational Psychology.
   (3-0) Cr. 3. F.W.S.
   Prerequisite: 230.
   Consideration of variables influencing learning. Emphasis upon principles of learning and forgetting, motivation for learning, transfer, educational measurement, and development of understanding.

370. Theory and Principles of Driver Education.
   (3-0) Cr. 4. W.
   Prerequisite: 270, 271, 270, Iowa driver's license, permission of instructor. Mrs. Schwenk.
   Source materials methods, policies and procedures, and psychological aspects of driver education; techniques including psycho-physical measurement and interpretation.

371. Practices of Driver Education.
   Cr. 1 to 3 each time elected, total no more than 4. F.W.S.S.
   Prerequisite: 370, Iowa driver's license, permission of instructor.
   Organization of, and experience with, both classroom and behind-the-wheel phases of driver education; lesson plans, films, scheduling and testing techniques.

380. Social Psychology.
   (3-0) Cr. 3. F.W.
   Prerequisite: 380; Psych. 201; 380. Mr. Lowin.
   380: Interpersonal behavior with attention to opinion change, propaganda, prejudice, social influence, leadership, group dynamics, and conformity. 381: Basic research and theory concerning the individual as a group member: morale, conformity, leadership, productivity, group effectiveness norms, communication, groups under stress.

430. Psychology of Adolescence.
   (3-0) Cr. 3. F.W.S.S.S.
   Prerequisite: 230; Messrs. Bath, Lewis.
   Developmental characteristics of the adolescent; emphasis upon typical behavior at this developmental period; implications for education and guidance of adolescents.
Description of Courses

Requirements, interaction and metabolism of nutrients by chickens and turkeys. Development and testing experimental diets, including deficiency studies.

See Animal Science.

690. Research.
A. Poultry Breeding. Mr. Nordskog.
C. Avian Physiology.
D. Poultry Products Technology. Messrs. Forzythe, Marion.

PSYCHOLOGY
Wilbur L. Layton, Ph.D., Head of Department

Associate Professors: Frederick G. Brown, Ph.D.; George G. Karas, Ph.D.; Edwin C. Lewis, Ph.D.; Arthur C. MacKinney, Ph.D.; John R. Schuck, Ph.D.; Roy E. Warman, Ph.D.

Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in psychology, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum

Psychologists are concerned with behavioral research and teaching in the areas of theoretical, comparative and physiological, psychometric, developmental, educational, differential, social, and personality psychology. Applied psychologists utilize the results of basic research in a variety of ways. Clinical psychologists work with mentally ill persons and those with personality and adjustment problems. Counseling psychologists work most often in schools and colleges with people who have personal and vocational problems to solve. Industrial psychologists work in business, industry, government, and the military to help improve the efficiency and personal satisfaction of workers. Psychologists also work in the public schools with pupil problems, especially those of exceptional (different from the average) children.

Undergraduate majors frequently are employed as employment interviewers, psychometricians and personnel technicians. Many positions require at least the Master of Science degree.

Undergraduate majors in this department should include the following courses in their programs: 201, 230, 301, 302, 380, 440, 460.

As supporting work, undergraduate majors are urged to take the following courses: Math. 101, 104; Stat. 201; Phys. 211, 212, 213, or Chem. 101, 102, 103; Soc. 134; Zool. 303, 355; Gen. 301 or 400; Phil. 370, 480, 481. The exact program of courses will be developed by the student and his major adviser.

For students desiring a minor in personnel psychology, 440, 450, 451, 550 and 551 are recommended.

The following courses appropriately can be taken by non-majors with primary interests in social science or education: 230, 270, 333, 370, 380, 436, 440, 521, 533, and 541.

The psychology requirement for an Iowa professional teaching certificate will be met by 101, 230 and 333.

270, 370 and 371, plus 5 hours from 499, 570, 571 or 599 and Ed. 550 will meet the minimum requirements of the State Department of Public Instruction for the teaching of driver education and safety.

Several undergraduate courses provide students with the opportunity to gain first-hand experience with psychological research through participation as subjects in experimentation directed by faculty members. In some courses, particularly 101, such experience is deemed important enough to warrant requiring every student to participate. In other courses opportunities are made available to students to volunteer for research participation.
Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in certain fields of psychology and minor work to students taking major work in other departments.

Students desiring a graduate major in psychology must have been graduated from a recognized curriculum substantially equivalent to one of the undergraduate curricula of Iowa State University. Prerequisite to admission is at least 15 quarter credits of basic psychology, which normally should include a laboratory course, a quantitative or methods course, social psychology course and a course with developmental emphasis.

Open to graduate students for minor only: 430, 436, 440, 441, 451, 460.

Index to field of work is given by the second and third figures of course numbers:

| 00-09 | Experimental and Statistics |
| 01-09 | General Psychology I. |
| 02-09 | General Psychology II. |
| 03-09 | Developmental Psychology. |
| 04-09 | Psychology of Sales and Advertising. |
| 05-09 | Problems of Human Conservation. |
| 06-09 | Experimental Psychology. |
| 07-09 | Counseling and Clinical |
| 08-09 | Social |
| 09-09 | Research, Special Problems, Special Topics |
| 10-09 | Counseling and Clinical |
| 11-09 | Educational Psychology. |
| 12-09 | Developmental and Educational |
| 13-09 | Differential and Psychometrics |
| 14-09 | Psychology of Sales and Advertising. |
| 15-09 | Problems of Human Conservation. |
| 16-09 | Experimental Psychology. |
| 17-09 | Counseling and Clinical |
| 18-09 | Social |
| 19-09 | Research, Special Problems, Special Topics |

COURSES FOR NONCOLLEGIATE STUDENTS

10. Academic Learning Skills. 
(2-2) Cr. 0 F.W.S.S.S. Mr. Warman. 
Efficient methods of studying and reading.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. General Psychology I. 
(3-0) Cr. 3 F.W.S. 
Introduction to fundamental psychological concepts derived from the application of scientific method to the study of behavior. Applications of psychology. 

201. General Psychology II. 
(3-0) Cr. 3 F.W.S. 
Prerequisite: 101. 
Fundamental concepts and classical experiments in thinking and learning, motivation and emotions, sensation and perception.

230. Developmental Psychology. 
(3-0) Cr. 3 F.W.S. 
Prerequisite: 101. 
Characteristic development and decline of physical traits, learning and intelligence social and emotional behavior, personality and adjustment from conception to senescence. Emphasis on childhood and adolescence.

250. Psychology of Sales and Advertising. 
(3-0) Cr. 3 W. 
Prerequisite: 101. Mr. Hannum. 
Psychological principles underlying sound salesmanship and advertising. Selection and training of salesmen in effective selling. Research on and testing of advertising. Attention, memory, readability, believability.

(3-0) Cr. 3 F. 
Prerequisite: 101. 
Survey of highway, industrial, farm and home safety and safety organizations. Principles of accident prevention; individual and group responsibilities.

301, 302. Experimental Psychology. 
(2-2) Cr. 3 each F.W.S. 
Prerequisite: 201, Stat. 201. 
Introduction to research methodology in psychology. The scientific study of human behavior is emphasized in psychophysics, perception, sensory processes, motivation and learning. Research techniques applied in laboratory setting.

333. Educational Psychology. 
(3-0) Cr. 3 F.W. 
Prerequisite: 230. 
Consideration of variables influencing learning. Emphasis upon principles of learning and forgetting, motivation for learning, transfer, educational measurement, and development of understanding.

370. Theory and Principles of Driver Education. 
(3-3) Cr. 4 W. 
Prerequisite: 101, 270, Iowa driver's license, permission of instructor. Mrs. Schwenk. 
Source materials, methods, policies and procedures, and psychological aspects of driver education; techniques including psycho-physical measurement and interpretation.

371. Practices of Driver Education. 
Cr. 1 to 3 each time elected, total no more than 4. F.W.S.S.S. 
Prerequisite: 370, Iowa driver's license, permission of instructor. 
Organization of, and experience with, both classroom and behind-the-wheel phases of driver education; lesson plans, films, scheduling and testing techniques.

380. 381. Social Psychology. 
(3-0) Cr. 3 F.W. 
Prerequisite: 380. Psych. 201; 381. 380. Mr. Lowin. 
380. Interpersonal behavior with attention to opinion change, propaganda, prejudice, social influence, leadership, group dynamics, and conformity. 381: Basic research and theory concerning the individual as a group member: morale, conformity, leadership, productivity, group effectiveness norms, communication, groups under stress.

430. Psychology of Adolescence. 
(3-0) Cr. 3 F.W.S.S. 
Developmental characteristics of the adolescent; emphasis upon typical behavior at this developmental period; implications for education and guidance of adolescents.
Description of Courses

436. Psychology of Exceptional Children.
   (3-0) Cr. 3. S. Mr. Charles.
Prerequisite: 230 or C.D. 336.
Emotional and behavioral characteristics of atypical children. Characteristics of gifted children; educational and psychological problems in physical, neural, sensory and intellectual deficiency. Clinical observation and work with handicapped available.

440. Psychological Measurement I.
   (3-0) Cr. 3. F.S.S.S.
Principles of psychological measurement including: sources of test information, quantitative concepts with applications to test construction, factors influencing test performance, uses and misuses of tests in counseling, educational and industrial settings.

441. Opinion, Attitude and Motivation Analysis.
   (3-0) Cr. 3. F.S.S.S.
Prerequisite: 201, Stat. 201. Mr. Wolns.
Genesis of opinions, attitudes and motives; construction of measuring devices; problems of sampling, scaling and analysis; implications and applications.

450. Industrial Psychology I.
   (3-0) Cr. 3. F.S.S.
Prerequisite: 201. Mr. MacKinney.
Content and methods of industrial psychology with emphasis on differential psychology; selection techniques, merit rating, employee counseling, attitudes and morale, training, leadership and job evaluation.

451. Industrial Psychology II.
   (3-0) Cr. 3. W.
Prerequisite: 450. Mr. MacKinney.
Content and methods of industrial psychology with emphasis on industrial social psychology and modifying employee performance.

460. Psychology of Adjustment.
   (4-0) Cr. 4. S.S.S.
Prerequisite: 9 credits in psychology. Mr. Hannum.
Modes of adjustment normal and abnormal. Emphasis on motivation and learning in development of adjustment patterns. Field trips.

499. Special Problems.
   Cr. 1 to 4 each time elected. F.W.S.S.S.
Prerequisite: 6 credits in Psych., permission of instructor.
A. Historical, Systematic, Theoretical.
B. Safety.
C. Advertising and Sales.
D. Genetic and Geriatric.
E. Experimental.
F. Educational and Learning.
G. Individual Differences and Psychometrics.
H. Honors.
I. Clinical and Abnormal.
J. Guidance, Personnel, Counseling.
K. Industrial.
L. Exceptional Children.
M. School Psychology.
N. Social.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

   501: (3-0) Cr. 3; 502, 503: (3-2) Cr. 4 each Yr.
Prerequisite: 501. 15 credits in Psych. including 302 or equivalent; 502: 501; 503: 502. Messrs. Karas, Schuck.
501: Psychological research methods with emphasis on the scientific method and laboratory techniques, psychological literature. 502: Advanced experimental investigation of sensory processes, perception and psycho-physics. Individual research project required. 503: Research techniques specific to experimentation on the learning process. Empirically derived concepts. Laboratory investigation of learning.

504. Engineering Psychology.
   (3-0) Cr. 3. S.
Prerequisite: 9 credits in Psych. Mr. Karas.
Contributions of psychology to the consideration of human factors in engineering design. Human sensory-motor characteristics important to design of man-machine systems.

505. Psychometrics.
   (Stat. 505) See Statistics.

506. Factor Analysis.

510. 511. Comparative and Physiological Psychology.
   (3-0) Cr. 3 W.S.
Prerequisite: 510: 15 quarter credits in Psych, 511: permission of instructor Messrs. Karas, Peters.
510: Concepts and techniques used by psychologists in the analysis of animal behavior. 511: Neurophysiological correlates of behavior with emphasis on motivation and learning. Methods and techniques of investigation.

520. Psychology of Vocations.
   (2-2) Cr. 3. W.
Prerequisite: 201, 440 Mr. Brown.
Vocational development. Factors determining selection of, entrance into, and progress in a vocation. Vocational interest theory.

521. Counseling Psychology I.
   (3-0) Cr. 3. F.
Prerequisite: 12 credits in Psych. Mr. Leuns.
Counseling procedures and techniques. Theory, research, and evaluation of counseling. Counseling as a profession.

530. Advanced Developmental Psychology.
   (3-0) Cr 3. F.
Prerequisite. 15 hours (including 230 or C.D. 336) or graduate standing. Mr. Charles.
Critical evaluation of major research in physical, sensory, intellectual, emotional and social development. Human behavior from conception to senescence. Maturity and old age emphasized.

531. Psychology of Exceptional Intelligence.
   (3-0) Cr. 3. S.
Prerequisite: 15 credits in Psych. including 430, or graduate standing. Mr. Charles.
Study of the psychological characteristics of the mentally deficient, and the gifted and creative. Theoretical views, current research in learning and cognition, perception, language, motor skills, adjustment: implications for clinical and educational practice.

533. Advanced Educational Psychology.
   (3-0) Cr. S.S.S.
Prerequisite: 9 credits in Psych., including 333. Mr. Bath.
Educational applications of the principles of human growth and development, individual differences and learning. Evaluation of research pertinent to curriculum and instruction.
535. Psychology of Reading. (3-0) Cr. 3. S.  
Prerequisite: 230, 333. Mr. Warman.  
The psychology of the reading process, its nature and development including effects of both internal and external factors on performance. Evaluation and diagnosis of reading skills. Remedial and developmental procedures.

540. Psychological Measurement II.  
(3-0) Cr. 3. W.  
Prerequisite: 9 credits in Psych., including 440. Mr. Layton.  
Theory of psychological measurement. Development and interpretation of individual tests. Supervised practice in administering and interpreting individual tests. Emphasis on current findings regarding trait variables, response variables and conceptualizations regarding contextual factors; use of measurement devices in relationship to concepts.

541. Individual Testing.  
(2-6) Cr. 4. F, S.  
Prerequisite: 440, permission of instructor.  
Test theory, development and evaluation, basic variables, qualifying concepts, current trends.

545. Differential Psychology.  
(2-0) Cr. 2. S.  
Prerequisite: 440. Mr. Layton.  

550. Advanced Industrial Psychology I.  
(3-0) Cr. 3. W.  
Prerequisite: 440 or permission of instructor.  
Mr. MacKinney.  

551. Advanced Industrial Psychology II.  
(3-0) Cr. 3. W.  
Prerequisite: Psych. 451, 550. Mr. MacKinney.  
Methods, theory and practice of industrial psychology, with emphasis on behavioral research in industrial settings.

561, 562. Psychology of Personality.  
(3-0) Cr. 3. Yr.  
Prerequisite: 15 credits in Psych or graduate standing  
560: Major concepts, methods and problems in the field of personality. Development of personality theories and implications for research. 561: Review and analysis of theories of personality with emphasis on personality structure and development in the normal population; includes classical, modern and interdisciplinary theories. 562: Personality Assessment. Analysis of basic concepts underlying modes of personality measurement, with emphasis on current findings regarding trait variables, response variables and conceptualizations regarding contextual factors; use of measurement devices in relationship to concepts.

570. Administration and Supervision of Human Conservation and Accident Prevention Programs.  
(3-0) Cr. 3. SS.  
Prerequisite: 270, 370.  
Effective methods of developing the background and motivation essential to accident prevention at various educational levels.

(2-0) Cr. 1. S.S.S.  
Prerequisite. 9 credits in Psych. and Ed., permission of instructor.  
Review of literature in field of safety. Round-table discussions with state and national safety experts and public officials.

580. Advanced Social Psychology.  
(3-0) Cr. 3. W.  
Prerequisite: 9 credits in Psych. including 380.  
Contemporary theories and models of the individual as group member and as communicator and recipient of persuasion. Research formulations of current social problems and implications of dissonance theory.

599. Special Topics.  
Cr. 1 to 4 each time elected. F.W.S.S.S.  
Prerequisite: 12 credits in Psych., permission of instructor.  
A. Historical, Systematic, Theoretical.  
B. Safety.  
C. Advertising and Sales.  
D. Genetic and Geriatric.  
E. Experimental.  
F. Educational and Learning.  
G. Individual Differences and Psychometrics.  
H. Honors.  
I. Clinical and Abnormal.  
J. Guidance, Personnel, Counseling.  
K. Industrial.  
L. Exceptional Children.  
M. School Psychology.  
N. Social.

(1 to 3-0) Cr. 1 to 3. F.W.S.  
Prerequisite: Enrollment in School Psychology.
372/Description of Courses

Training Program, permission of instructor.
Mr. Charles.
The practice of School Psychology: examination of the duties, responsibilities, ethics and problems of the profession.

690. Seminar in Special Areas of Psychology.
(1 to 3-0) Cr. 1 to 3 each time elected. Offered when demand warrants.
Prerequisite: Graduate standing. Graduate staff.

691. Practicum in Psychology.
(As Arranged) Cr. 1 to 4 each time elected
F.W.S.S
Prerequisite: Permission of instructor. Graduate staff
Supervised practice and experience in the following fields of specialization in Applied Psychology:
A. Counseling Psychology.
B. Industrial Psychology.
C. School Psychology.

699. Research.
Graduate staff.

SCIENCE

Chalmer J. Roy, Ph.D., Dean of the College of Sciences and Humanities
John J. L. Hinrichsen, Ph.D., Associate Dean
Frank E. Bortle, Ph.D., Assistant Dean
Orlando C. Kreider, Ph.D., Chairman, Teacher Education Committee, College of Sciences and Humanities
Joseph G. O'Mara, Ph.D., Chairman, Committee for Graduate Programs in General Science

ASSOCIATE PROFESSOR: Delma Harding, Ph.D.
ASSISTANT PROFESSOR: Carl Vondra, Ph.D.

Opportunities for Undergraduate Study

The Science Department offers courses involving subject matter crossing departmental lines within the College of Sciences and Humanities. These currently deal with computer science and preparation for secondary school teaching. See Teacher Education. Other broad plans for study in the College of Sciences and Humanities are provided by the Distributed Studies Program. See Distributed Studies.

Opportunities for Graduate Study

The degree Master of Science with a major in general science is available to graduate students who want or need a more diversified course of study than generally is permitted students who specialize in a single subject. Those who elect this program are allowed to take courses in three different subjects, each subject contributing approximately one-third of the required credits toward the degree. The courses which may be used for credit toward this degree are those listed in this catalog for graduate credit. In addition to completing a minimum of 45 credits, the student must pass the usual examination for reading proficiency in a foreign language. Languages used to satisfy this requirement may be French, German, Spanish or Russian. Permission to present other languages in lieu of these will depend on demonstration by the student that the language will be useful to him professionally. A thesis, which may be based on field, laboratory or library research, is required.

The program has been most useful to those who wish to improve their subject matter competence in teaching. Students who wish to qualify for this degree should contact the Program Chairman as soon as possible so that the committee for direction of the course of study may be appointed.

Under sponsorship of the National Science Foundation, the College has administered summer institutes for college teachers of mathematics and statistics and for high school teachers of biology, chemistry, earth science, mathematics and physics. The institutes have emphasized special preparation in subject matter. The institutes for college teachers have been based on
selected topics from regular course offerings. Since institute programs vary from year to year, interested persons should inquire of the Graduate College Dean's Office.

Open to graduate students for minor credit 480.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

417. Observation and Supervised Teaching. 
Cr. 2 to 12 each time elected; maximum permitted 12 Cr. F.
Prerequisite: Ed. 305; Engl. 494 or Sp. 495 or Math. 497 or Sci. 486 or 496 or P.E.M 497 or M.L. 476; advance reservation required. Observation, evaluation of instruction, lesson planning, and teaching in the sciences and humanities.
A. Social Studies.
B. Physical Sciences.
C. Mathematics.
D. Biological Sciences.
E. English and Literature.
F. Physical Education for Men.
G. Modern Languages.
H. Speech.
I. Journalism.
J. Earth Science.

480. Special Preparation in Subject Matter for Elementary and Secondary Teachers. 
Cr. arr Maximum of 12 Cr. in each area
listed below:
A. Social Studies.
B. Physical Sciences.
C. Mathematics.
D. Biological Sciences.
E. English and Literature.
F. Physical Education for Men.
G. Modern Languages.
H. Speech.
I. Journalism.
J. Earth Science.

486. Methods of Teaching Science. 
(3-0) Cr. 3. W.
Prerequisite: Admission to Teacher Education and 15 credits in subject matter field.
Field trips.

496. Methods of Teaching Social Studies. 
(3-0) Cr. 3. W.
Prerequisite: Admission to Teacher Education and 15 credits in subject matter field.
Field trips.

COURSE PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

501, 502, 503. Programming Languages and Systems. 
(3-0) Cr 3 each. F.W.S.
Prerequisite: 15 credits in Math., Stat. 380 or equivalent
Boolean algebra; logical structure in digital computing; machine language; assembler and compiler systems; symbolic and problem oriented languages; monitor and executive systems; real-time; time-sharing multi-programming.

SOIL SCIENCE

For description of courses, see Agronomy.

SPAN

Student Project for Amity among Nations (SPAN) is a program of carefully supervised, individual, foreign study. Participants spend one academic year planning research projects and gaining background on the country to be visited. Field studies require at least eight weeks abroad during the summer. During the following academic year participants prepare a report on their investigation and devote appropriate effort to the promotion of SPAN.

Total credits offered is 12; six for preparation and the field study, six for the report and SPAN activity. Grades for the first six credits are determined by the group; for the final six credits the grades are determined jointly by the project counselor and the group adviser. Classification may be in appropriate formal or "Special Topics" courses. Registration is normally for six credits each session of the summer term.

STATISTICS

Theodore A. Bancroft, Ph.D., Head of Department


ASSOCIATE PROFESSORS: Om P. Aggarwal, Ph. D.; Foster B. Cady, Ph. D.; Wayne A.
Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in statistics, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum.

The curriculum in sciences and humanities with a major in statistics is designed to prepare students for (1) graduate study in statistics, and (2) positions as assistants to research workers in business, industry or government. This work may include the following: statistical design, analysis and interpretation of experiments and surveys; statistical quality control; sample inspection; high speed data processing; application of statistical principles and methods to industrial research and development and to industrial design and specifications; operations research to analyze the performance of men, machines and processes under operational conditions; market, sales, advertising and consumer research; cost and price analyses; newspaper, magazine, radio and television research; psychological testing; public health studies. Also, there are opportunities for work in statistics that require a major in a subject-matter field and a minor in statistics.

Undergraduate majors in this department usually include the following basic courses in their programs: 201, 341, 342, 343, 380, 401, 402, 411, 421, 482. As supporting work, undergraduates have found the following courses desirable: Math 101, 102, 110, 211, 212, 213. It is also advisable to have a strong minor in a field of application. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Students intending to do graduate work in statistics normally would take additional courses in mathematics.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in statistics and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum essentially equivalent to the curriculum in science at this institution together with a year of calculus and a knowledge of statistical theory and methods as contained in Stat. 341, 342, 343. Introduction to Theory of Probability and Statistics.

Students have found the following courses desirable: Math 211, 212, 213. It is also advisable to have a strong minor in a field of application. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Courses for Undergraduate Students

201. Principles of Statistics. (4-3) Cr. 5. F.W.S.
Prerequisite: 3 credits in Math.
Statistical concepts in modern society; frequency distributions; elements of statistical inference; introduction to regression, correlation; contingency tables; analysis of variance, single classification.
A. (2-3) Cr. 3. W.S. For students in agricultural and biological sciences.
Prerequisite: 3 credits in Math.
Emphasis on experimental problems from biological fields; elementary experimental design.
B. (3-0) Cr. 3. F.S. For students in engineering.
Prerequisite: Math. 110.
Emphasis on engineering applications. More emphasis on probability. Introduction to order statistics included.

(2-3) Cr. 3. F.
Prerequisite: 201. Mrs. Fuchs.
Applications of statistical principles to business; sources of data; methods of presenting statistical material, elementary discussion of index numbers, time series, forecasting, quality control and market research.

(Math. 341, 342, 343) (3-0) Cr. 3 each Yr.
Prerequisite: Math 212 Mr Huntsberger.
Probability; distribution functions and their properties; role of the theory of stochastic processes; simple time dependent processes; Markov chains; sampling distribution; theory of estimation and tests of hypotheses; linear hypothesis theory, regression and correlation;
the multivariate normal distribution; non-parametric methods.


401. 402. Statistical Methods for Research Workers. (3-3) Cr. 4 each. 401: F.W.SSI. 402: W.SSII. Prerequisite: 401: 201 or graduate classification. Math. 101; 402: 401. The role of statistics in research. Introduction to the methods of analyzing data from experiments and surveys. 401: Statistical concepts and models; simple tests of significance; linear regression and correlation; introduction to analysis of variance. 402: Methods of analysis of variance and covariance; analysis of components of variance; introduction to multiple regression, covariance and correlation, both linear and non-linear.

411. Experimental Design for Research Workers. (3-0) Cr. 3. S.SSI. Prerequisite: 402. Messrs. Cady, Hotchkiss. Methods of constructing and analyzing designs for experimental investigations; concepts of blocking, randomization and replication; experimental unit technique; complete block designs; confounding in factorial experiments; incomplete block designs; response surface methodology.

421. Survey Designs for Research Workers. (3-0) Cr. 3. S.SSII. Prerequisite: 401. Mr. Fuller. Methods of constructing and analyzing designs for survey investigations; simple random, stratified, multistage and multiphase sampling designs; questionnaire construction; methods of estimation; techniques of survey investigation.

431. Elementary Statistical Quality Control. (3-0) Cr. 3. S. Prerequisite: 201 or 401 or I.E. 362, junior classification.

Application of statistical principles to manufacturing. Survey of control chart technique and sampling inspection schemes now in use.

438. Economic Statistics. (Ecom. 438) (3-0) Cr. 3. S. Prerequisite: 402. Analysis of economic data obtained through research investigations. Applications of regression techniques to production functions, demand functions, cost functions, etc. Brief treatment of index numbers.


480. Processing of Data. (2-0) Cr. 2. F. Prerequisite: I.Ad. 480. Mr. Mosier. Use of high speed electronic computers for data processing in accounting and administrative applications such as cost accounting, payroll, production control, inventory control.

481. Processing of Statistical Data. (2-0) Cr. 2. W. Prerequisite: 3 credits in Math. Mr. Mosier. Introduction to programming statistical analyses for research problems.

482. Processing of Statistical Data. (2-0) Cr. 2. S. Prerequisite: 380 or 481. Mr. Mosier. Use of high-speed electronic computers in problems in statistical analysis. Programming techniques include assembly and compiler routines.

499. Special Problems. Cr. arr. Prerequisite: 15 hours in Stat. Staff. For advanced undergraduate students. H. Honors Program.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

501. Intermediate Statistical Methods. (3-0) Cr. 3. F. Prerequisite: 402 Mr. Bancroft. Special situations in the analysis of variance; multiple comparisons; transformations; multiple covariance; fitting of polynomials and non-linear regression; extension of chi-square applications.

505. Psychometrics. (Psych. 505) (3-0) Cr 3. S. Prerequisite: 402, Psych. 440. Mr. Wolins. Theories of psychological scaling and measurement; derivation of formulas used in reliability experiments; useful approximation procedures.


511, 512. Design of Experiments. (3-0) Cr. 3 each. W.S. Prerequisite: 402. Mr. Zyskind. Principles of statistical design for experimental investigations in biological, agricultural and industrial research; tests; estimation; randomized blocks; Latin squares; Graeco-Latin squares; 2^k, 3^n and other factorial systems; fractional replication; simple split-plot-trials; introduction to quasi-factorial and incomplete block designs; determination of optima.

521, 522. Design of Surveys. (3-0) Cr. 3 each. W.S. Prerequisite: 521: 402, 448 or 541; 522: 521. Mr. Sedransk. Comprehensive account of sampling theory as developed for use in sample surveys; simple random, stratified, systematic, cluster and
Fuller, Ph.D.; William J. Hemmerle, Ph.D.; Donald K. Hotchkiss, Ph.D.; Howard W. Jespersen, M.S.; Akio Kudo, Ph.D. (Visiting Associate Professor); C. C. Mosier, B.S.; J. K. Sengupta, Ph.D.; Leroy Wolins, Ph.D.; George Zyskind, Ph.D.

ASSISTANT PROFESSORS: Harold D. Baker, M.S.; Edward J. Carney, M.S.; Carol E. Fuchs, Ph.D.; B. K. Kale, Ph.D. (Visiting Assistant Professor); Edward Pollak, Ph.D.; James R. Prescott, Ph.D.; Joseph Sedransk, Ph.D.

INSTRUCTORS: Thomas C. Jetton, M.S.; Donald J. Souls, M.S.; Richard D. Warren, M.S.

Opportunities for Undergraduate Study

For the undergraduate curriculum in sciences and humanities, major in statistics, leading to the degree Bachelor of Science, see Sciences and Humanities, Curriculum

The curriculum in sciences and humanities with a major in statistics is designed to prepare students for (1) graduate study in statistics, and (2) positions as assistants to research workers in business, industry or government. This work may include the following: statistical design, analysis and interpretation of experiments and surveys; statistical quality control; sample inspection; high speed data processing; application of statistical principles and methods to industrial research and development and to industrial design and specifications; operations research to analyze the performance of men, machines and processes under operational conditions; market, sales, advertising and consumer research; cost and price analyses; newspaper, magazine, radio and television research; psychological testing; public health studies. Also, there are opportunities for work in statistics that require a major in a subject-matter field and a minor in statistics.

Undergraduate majors in this department usually include the following basic courses in their programs: 201, 341, 342, 343, 380, 401, 402, 411, 421, 482. As supporting work, undergraduates have found the following courses desirable: Math. 101, 102, 110, 211, 212, 213. It is also advisable to have a strong minor in a field of application. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic, non-specialized study which may be needed.

Students intending to do graduate work in statistics normally would take additional courses in mathematics.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in statistics and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum essentially equivalent to the curriculum in science at this institution together with a year of calculus and a knowledge of statistical theory and methods as contained in Stat. 341, 342, 343, 401, 402.

Open to graduate students for minor only: 401, 402, 411, 421, 431, 446, 447, 448, 481, 482.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

(4-3) Cr. 5. F.W.S.
Prerequisite: 3 credits in Math.
Statistical concepts in modern society; frequency distributions; elements of statistical inference; introduction to regression, correlation; contingency tables; analysis of variance, single classification. A (2-3) Cr. 3. W.S. For students in agricultural and biological sciences.
Prerequisite 3 credits in Math.
Emphasis on experimental problems from biological fields; elementary experimental design. B (3-0) Cr. 3. F.S. For students in engineering.
Prerequisite Math. 110.
Emphasis on engineering applications. More emphasis on probability. Introduction to order statistics included.

(2-3) Cr. 3. F.
Prerequisite: 201. Mrs. Fuchs.
Applications of statistical principles to business; sources of data; methods of presenting statistical material, elementary discussion of index numbers, time series, forecasting, quality control and market research.

(Math. 341, 342, 343) (3-0) Cr 3 each Yr.
Prerequisite Math. 212 Mr. Huntsberger.
Probability; distribution functions and their properties; role of the theory of stochastic processes; simple time dependent processes; Markov chains; sampling distribution; theory of estimation and tests of hypotheses; linear hypothesis theory, regression and correlation;
the multivariate normal distribution; non-parametric methods.

380. Introduction to High Speed Computing. (Math. 380) (2-3) Cr. 3. F.W.S.
Components of a high speed computer; programming in problem-oriented machine languages; use of sub-routines, compilers, assemblers, and interpretation routines; input-output methods. All concepts illustrated by examples programmed on available computers.

401. 402. Statistical Methods for Research Workers. (3-3) Cr. 4 each. 401. F.W.SSII. 402. W.S.SSII.
Prerequisite: 401: 201 or graduate classification; 402: 401. The role of statistics in research. Introduction to the methods of analyzing data from experiments and surveys. 401: Statistical concepts and models; simple tests of significance; linear regression and correlation; introduction to analysis of variance. 402: Methods of analysis of variance and covariance; analysis of components of variance; introduction to multiple regression, covariance and correlation, both linear and non-linear.

411. Experimental Design for Research Workers. (3-0) Cr. 3. S.SSI.
Prerequisite: 402. Messrs. Cady, Hotchkiss. Methods of constructing and analyzing designs for experimental investigations; concepts of blocking, randomization and replication; experimental unit technique; complete block designs; confounding in factorial experiments; incomplete block designs; response surface methodology.

421. Survey Designs for Research Workers. (3-0) Cr. 3. S.SSII.
Prerequisite: 401. Mr. Fuller. Methods of constructing and analyzing designs for survey investigations; simple random, stratified, multistage and multiphase sampling designs; questionnaire construction; methods of estimation; techniques of survey investigation.

431. Elementary Statistical Quality Control. (3-0) Cr. 3. S.
Prerequisite: 201 or 401 or I.E. 362, junior classification.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

501. Intermediate Statistical Methods. (3-0) Cr. 3. F.
Prerequisite: 402. Mr. Bancroft.
Special situations in the analysis of variance; multiple comparisons; transformations; multiple covariance; fitting of polynomials and non-linear regression; extension of chi-square applications.

505. Psychometrics. (Psych. 505) (3-0) Cr. 3. S.
Prerequisite: 402, Psych. 440 Mr. Wolins. Theories of psychological scaling and measurement; derivation of formulas used in reliability experiments; useful approximation procedures.

506. Factor Analysis. (Psych. 506) (3-0) Cr. 3. F.
Prerequisite: 505. Mr. Wolins. Derivation of procedures from the general model of factor analysis. Thurstone's, Hotelling's and Lawley's factorial methods. Criteria for significance of factor loadings and for testing for minimum rank. Factor rotation.

511. 512. Design of Experiments. (3-0) Cr. 3 each. W.S.
Prerequisite: 402. Mr. Zyskind. Principles of statistical design for experimental investigations in biological, agricultural and industrial research; tests; estimation; randomized blocks; Latin squares; Graeco-Latin squares; 2^k, 3^k and other factorial systems; fractional replication; simple split-plot-trials; introduction to quasifactorial and incomplete block designs; determination of optima.

521. 522. Design of Surveys. (3-0) Cr. 3 each. W.S.
Prerequisite: 521: 402, 448 or 541; 522: 521. Mr Sedransk. Comprehensive account of sampling theory as developed for use in sample surveys; simple random, stratified, systematic, cluster and application of statistical principles to manufacturing. Survey of control chart technique and sampling inspection schemes now in use.

438. Economic Statistics. (Econ. 438) (3-0) Cr. 3. S.
Prerequisite: 402. Analysis of economic data obtained through research investigations. Applications of regression techniques to production functions, demand functions, cost functions, etc. Brief treatment of index numbers.

446, 448. Statistical Theory for Research Workers. (3-0) Cr. 3 each. 446: F.; 447: W.SSII.; 448: S.SSII.

480. Processing of Data. (2-0) Cr. 2. F.
Prerequisite: I. Ad. 480. Mr. Mosier. Use of high speed electronic computers for data processing in accounting and administrative applications such as cost accounting, payroll, production control, inventory control.

481. Processing of Statistical Data. (2-0) Cr. 2. W.
Prerequisite: 3 credits in Math. Mr. Mosier. Introduction to programming statistical analyses for research problems.

482. Processing of Statistical Data. (2-0) Cr. 2. S.
Prerequisite: 380 or 481. Mr. Mosier. Use of high-speed electronic computers in problems in statistical analysis. Programming techniques include assembly and compiler routines.

499. Special Problems. Cr. arr.
Prerequisite: 15 hours in Stat. Staff. For advanced undergraduate students. H. Honors Program.
multistage sampling; methods of estimation, including ratio and regression techniques; non-sampling errors; descriptive vs. analytical surveys.

531. Industrial Statistics: Sampling Inspection. (3-0) Cr. 3. F.
Prerequisite: 543 or 448. Mr. David.
Control of quality of manufactured products; attributes and variables inspection; single, double and sequential plans; sampling plans for continuous production. Cost functions and elementary decision functions.

532. Industrial Statistics: Design of Experiments. (3-0) Cr. 3. Alt. S. Offered 1967
Prerequisite: 402, 531. Mr. David.

533. Biological Statistics. (3-0) Cr. 3. S.
Prerequisite: 402. Mr. Cox.
Direct and indirect biological assay; dose response curve; parallel line and slope ratio assay; crossover design; multiple assays; quantal responses; probit analysis.

534. Genetic Statistics. (Gen. 536, 537) (3-0) Cr. 3 each. F.W.
Prerequisite: 402, 448, Gen. 301; or Gen. 460, permission of instructor. Mr. Pollak.
Probability as applied to genetic systems; the theory of inbreeding; estimation of genetic parameters and testing of genetic hypotheses; models for quantitative inheritance; the partition of genotypic variance; covariances among relatives with random mating and with selfing; experimental designs for evaluating parameters; phenotypic selection for quantitative traits.

535. Elementary Econometric Statistics. (Econ. 538) (3-0) Cr. 3. F.
Prerequisite: 448. Mr. Fuller.
Theory of estimation of structural economic relations in simultaneous equation systems; large sample theory and computation techniques; testing of hypotheses. Topics in the evaluation of econometric models; dummy variables, autocorrelated errors, errors in the variables.

536. Operations Research Methods. (Econ. 539, Math. 539) (3-0) Cr. 3 W.
Prerequisite: 531 or 538 (Econ 538). Mr. David.
Topics in the theory of queues, inventory control, game theory and programming.

537. Operations Research Methods and Economic Analysis. (Econ. 540, I.E. 540, Math. 540) (3-0) Cr. 3. S.
Prerequisite: 446 or Math. 212. Econ. 537 or I.E. 415 or Stat. 539. Mr. Semiputa.
Techniques of inventory control and management; other types of control, forecasting and optimization techniques; methods of simulation and sensitivity programming and their economic applications; programming under risk in dynamic models of transportation, allocation and replacement; dynamic and recursive programming; methods of quantitative planning of economic policy.

541. 542, 543. Theory of Probability and Statistics. (Math. 541, 542, 543) (3-0) Cr. 3 each. Yr
Prerequisite: 541. Math. 414; 542: 541, Math. 415; 543: 542. Mr Arnold.
Development of distribution theory from the theory of probability; common distribution functions; derivation of sampling distributions with particular attention to normal populations; estimation by maximum likelihood; likelihood ratio tests of parametric hypotheses; introduction to general linear hypothesis theory; elements of sequential analysis; distribution free methods.

Prerequisite: 539. Mr. David.
Admissibility and completeness; decision functions; Bayes and minimax solutions; sequential and nonsequential cases; utility and principles of choice.

554, 555. Probability. (Math. 554, 555) See Mathematics

580 Scientific Applications of Digital Computers I. (Math. 580) (3-0) Cr. 3. W.
Prerequisite: 380 or FORTRAN short course, Math. 414.
Numerical evaluation of integrals by series expansion, interpolation, and quadrature techniques; finding zeros of a function; min-max functional approximation; Monte Carlo and simulation techniques, generation of random variates from statistical distributions; combinatorial problems.

581. Scientific Applications of Digital Computers II. (Math. 581) (3-0) Cr 3 S
Prerequisite. 380 or FORTRAN short course, Math. 404.
Computational techniques for matrix inversion, solution of linear equations, and characteristic roots and vectors; symmetric and non-symmetric, real and complex systems; least squares analysis, curve-fitting and regression; solution of non-linear equations; linear programming.

599 Special Topics.
Cr. arr. Graduate staff
A. Theory.
B. Methods.
C. Design of Experiments
D. Design of Surveys.

COURSES FOR GRADUATE STUDENTS, major or minor

601. Advanced Statistical Methods. (3-0) Cr. 3. F.
Prerequisite: 501; 448 or 543. Mr. Cox.
Principles of regression analysis; general orthogonal polynomials; multivariate analysis including Hotelling's T2, the linear discriminant function and the analysis of dispersion; regression non-linear in the parameters; seminars on special topics.

602. Seminar on Statistical Methods.
Cr. arr.
Prerequisite: 501, 448 or 543.

611, 612 Advanced Design of Experiments. (3-0) Cr. 3 each. Alt W.S. Offered 1967.
Prerequisite: 512, 641 Mr Kempthorne.
Randomization theory of designs; general theory of factorial designs; fractional replication, theory of quasi-factorial and incomplete block designs; analysis of groups of experiments; treatments applied in sequence; designs for determining optima.

Prerequisite: 522, 543 Mr. Aggarwal.
Advanced topics in sampling theory as used in survey design; unequal probability sampling with and without replacement; unbiased ratio and regression type estimators; analytical treatment of non-sampling errors.

622. Seminar on Design of Surveys.  
*Cr. arr. Alt. S. Offered 1966*  
*Prerequisite: 621. Mr Appurual*  
*Special topics of current interest in design of surveys; review of recent literature.*

Prerequisite: 538, 543.*  
*Distribution theory of autoregressive multiple equation systems; identification problems; applications to prediction and economic policy.*

*(Math. 641) (3-0) Cr 3. F.  
Prerequisite: 543, Math 404. Mr Zyskind.*  
*Theory of least squares; theory of general linear hypothesis; analysis of multiple classification data; components of variance.*

*(Math. 642) (3-0) Cr 3. F.  
Prerequisite: 543. Mr. Kale.*  
*Probability measure and distribution functions; random variables; characteristic functions; asymptotic distributions.*

*(Math. 643) (3-0) Cr. 3. W  
Prerequisite: 543 Mr. Kudo.*  
*Neyman-Pearson theory of testing hypotheses; point and interval estimation; sufficient statistics; elements of decision theory.*

646. Time Series.  
*(Math. 646, Econ. 646) (3-0) Cr 3 Alt. S. Offered 1967.  
Prerequisite 448 or 543 Mr. Fuller.*  
*Random elements; variate difference method; seasonal variations; cyclical variations; Fourier series, harmonic analysis; trend; orthogonal polynomials, correlation; moving average and autoregressive processes.*

647. Multivariate Analysis.  
*(Math. 647) (3-0) Cr. 3. S.  
Prerequisite: 543, Math. 404. Mr. Kudo.*  
*Multivariate normal distribution; Wishart distribution; Hotelling's T², multivariate regression analysis; discriminant functions.*

*(Math. 648) Cr. arr.  
Prerequisite: 543.*

649. Recent Developments in Statistics and Probability.  
*(Math. 649) (3-0) Cr. 3.*  
*Prerequisite: 642, 643.*  
*Material selected from one of the following or other modern areas which become sufficiently important: sequential analysis, decision theory, nonparametric inference stochastic processes.*

680. Seminar on Advanced Computer Topics.  
*(Math. 680) Cr. arr. F.  
Prerequisite: 580 or 581, permission of instructor.*  
*A series of lectures covering the computational aspects of the research topics of those individuals enrolled in the course. One or more lectures devoted to each topic.*

699. Research.  
*Cr arr Graduate staff.*

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**TEACHER EDUCATION**

Virgil S. Lagomarcino, Ph.D., *Director*

*University Committee on Teacher Education.* Virgil S. Lagomarcino, Ph.D., Chairman; Ray J. Bryan, Ph.D., Head, Department of Education; Glenn R. Hawkes, Ph.D., Head, Department of Child Development; Orlando C Kreider, Ph.D., Chairman, Secondary Teacher Preparation, College of Sciences and Humanities; Wilbur L. Layton, Ph.D., Head, Department of Psychology; M. Marguerite Scruggs, Ph.D., Head, Department of Home Economics Education; Harold E. Dilts, Ph. D., Committee Secretary.

**Teacher Certification**

The Iowa Professional Certificate will be recommended for a person who holds a bachelor's degree from Iowa State University and who has completed the following:

1. All requirements of an approved teacher education program.
2. A minimum of 75 credits in courses designed to serve the general needs of college students. Govt. 215 is to be included.
3. An approved subject matter concentration area of at least 45 credits for full-time teaching in secondary schools. A second subject matter area of at least 30 credits for half-time teaching is desirable but not required.
4. Approval for the elementary certificate requires the successful completion of the curriculum in *Child Development-Elementary Education.*

The permanent professional certificate may be recommended for a person who has met the requirements for the professional certificate, who has earned a Master's Degree and who has four years of successful teaching experience.
Graduate programs are available for those who seek approval as secondary school principals, superintendents, school psychologists, teacher-counselors, counselors, and as teachers in junior colleges.

Persons interested in types of certificates not described above, or who wish to know what courses meet the specific requirements of any certificate, should communicate with the Director of Teacher Education.

Undergraduate Programs in Teacher Education

Personnel and Facilities

Teacher preparation at Iowa State University is a cooperative endeavor involving the personnel and facilities of the University. However, most of the teacher education activities are in the Colleges of Agriculture, Home Economics, and Sciences and Humanities.

Undergraduate Admission

Students seeking admission to a teacher education program must apply to and be accepted by the committee on selection of the specific program in Agricultural Education, Art, Child Development-Elementary Education, Home Economics Education, Industrial Education, Physical Education for Women, or Sciences and Humanities. Each committee will consider the factors of scholarship (minimum of 2.3 quality point average), interest in teaching, character, and physical and mental health. Students should apply as early as possible but not later than the fourth quarter preceding the one in which they intend to do student teaching. All students recommended by the selection committees must be confirmed by the University Committee on Teacher Education before they can be admitted to the program in teacher education.

Undergraduate Areas of Concentration and Advisers

Details of each area will be found in the appropriate departmental section.

ELEMENTARY EDUCATION:
Mr. Glenn R. Hawkes

SECONDARY EDUCATION:
Agricultural Education, Mr. Clarence Bundy
Art, Miss Marjorie Garfield
Biology, Miss Delma E. Harding
Chemistry, Mr. W. Bernard King
Earth Science, Mr. Keith Hussey
English, Mr. Duncan Mallam
General Science, Mr. Orlando C. Kreider
Home Economics Education, Miss M. Marguerite Scruggs
Industrial Education, Mr. Lowell L. Carver
Journalism, Mr. James W. Schwartz
Mathematics, Mr. Orlando C. Kreider
Modern Languages, Mr. C. D. McVicker
Physical Education for Men, Mr. Harry Schmidt
Physical Education for Women, Miss Barbara Forker
Physics, Mr. Lester Earls
*Safety Education, Mrs. Lillian C Schwenk
Social Studies (Economics, Sociology, Government, Geography and History), Mr. Phillip Zaring
Speech, Mr. William R. Underhill

*Students qualifying to teach Safety Education also must qualify in another teaching area.

General Education

A total of 75 credits is required in General Education and shall be distributed as follows:
Teacher Education

- Biological Sciences ........................................... 9-21 credits
- Communicative Arts ............................................ 15-21 credits
- Humanities ...................................................... 9-21 credits
- Physical Sciences and Mathematics ............................. 9-21 credits
- Social Sciences ................................................... 9-21 credits

Core Courses in Teacher Education
- Developmental Psychology-Psych 230 .......................... 3 credits
- Educational Psychology-Psych. 333 ............................ 3 credits
- Foundations of American Education -Ed. 204 .................. 3 credits
- Methods of Teaching-Ed. 305B .................................. 1 credit

Elementary Education

See Major in Child Development-Elementary Education for courses required.

Secondary Education

- Methods of Teaching-Ed. 305A .................................... 3 credits
- Principles of Secondary Education-Ed. 426 ..................... 3 credits

Professional Courses in Areas of Concentration:

- Agricultural Education: 211, 321, 423, 424, 425.
- Art: 416, 417.
- General Science: Sci. 417B, 486.
- Home Economics Education: 406, 407, 408, 409
- Industrial Education: 415, 416
- Mathematics: 497, Sci. 417C.
- Modern Languages: 476, Sci. 417G.
- Physical Education for Men: 497, Sci. 417F.
- Physical Education for Women: 417.
- Physics: Sci. 417B, 486.
- Safety Education: Psych. 274, 370, 372.
- Social Studies: Sci. 417A, 496
- Speech: 495, Sci. 417H.

Graduate Programs in Teacher Education

Graduate programs are planned for each student on the basis of previous education and experience as well as future plans and needs. As a prerequisite to major graduate work in education a student should have preparation substantially equivalent to the completion of one of the undergraduate curricula in teacher education offered at Iowa State University.

Graduate programs are available in the following areas:

a. Agricultural Education
b. Applied Art
c. Child Development
d. Guidance (Teacher-Counselor, Counselor)
e. Home Economics Education
f. School Administration
h. School Psychology
i. Graduate programs for teachers in many of the departments in the Colleges of Home Economics and Sciences and Humanities.
j. Master of Science Degree with a major in General Science, for students who desire more diversified study than generally is permitted when specializing in a single subject matter area.

For further information on each area, see Index

Course offerings on the graduate level are described in the departmental listings, which are arranged alphabetically under Description of Courses.
Teacher Placement

A Teacher Placement Office is maintained for students and graduates in teacher education who are interested in positions in education. Placement services are extended both to candidates and to employers. The candidate is charged a small registration fee. Requests for placement information should be addressed to the Teacher Placement Office, 3 Beardshear, Iowa State University, Ames, Iowa.

TECHNICAL JOURNALISM

James W. Schwartz, M.S., Head of Department

Professors: Rodney T. Fox, M.S.J.; Kenneth R. Marvin, M.S.
Associate Professors: Edmund G. Blinn, M.S.; Richard L. Disney, Jr., B.A.; William F. Kunerth, M.S.J.; John D. Shelley, B.S.
Assistant Professors: Merritt Bailey, M.S.; C. Gene Bratton, M.S.; Raymond P. Fassel, M.A.; Robert C. Johnson, M.S.; Dwight L. Teeter, M.J.; Donald E. Wells, Ph.D.
Instructor: J. William Milldyke, A.B.

Opportunities for Undergraduate Study

For undergraduate curricula in agricultural journalism, home economics journalism, science journalism, and engineering journalism, see Index.

Instruction in journalism is offered to all students and adapted as far as possible to their individual needs. Its purpose is two-fold: to serve those professionally interested in journalism and to aid non-majors in their relationships with mass media and to improve their general ability to communicate.

Professional students are offered preparation for editorial and advertising-promotion positions with newspapers, magazines, radio and television; for technical writing positions in a variety of specialized fields, and for public relations and information positions with industry and government.

Students majoring in other fields who wish to minor in journalism are invited to consult with journalism staff members for a recommended sequence of courses tailored to fit their particular needs and goals.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in journalism and mass communication, and minor work to students taking major work in other departments.

For major work, a student must have a Bachelor’s degree in journalism or in a subject matter area which he wishes to combine professionally with advanced training in journalism and mass communication.

Options for the modern language requirement include Spanish, French, German, and Russian.

Open to graduate students for minor only: 430, 431, 445, 475.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101. Introduction to Mass Communication. (2-0) Cr. 2. W.S.
Communication models and their application to the mass media; the mass communication process; characteristics and responsibilities of the mass media; media-related professional operations.

221, 222, 223. Basic Reporting. 221, 222 (2-6) Cr. 4. F.W.S.; 223 (2-0) Cr 3 1 hr arr. F.WS
Prerequisite 221 101, Engl 102, some proficiency in typing; 222 221; 223 222.
News values, news style, news gathering and writing. Sequence will move through newspaper news writing into specialized coverage of courts, public affairs and business news with emphasis finally shifting to the writing of articles for general and specialized magazines in which considerable attention is given to reporting of scientific and technical information.

225. Publicity and Public Relations. (3-0) Cr. 3. F.W.S.SSI,11.
Prerequisite Engl. 103
Communication fundamentals; gathering and preparing material for mass communication media; use of communication media for public relations purposes.
317. Fundamentals of Photography. (2-0) Cr. 4. F.W. S.S.SI.
   Camera and dark room techniques. Evaluation of pictures; the picture story; lighting; pictorial composition.

325. Advertising. (3-0) Cr. 3. F.W. S.S.SI.
   Principles of advertising; market and product research; planning, preparing and placing advertising.

326. Radio and Television Advertising. (3-0) Cr. 3. W.
   Principles of advertising as applied to radio and television.

335. Feature Articles for Technical Journals. (3-0) Cr. 3. S.
   Prerequisite: 225.
   For those not majoring in journalism. Writing of articles dealing with agriculture, engineering, home economics, or science.

341. 342. Practice in Copy Editing and Typography. (2-3) Cr. 3 each. 341: F.S.; 342: W.
   Prerequisite: 221 or 225.
   Copy editing, headline writing and newspaper makeup. Type, copy fitting and design of printed matter.

400. Specialized Writing. (3-0) Cr. 3 each time elected. 400A: F.
   400B: S. 400C: W.
   Prerequisite: 223, junior classification.
   Personal guidance in researching material and writing for areas related to the student's special interests and background.
   A. Magazine and Industrial Publications.
   B. Reporting Public Affairs
   C. The Editorial Page.

430. Law of Communications. (3-0) Cr. 3. P.S.
   Prerequisite: Junior classification.
   Libel, slander, lottery, copyright; postal laws; the Federal Communications Act; laws affecting advertising and legal publication.

431. History of Journalism. (3-0) Cr. 3. W.
   Prerequisite: Junior classification.

445. Retail Advertising. (3-0) Cr. 3. W.
   Prerequisite: 325 or graduate standing.
   Retail business policies as related to advertising programs; selling, budgeting, layout and copywriting.

475. Informative Writing for Radio and Television. (3-3) Cr. 3. F.S
   Prerequisite: 221 or 225 or graduate standing.
   Writing and planning continuity, talks, interviews, demonstrations, forums and discussions; documentary programs for radio and television. Field trips.

476. Motion Picture Techniques. (2-3) Cr. 3. F.
   Prerequisite: 317.
   Basic techniques in shooting, editing and presenting motion pictures as a means of communication with special stress on the requirements for television.

481. Radio and Television News. (3-3) Cr. 4. W.
   Prerequisite: 221 or 225.
   Techniques in gathering, writing and editing news for radio and television; use of film and other visual devices in television news. Field trips.

490. Special Problems in Communications, Cr. arr.
   Prerequisite: Junior classification, permission of instructor.
   H. Honors program.

   COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Process and Strategy of Mass Communication Research. (4-0) Cr. 4. F.
   Prerequisite: Graduate standing or permission of instructor.
   Nature of science and the research process. Relationship of theory, hypotheses, and measurement models. Communication research techniques and study analysis.

512. Literature in Mass Communication. (3-0) Cr. 3. W.
   Prerequisite: 510.
   Examination of major areas of research activity and theoretical development related to the organization, functions and effects of mass communication.

515. Persuasion and Mass Communication. (3-0) Cr. 3. S.S.SI.
   Prerequisite: 221 or 225 or graduate standing.
   Survey and synthesis of some of the major factors influencing public opinion and a study of their importance in editorial writing, advertising and public relations.

517. Pictorial Communication. (3-0 to 3-6) Cr. 3 or 5. W.
   Prerequisite: 221 or 225 or graduate standing; 317 for laboratory.
   A survey of the uses in communication of photographs, drawings, graphs, charts, maps and non-word symbols. Special emphasis on how to communicate by means of pictures. Laboratory emphasis on photographic composition and print quality.

526, 527, 528. Reporting on Science and Technology. (1-4) Cr. 3 each. Yr.
   Prerequisite: 526: Graduate standing or permission of instructor; 527: 526 or equivalent; 528: 527.
   Writing and editing problems of the communicator who mediates between scholar, scientist and various reading publics. Communication objectives, audience analysis, code selection, treatments, media characteristics.

532. Press Freedom, Responsibility and Ethics. (3-0) Cr. 3. P.
   Prerequisite: 221 or 225 or graduate standing.
   Philosophies upon which the concept of freedom of communication in America is based; theory of responsibility assumed by mass communication media as related to freedom and other privileges; ethical problems faced by users of printed and electronic media.

590. Special Problems. Cr. arr.
   Prerequisite: Permission of instructor.
382/Description of Courses

COURSES FOR GRADUATE STUDENTS

650. Seminar. 
   R. (3-0) Cr. 3.

690. Research.

TELECOMMUNICATIVE ARTS

For description of courses, see English and Speech.

TEXTILES AND CLOTHING

Margaret C. Warning, Ph.D., Head of Department

Professors: Norma R. Hollen, M.S.; Fannie Potgietter, M.A., (Emeritus); Jane Saddler, M.S.

Associate Professors: Ruth E. Hall, Ph.D.; Harriett T. McJimsey, M.A.; Opal M. Roberson, M.A.; Geitel Winakor, Ph.D.

Assistant Professors: Donna R. Danielson, M.S.; Agatha L. Huepenbecker, M.S.; Harriet W. Lewis, M.S.; Anita M. Rice, M.S.; Evelyn L. Shibles, M.S.; Shirley Jean Smith, M.S.; Elsie W. Williams, M.S.

Instructor: Louise K. Swenson, M.S.

Opportunities for Undergraduate Study

Courses in textiles and clothing furnish knowledge and training essential to the consumer for satisfactorily providing clothing and household fabrics for the individual, the family and the home. The aesthetic, economic, sociological, psychological, scientific and cultural aspects of textiles and clothing are stressed.

Five majors are offered: merchandising, textiles and clothing design, textiles, clothing, and textiles and related science.

Each of these majors provides preparation for many different kinds of positions and provides a good basis for advanced study.

The major in merchandising prepares students for such positions as comparison shopper, fashion stylist or coordinator, assistant buyer or buyer, merchandise manager, copywriter, fashion market reporter, director of fashion board, owner-manager of small store, promotion work, director of education of sales personnel, shopping service director. Supervised work experience in a department store may be arranged.

The major in textiles and clothing design is planned for students interested in apparel designing.

The major in textiles prepares students for work in quality control laboratories as consultants for promotional fabric development.

The major in clothing leads to opportunities in many areas such as teaching in stores, extension or trade schools, custom dressmaking, work with commercial companies as consultant, sample maker, or educational director.

The major in textiles and related science is designed for those who wish to prepare for work in textile laboratories or to do research in textiles. It affords an excellent background for graduate work in textiles and clothing.

Opportunities for Graduate Study

The department offers major work for the degree Master of Science and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of courses in applied art, chemistry (including inorganic and organic), economics, physics, textiles and clothing (including specific courses in general textiles, clothing construction and costume designing). Additional prerequisites may be required, depending upon the nature of the work the student wishes to pursue.
For the language requirement see Graduate College.

Open to graduate students, for minor only: 404, 410, 414, 454, 464.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

104. Textiles. (2-3) Cr. 3. F.W.S.SSI.
Fundamental weaves, yarn, fibers, color and finishes with reference to selection of fabrics in relation to end use.

123. Pattern Making and Clothing Construction. (2-10) Cr. arr. F.W.S.
Prerequisite: Placement test-Z classification.
Use of a commercial basic pattern; introduction to principles of flat pattern designing and pattern making; basic garment construction and construction for specific fabrics and designs.

125. Pattern Making and Clothing Construction. (2-7) Cr. 4. F.W.S.
Prerequisite: Placement test-X or Y.
For students who rank high on the placement test. The use of commercial basic patterns and development of foundation patterns; flat pattern designing and related garment construction; making patterns for and constructing selected dress design in appropriate fabric.

223. Pattern Making. (2-7) Cr. 4. W.S.SSI.
Prerequisite: Transfer students in H.E.E.ED. who have had a course in clothing construction.
Flat pattern designing and draping with emphasis on fitting.

225. Draping and Clothing Construction. (2-4) Cr. 3. F.W.S.SSI.
Prerequisite: 123 or 125, credit or classification in 245.
Draping with emphasis on designing, fitting and construction.

245. Clothing Selection. (2-3) Cr. 3. F.W.S.
Prerequisite. A.A. 103.
Selection of appropriate and becoming clothing for individuals, with recognition of social, economic and design factors.

304. Intermediate Textiles. (3-0) Cr. 3. F.W.S.
Prerequisite: 104, Chem. 231 or equivalent.
Application of basic principles of textiles in specific end uses; household textiles, clothing, non-woven textiles; textile testing; emphasis on serviceability, aesthetic, economic, and psychological aspects.

326. Children’s Clothing. (2-4) Cr. 3. F.W.S.
Prerequisite: 123 or 125. Mrs. Williams.
Selection of clothing as it relates to the growth and development of the child. Evaluation of ready-to-wear. Designing and construction of suitable clothing for children.

345. Costume Design and Selection. (2-4) Cr. 3. F.W.S.
Prerequisite: 245, A.A. 213 or 214. Mrs. McJimsey.
Creative problems based on source material commonly used in designing clothing.

365. Professional Opportunities in Textiles and Clothing. (3-0) Cr. 3. W.
Prerequisite: Junior or senior classification.
Survey of career opportunities related to various job areas of merchandising, designing, promotion, public relations, consumer service, research and textile testing. Individual investigations of specific jobs.

401. Senior Study Tour. Cr. R. E.S.
Prerequisite: Credit or classification in 414 or 454, junior or senior classification.
Study of and visits to mills, factories, dress houses, stores, museums and laboratories.

404. Advanced Textiles. (3-0) Cr. 3. F.W.S.
Prerequisite: 304. Mrs. Lewis.
New developments in the textile field as reported in current literature.

410. Textiles and Clothing Department Seminar. (2-0) Cr. 1. S.
Prerequisite: Senior standing.

414. Historic Textiles. (3-0) Cr. 3. F.W.S.SSI.
Prerequisite: 104. Hist. 211, 212 or 311, 312. Miss Huepenbecker.
Development of textiles from ancient times; a study of specific historic textiles; contemporary interpretations of historic textile designs.

454. History of Costume. (3-0) Cr. 3. F.W.S.SSI.
Prerequisite: Hist. 211, 212 or 311, 312; junior or senior classification. Miss Winakor.
Styles of costume in western civilization from ancient times to the present day; cultural and economic factors associated with the development, adoption and abandonment of styles.

464 Family Clothing Consumption. (3-0) Cr. 3. F.S.SSI.
Prerequisite: 304, Econ. 242. Miss Winakor.
Current theories of clothing consumption; factors affecting family clothing expenditure; production and distribution of textile and clothing products for the consumer market.

490. Special Problems. Cr. 1-4 per quarter. F.W.S.SSI, II.
Prerequisite: 10 credits in T. and C. Staff.
Permission from the department head and instructor.
A. Textiles. Misses Hollen, Saddler, Mrs. Lewis.
B. Historic Textiles. Miss Huepenbecker.
C. Clothing Construction, Staff.
D. Costume Design. Miss Danielson, Mrs. McJimsey.
E. History of Costume. Miss Winakor.
F. Socio-Psychological Aspects of Textiles and Clothing. Miss Warning.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

504. Experimental Textiles. (2-4) Cr. 3. W.
Prerequisite: 404, senior or graduate classification. Mrs. Lewis.
Experience in planning, executing and reporting introductory studies in textile research; review of pertinent literature and testing of fabrics using equipment available.
Description of Courses

523. Experimental Clothing Construction.
   (2-4) Cr. 3. S.S.S.
   Prerequisite: 225 or graduate standing, Miss Saddler.
   Experimental approach to the study of factors influencing sewing construction; evaluation of sewing techniques.

525. Advanced Draping.
   (2-4) Cr. 3. S.S.S.
   Prerequisite: 225, 345, Miss Saddler.
   Application of design and pattern making principles to various fabrics and styles.

527. Tailoring.
   (2-6) Cr. 4. F.W.S.S.
   Prerequisite: 225.
   Tailoring techniques applied in making coats and suits.

544. Advanced Costume Design.
   (2-4) Cr. 3. W.
   Prerequisite: 345. Mrs. McJimsey.
   Creative problems to meet individual needs; experience in designing for different ages and figures.

COURSES FOR GRADUATE STUDENTS, major or minor

610. Seminar.
    Cr. as arr. W.

614. Research.
    F.W.S.S. 11
    Misses Hall, Hollen, Warning, Winakor, Mrs. McJimsey

VETERINARY ANATOMY

Robert Getty, D.V.M., Ph.D., Head of Department

Professors: Neal R. Cholvin, D.V.M., Ph.D.; George C. Christensen, D.V.M., Ph.D.
Associate Professors: James E. Lovell, D.V.M., Ph.D.; B. H. Skold, D.V.M., Ph.D.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree Doctor of Veterinary Medicine, see Veterinary Medicine, Curriculum.

Through courses in this department, veterinary students acquire a detailed knowledge of the anatomy of the domestic animals which is necessary for a proper understanding of physiology, pathology, diagnosis, surgery, and medicine.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in microscopic and gross anatomy and minor work to students taking major work in other departments.

Instruction and research facilities in biomedical engineering are provided jointly by the Departments of Electrical Engineering, Veterinary Anatomy, and Veterinary Physiology and Pharmacology. See Biomedical Engineering for requirements for graduate minor.

Prerequisite to major graduate work is the completion of an undergraduate curriculum substantially equivalent to that in veterinary medicine.

Open to graduate students for minor only: 301, 302, 303, 304.
COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

101, 102, 103. Microscopic Anatomy. Cr. 5 each time taken. F.W.S.
Prerequisite: One year of college biology; 101: 102; 103: (1-12)
Cells, tissues, organs, histogenesis, embryology, organogenesis, and structure.

111, 112, 113. Gross Anatomy. Cr. 6 each; 113: (0-15) Cr. 5.
Prerequisite: One year of college biology.
Systematic and topographic study and dissection of horse, ox, sheep, dog, chicken, and laboratory animals.

217. Anatomy of Domestic Animals. Cr. 3. F.
For students in agriculture and others desiring fundamental knowledge of anatomy.

301, 302, 303. Advanced Microscopic Anatomy. Cr. 5 each. Yr.
Prerequisite: One year of college biology.
Mesrs. Getty, Skold.
CytoLOGY, embryology, and microscopic organization of the animal body.

304. Systematic Anatomy. Cr. 5 each time taken. SS.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

Prerequisite: Permission of instructor.
Mesrs. Getty, Gillette, Swenson.
Embryology, structure and function of endocrine organs.

Prerequisite: Permission of instructor.
Mesrs. Getty, Ramsey, Skold.
Central and peripheral nervous system including the organs of special sense.

513. Anatomy for Biomedical Engineering. Cr. 4. F.
Prerequisite: Credit or classification in E.E. 301 and Chem. 483.
Mesrs. Cholvin, Getty.

590. Special Topics, Cr. 2 to 5 each time elected.
Prerequisite: 15 credits of acceptable graduate work, permission of instructor. Staff.
A series of non-sequential courses selected from the following topics:
A. Ultra Structure of Animal Tissues.
B. Structures of Intercellular Substances and Morphology of Cells.
C. Gerontology of Domestic Animals.
D. Special Problems in Gross Anatomy.
E. Special Problems in Microscopic Anatomy.
F. Anatomy of Laboratory Animals.

COURSES FOR GRADUATE STUDENTS, major or minor

604 Seminar. Cr. 1. Yr. Mr. Getty.

690 Research.
A. Gross Anatomy. Staff.
B. Microscopic Anatomy. Staff.

Research is encouraged in: Experimental Neuroanatomy, Advanced Veterinary Microscopic Organology, Surgical Anatomy, Advanced Anatomy for Biomedical Engineering, and Research in Ultrastructure of Cells.

VETERINARY CLINICAL SCIENCES

Wallace M. Wass, D.V.M., Ph.D., Head of Department


Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree Doctor of Veterinary Medicine, see Veterinary Medicine, Curriculum.

The study of medicine and surgery summarizes and shows the application in practice of the training previously received in anatomy, physiology, pathology, and therapeutics. On completion of the senior year the student has not only the theoretical knowledge, but some of the more practical methods of applying such knowledge. The transition from the student to the practitioner presents little difficulty after such training.

The department presents the course work in obstetrics in three categories: (a) interferences with parturition both fetal and maternal; (b) diseases of the newborn, from birth to several days of age, with special emphasis on the etiology, treatment and prevention of such interferences with animal reproduction; (c) interferences with normal reproduction, commonly called “sterility.”

The importance of radiology as a diagnostic aid and a therapeutic measure in the handling of animal disease rapidly is becoming more important. More veterinarians are adding X-ray apparatus to their therapeutic equipment. The department presents a systematically organized course in radiology emphasizing the handling, taking, processing and interpretation of skiagraphs, and the dangers of X-rays to man and animal when improperly used.

Opportunities for Graduate Study

The department offers major work leading to the degree Master of Science in the Veterinary Clinical Sciences. Instruction is offered in veterinary medicine, surgery, radiology, and the study of reproductive diseases. Minor work is available to students taking major work in other departments.

The laboratory facilities of the Veterinary Medical Research Institute are available to approved and qualified students.

Prerequisite to major graduate work is graduation from an approved college of veterinary medicine.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

   (2-2) Cr. 3. S.
   Prerequisite: First 5 quarters of veterinary curriculum.
   Care of the pregnant animal. Cause and treatment of difficult parturition. Care and diseases of the newborn animal during the first two weeks of life.

331. Large Animal Medicine I.
   (5-0) Cr. 5. E.
   Prerequisite: First 2 years of veterinary curriculum.
   Diagnostic methods and consideration of diseases of large domestic animals.

332. Large Animal Medicine II.
   (4-0) Cr. 4. W.
   Prerequisite: 331.
   Diagnosis and treatment of sporadic and non-infectious diseases of large animals.

333. Large Animal Medicine III.
   (5-0) Cr. 5. S.
   Prerequisite: 332.
   Diagnosis and treatment of sporadic and non-infectious diseases of large animals.

335. Small Animal Medicine I.
   (4-0) Cr. 4. W
   Prerequisite: 331.
   The diagnosis, therapeutics, and prevention of diseases of small animals.

336. Small Animal Medicine II.
   (4-0) Cr. 4. S.
   Prerequisite: 335.
   The diagnosis and treatment of small animal diseases and the diseases of fur-bearing animals and pet birds.

337. Small Animal Surgery I.
   (4-0) Cr. 4. W.
   Prerequisite: 371.
   Surgical diseases of small animals.

338. Small Animal Surgery II.
   (4-0) Cr. 4. S.
   Prerequisite: 337.
   Surgery of small domestic and fur-bearing animals and pet birds.

   (4-3) Cr 5. F.
   Prerequisite: 245.
   Diseases of the female generative organs, their causes, control and treatment.
COURSES FOR GRADUATE STUDENTS, major or minor

604. Seminar.
Cr. 1. F.W.S. Mr. Emmerson.

(2-3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 345. Mr. Emmerson.
Diseases of reproductive organs of the male.

645. Advanced Obstetrics.
(2-3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 345. Mr. Emmerson.
Diseases of reproductive organs of the female.

(2-3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 338 and 373.

Detailed principles of veterinary surgery and anesthesia.

672. Advanced Special Surgery.
(2-3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 338 and 373.
Techniques of the various operations and manipulations in veterinary surgery.

676. Advanced Medicine.
(2-3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 333 and 336.
Principles of large animal medicine.

690. Research.

VETERINARY HYGIENE

R. Allen Packer, D.V.M., Ph.D., Head of Department


ASSISTANT PROFESSORS: Eric Broughton, D.V.M., M.S.; Martin Van Der Maaten, D.V.M., Ph.D.

INSTRUCTORS: B. J. Edmundson, D.V.M.; Roger M. Hogle, D.V.M.
Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree Doctor of Veterinary Medicine, see *Veterinary Medicine, Curriculum*.

The Veterinary Hygiene Department offers instruction in bacteriology, virology, immunology, food hygiene, and in the diagnosis and control of the infectious diseases. The department cooperates in the sanitary control of the milk supply to the city of Ames which furnishes a teaching laboratory in the course in dairy hygiene.

Opportunities for Graduate Study

The department offers major work for the degree Master of Science in veterinary bacteriology and veterinary hygiene, major work for the degree Doctor of Philosophy in veterinary bacteriology and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the possession of the D.V.M. degree or the completion of an undergraduate curriculum substantially equivalent to that in veterinary medicine.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

224. General Bacteriology and Immunology.
   (3-9) Cr. 6. F.
   Prerequisite: B. and B. 304, 305 or equivalent.
   Morphology, classification, and physiological characteristics of pathogenic bacteria; principles of infection and immunity.

225. Pathogenic Bacteriology.
   (3-6) Cr. 5. W.
   Prerequisite: 224, V.Path. 254.
   Detailed study of bacteria associated with animal diseases.

   (3-3) Cr. 4. S.
   Prerequisite: 225, V.Path. 254, 255.
   The general properties of viruses and characteristics of virus diseases of animals.

420. Dairy Hygiene.
   (2-6) Cr. 4. F.W.S.
   Prerequisite: First 3 years of veterinary curriculum.
   Study of effect of bovine diseases and sanitation on safety and quality of milk and milk products.

421, 422, 423. Infectious Diseases.
   421, 422: (4-0) Cr. 4 each; 423: (4-3) Cr. 5. F.W.S.
   Prerequisite: First 3 years of veterinary curriculum.

426. Meat Hygiene.
   (3-0) Cr. 3. S.
   Prerequisite: First 3 years of veterinary curriculum.
   Organization of federal division of meat inspection, slaughter of meat-producing animals, methods of inspection, and rules for disposition of abnormal meat.

427. Livestock Sanitation.
   (3-0) Cr. 3. S.
   Prerequisite: Bact. 200 or 304.
   Principles of sanitation and methods of controlling common animal infections. Designed for students of animal science and vocational agriculture.

428. Poultry Sanitation.
   (3-0) Cr. 3. Alt. S Offered 1966.
   Prerequisite: Bact. 200 or 304.
   Study of principles of sanitation and methods of controlling common poultry diseases. Designed for poultry science students.

490. Special Problems.
   (1-5) Cr. arr.
   Prerequisite: Permission of department head.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

509. General Virology.
   (Bact. 509) See Bacteriology.

520. Serology.
   (2-6) Cr. 4. F.
   Prerequisite: 224 or Bact. 304.
   Principles of serological diagnosis of the infectious diseases of animals.

   (3-0) Cr 3. W.
   Prerequisite: 225, 226.
   Factors which influence the spread and perpetuation of animal diseases in animal and human populations.

590. Special Topics.
   Cr. 1 to 5. F.W.S.

COURSES FOR GRADUATE STUDENTS, major or minor

604. Seminar.
   (1-0) Cr. 1. F.W.S. Mr. Packer.

625. Pathogenic Bacteriology.
   (3-6) Cr. 5. S.
   Prerequisite: 224, 225. Mr. Packer.
   Advanced study of the pathogenic bacteria and technical procedures used in research.

626. Animal Virology.
   (3-3) Cr. 4. S.
   Prerequisite: 226, V.Path. 256 or 553, permission of instructor. Mr. Gratzek.
   Advanced study of animal viruses and technical procedures used in research.
629. Immunology.
(3-6) Cr. 5. W.
Prerequisite: 225, 226, 520, permission of instructor, Mr. Kaeberle.
Mechanism of antibody formation, immunity to disease and detailed study of the procedures used in the detection of antibodies.

690. Research.
Messrs. Frank, Gratzek, Hofstad, Kaeberle, Manthey, Merchant, Mott, Packer, Pier, Sutner, Wedman.

VETERINARY PATHOLOGY
Frank K. Ramsey, D.V.M., Ph.D., Head of Department


ASSISTANT PROFESSOR: Virginia L. Marshall, M.S.


Opportunities for Undergraduate Study
For undergraduate curriculum in veterinary medicine leading to the degree Doctor of Veterinary Medicine, see Veterinary Medicine, Curriculum.

The Department of Veterinary Pathology offers a systematic study of the dynamics of the disease process. Emphasis is placed on the manner in which disease brings about alterations in the anatomical structure and chemical and physiologic activities of animal cells, tissues, organs and body systems. The application of these studies forms the basis for more accurate diagnosis which is essential for the treatment and prevention of animal diseases.

Opportunities for Graduate Study
The department offers major work for the degrees Master of Science and Doctor of Philosophy in veterinary pathology and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum leading to the degree Doctor of Veterinary Medicine.

Minor work is recommended in other departments of the College of Veterinary Medicine, and in bacteriology, chemistry, zoology, entomology, physics, botany, genetics, psychology, or education.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

254. General Pathology.
(3-4) Cr. 5. F.
Prerequisite: V. Anat. 103, 113, V. Phys. 164.
Causes and effects of disease applying to the body as a whole.

255, 256. Special Pathology.
255: (3-4); 256: (3-6) Cr. 5 each. W.S.
Prerequisite: 255: 254; 256: 255.
Etiology, pathogenesis, lesions, and termination of disease in organs or systems of organs.

257, 258. Veterinary Parasitology.
257: (3-2); 258: (3-3) Cr. 4 each. W.S.
Prerequisite: 257: 255; 258: 257.
Parasites and parasitic diseases of animals and the principles of their control.

450. Applied Avian Pathology.
(3-0) Cr. 3. F.
Prerequisite 256, 258, V. Hyg. 224, 225.
Problems of disease and resistance encountered in poultry.

451. Veterinary Toxicology.
(3-0) Cr. 3. W.
Prerequisite: Fourth year classification in veterinary medicine.
A study of the diagnosis of diseases caused by and the mode of action of toxicologic compounds.

455. Post-Mortem and Clinical Pathology.
(0-9) Cr. 3. S.
Prerequisite: 256, 258.
Post-mortem and laboratory techniques applied to diagnosis of veterinary hospital and field cases.

490. Special Problems.
Cr. 1 to 5 each time taken. Yr.
Prerequisite: Permission of department head.
COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

511. Neuroanatomy. (V. Anat. 511) (2-0 or 2-6) Cr. 2 or 4. Alt F. Offered 1966. 
Prerequisite: Permission of instructor. Messrs. Getty, Ramsey. 
Central and peripheral nervous systems including the organs of special sense.

551. General Pathology. (3-4) Cr. 5. F. 
Prerequisite: V. Anat. 103, 113. Mr. Ramsey. 
Fundamentals of disease with emphasis on disease in animals.

552, 553. Special Pathology. 552: (3-4); 553: (3-6) Cr. 5 each. W.S.


Prerequisite: 511, 653. Mr. Ramsey. 
Advanced study of diseases of the nervous system.

655. Physiopathology of the Skeletal System. (3-0 or 3-4) Cr. 3 or 5. Alt W. Offered 1965-66. 
Prerequisite: 653. Mr. Ramsey. 
An advanced study of the nutritional and infectious diseases of bones and joints of animals.

656. Advanced Veterinary Pathology. (1-3 to 12) Cr. 2 to 5. F.W.S. 
Prerequisite: 256, 258 or 553, 558. 

557. 558. Veterinary Parasitology. 
557: (3-2); 558: (3-3) Cr. 4 each. W.S. 
Problems of parasitism in relation to animals.

590. Special Topics. 
Cr. 1 to 5 : F.W.S. 
Prerequisite: 256. Mr. Ramsey. 
Special topics in the field of veterinary pathology and parasitology.

COURSES FOR GRADUATE STUDENTS, major or minor


653. Cellular Pathology. (3-0 or 3-4) Cr. 3 or 5. F. 
Prerequisite: 256 or equivalent. Mr. Ramsey. 
Fundamentals involved in the pathogenesis of disease processes.

659. Advanced Veterinary Parasitology. (1-3 to 12) Cr. 2 to 5. F.W.S. 
Prerequisite: 256, 258 or 553, 558. Messrs. Benbrook, Greve, Zimmermann. 
Introduction to research in animal parasitology.

660. Pathology of Parasitic Diseases. (2-6) Cr. 5. Alt. SS Offered 1966. 
Prerequisite: V. Path. 551 or equivalent. Messrs. Greve, Zimmermann. 
An advanced study of disease processes associated with parasitism in domestic animals.

690. Research. 

VETERINARY PHYSIOLOGY AND PHARMACOLOGY
Melvin J. Swenson, D.V.M., Ph.D., Head of Department


INSTRUCTORS: Larry D. Claborn, D.V.M.; Richard L. Engen, M.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree Doctor of Veterinary Medicine, see Veterinary Medicine, Curriculum.

A thorough knowledge of basic physiology is imperative in order to understand physiologic changes encountered in metabolic and infectious diseases. In physiology courses the students make a detailed study of functions and activities of cells, tissues, organs and systems constituting the animal body.

Pharmacology in its broad sense is the science that investigates drugs, and for convenience
of study often is subdivided into pharmacognosy, pharmacy, pharmacodynamics, and toxicology. Each of these is given proper consideration in the courses in pharmacology, with special emphasis on drugs and therapeutic practices important in veterinary medicine.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in physiology and minor work to students taking major work in other departments.

Instruction and research facilities in biomedical engineering are provided jointly by the Departments of Electrical Engineering, Veterinary Anatomy, and Veterinary Physiology and Pharmacology. See Biomedical Engineering for requirements for graduate minor.

Students expecting to do major work should have fundamental knowledge of physiology, mathematics, zoology, anatomy, physics and chemistry.

Open to graduate students for minor only: 366, 461, 462, 463, 490.

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

164. Comparative Mammalian Physiology.
(5-3) Cr. 6. S
Prerequisite: V. Anat. 102, 112.
Basic concepts and principles in physiology. Physiology of the nervous and muscular systems.

264. Physiology of Domestic Animals.
(3-0) Cr. 3 W S
Prerequisite: V. Anat. 217.
For agricultural and other students who are interested in basic and applied animal physiology.

265. Comparative Mammalian Physiology.
(5-3) Cr. 6. F
Prerequisite: 264
Physiology of digestion, absorption, metabolism, energy, temperature regulation, special senses, cardiovascular system including blood coagulation and circulating fluids of the body.

266. Comparative Mammalian Physiology.
(5-3) Cr 6. W
Prerequisite 265
Physiology of respiration, excretion, skin, endocrine organs, reproduction, and lactation.

267. Pharmacology.
(4-0) Cr. 4. S
Prerequisite: 266
Measurement, administration, distribution, and elimination of drugs. Introduction to specific drugs.

366. Avian Physiology.
(2-3) Cr. 3. Alt. W Offered 1966
Prerequisite: 264 or equivalent.

Basic physiological processes in poultry with emphasis on the chicken.

367, 368. Pharmacology.
(3-3) Cr. 4 each F.W.
Prerequisite: 266, 267.
Pharmacodynamics of drugs and their classes which are important in veterinary medicine.

461. Comparative Mammalian Physiology.
(4-0 or 4-3) Cr. 4 or 5. S
Prerequisite: Permission of instructor.
Adapted for graduate students as minor work in fields of animal, dairy or poultry science; in biological sciences, chemistry and home economics. Same applies to 462 and 463. Basic concepts and principles in physiology. Physiology of the nervous and muscular systems.

462. Comparative Mammalian Physiology.
(4-0 or 4-3) Cr. 4 or 5. F
Prerequisite: Permission of instructor.
Physiology of digestion, absorption, metabolism, energy, temperature regulation, special senses, cardiovascular system including blood coagulation and circulating fluids of the body.

463. Comparative Mammalian Physiology.
(4-0 or 4-3) Cr. 4 or 5. W
Prerequisite: Permission of instructor
Physiology of respiration, excretion, skin, endocrine organs, reproduction, and lactation.

490. Special Problems.
Cr. 1 to 5 each time selected Yr.
Prerequisite: Permission of department head. Staff.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

510. Endocrinology.
(V. Anat. 510) (4-3) Cr. 5. Alt. S. Offered 1967
Prerequisite: Permission of instructor Messrs. Getty, Swenson. Embryology, structure, and function of endocrine organs.

514. Physiology for Biomedical Engineering.
(3-3) Cr. 4 W
Prerequisite: V. Anat. 513, credit or classification in E.E. 302 or 445. Chem. 484 Mr. Cholvan.
Mammalian physiology from an engineering point of view. Functional studies of neural and chemical regulatory processes, using the dog as the pattern animal. Mathematical problems in circulation, diffusion, respiration, metabolism, acid-base balance, and neuromuscular and autonomic functions. Designed for students in biomedical engineering and available to other interested and qualified students.
590. Special Topics.
(1-5) Cr. 1 to 5.
Prerequisite: Permission of instructor.
Special work in instrumental methods, lactation, reproduction, psychotropic drugs, autonomic drugs, smooth muscle physiology, hematology, biochemistry of diseases, biomedical mathematics, or other subjects.

COURSES FOR GRADUATE STUDENTS, major or minor

604. Seminar.
Cr. 1.
Prerequisite: Permission of instructor. Staff.
A student participation seminar in which graduate students present an oral and written review of an assigned topic.

660. Digestive Physiology.
(3-0) Cr. 3. Alt. S. Offered 1966.
Prerequisite: Permission of instructor.
Neuromuscular characteristics of digestive tract, digestion, absorption, microbial digestion, and a comparative study of differences between ruminant and simple-stomached animals.

690. Research.
Messrs. Cholyn, Crump, Gillette, Klemm, Picken, Swenson.

WATER RESOURCES

Advisory Committee: Don Kirkham, Ph.D., Chairman; E. R. Baumann, Ph.D.; R. J. Beers, Ph.D.; K. D. Carlander, Ph.D.; J. D. Dodd, Ph.D.; G. E. Gatherum, Ph.D.; K. M. Hussey, Ph.D.; H. P. Johnson, Ph.D.; J. F. Timmons, Ph.D.; Helen J. VanZante, Ph.D.

Major work in water resources is offered for the degrees Master of Science and Doctor of Philosophy under a cooperative arrangement with various departments including Agricultural Engineering, Agronomy, Bacteriology, Botany and Plant Pathology, Civil Engineering, Dairy and Food Industry, Economics, Forestry, Geology, Household Equipment and Zoology and Entomology. Minor work is offered to students taking major work in other areas. Facilities exist in several departments for fundamental research in such areas as source, distribution and movement of water (hydrology); hydraulics of water control facilities; physical, biological and chemical properties of water (water quality); and economics of water resource development.

A student majoring in water resources will choose a major professor from the graduate faculty membership of the cooperating departments and will develop his program of study under the guidance of a committee nominated by the administrative department head, approved by the Water Resources Advisory Committee; and appointed by the Dean of the Graduate College. For administrative purposes the student will be in the department of his major professor.

WILDLIFE BIOLOGY

For description of courses, see Zoology and Entomology.

ZOOGY AND ENTOMOLOGY

Oscar E. Tauber, Ph.D., Chairman of Department


Associate Professors: John H. D. Bryan, Ph.D.; Ian M. Campbell, Ph.D.; Jewett Dunham, Ph.D.; Wilbur D. Guthrie, Ph.D.; Delma E. Harding, Ph.D.; Robert B. Moorman,
Opportunities for Undergraduate Study

For undergraduate curriculum in sciences and humanities, major in zoology, see College of Sciences and Humanities, Curriculum. For undergraduate curricula in agriculture, majors in entomology or fisheries and wildlife biology, see College of Agriculture, Curricula.

Majors in the department find employment as teachers and research workers, wildlife and fishery biologists, entomologists, research aides, extension specialists, and as technicians in industrial laboratories, hospitals, and clinics.

The department offers courses fundamental to specialization in the various branches of zoology and biology and the teaching of biological sciences, as well as in human and veterinary medical sciences, agriculture, and home economics. The curricula are flexible and adaptable to the needs of the individual. Opportunity is given for each student to plan his program of courses so that emphasis is put on his own vocational objective. Undergraduate preparation is offered in fisheries biology, wildlife biology, entomology, general zoology, physiology, parasitology, embryology and in pre-medical, pre-dentistry, and pre-medical technology requirements.

Undergraduate majors in this department usually include the following basic courses in their programs: 101, 102, 224, 234, 274, 303, 311, 355, 407, 424. As supporting work, undergraduate majors have found the following courses desirable: Gen. 301; Bot. 101, 310; Chem. 101, 102, 103, 334, 335; Psych. 101; Soc. 134; Math. 101, 102, 110; Stat. 201; Geol. 100; Phys. 111, 112, 113; Bact. 304; Econ. 241, 242.

These courses are not to be regarded as fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of the students or advisers who wish to estimate the amount of basic, nonspecialized study which may be needed.

Majors in the Department of Zoology and Entomology are encouraged to take advantage of the special opportunities available in summer courses at the Iowa Lakeside Laboratory at Lake Okoboji. Those students interested should consult with, or write to, the department chairman.

Opportunities for Graduate Study

The department offers major work for the degrees Master of Science and Doctor of Philosophy in the fields of general zoology, morphology, ecology, taxonomy, embryology, cytology, physiology (vertebrate and comparative), parasitology (protozoology and helminthology), acarology, entomology (morphology, taxonomy, toxicology, insect physiology, and general, medical and economic entomology), wildlife management, fisheries management, and fisheries and wildlife biology, and minor work to students taking major work in other departments.

Prerequisite to major and minor graduate work in the Department of Zoology and Entomology is the completion of at least two years of zoological courses, for part of which credit in other closely allied biological sciences may be substituted. Specific course requirements for advanced degrees depend upon previous training and experience in the major field of specialization.

Major and minor work in the area of cell biology is offered under cooperative arrangement with the Departments of Bacteriology, Biochemistry and Biophysics, Botany and Plant Pathology, and Genetics. For description, see Cell Biology.

Zoology and Entomology is one of the cooperating departments in the Water Resources program; see Water Resources.
394/Description of Courses

Zoology and Entomology is one of the cooperating departments in the Biology Program; see Biology.

Graduate programs of the fisheries and wildlife section of the department are associated with the Iowa Cooperative Fisheries Research Unit, and the Iowa Cooperative Wildlife Research Unit. The European Corn Borer Laboratory at Ankeny, Iowa, is available for advanced study in certain phases of entomological research. Various graduate courses in zoology are taught during the summer, and special research projects are supervised at the Iowa Lakeside Laboratory, Lake Okoboji.

Open to graduate students for minor only: 402, 407, 424, 434, 447, 448, 464, 465.

Index of field of work is given by the second and third figures of course numbers:

00-09 General Zoology
10-19 Parasitology
20-29 Anatomy
30-39 Embryology
40-49 Wildlife Biology

50-59 Physiology
60-69 Fisheries Biology
70-79 Entomology
90-99 Problems and Research

COURSES PRIMARILY FOR UNDERGRADUATE STUDENTS

100. Technical Lecture.
(1-0) Cr. R. F. Selected staff.
Orientation to fields of entomology and fisheries and wildlife. Required of agriculture students majoring in entomology and fisheries and wildlife biology.

(3-3) Cr. 4. F.W.S.SSI Mr Dunham
Principles of modern animal biology; introduction to molecular basis of life and organization of cells and tissues; interrelationships of structure and function in living systems.

102. The Animal Kingdom.
(3-3) Cr. 4. F.W.S.SSI, Mr Mutchmor
Phylogeny, classification, and animal organization demonstrated through a survey of major phyla; emphasis on selected animals important to man’s welfare.

(3-0) Cr. 3. W.
Prerequisite 101 or 102. Mr. Voks.
History and biological basis of fish and wildlife conservation.

155. Elementary Human Physiology and Anatomy.
(3-4) Cr. 5. F.W.S.SSII Mrs Elwell
Miss Harding
Basic physiology and anatomy of human organ systems. Not accepted as credit toward a major in zoology.

224. Comparative Anatomy.
(2-6) Cr. 4. F.W.S.
Prerequisite 101, and 102 or V. Anat. 217
Mr. Hicks.
Study of selected vertebrate types with emphasis on those not examined in general courses.

234. Vertebrate Embryology.
(3-6) Cr. 5. F.W.S.SSI
Prerequisite 101, and 102 or V. Anat. 217;
224 recommended Mr. Arnold
Introduction to principles and mechanisms of embryonic development of vertebrates.

274. General Entomology.
(2-6) Cr. 4. F.S.SSI
Prerequisite 101 or 102 Mr. Lafloun
Structure, life history, habits and recognition of common insects, with interesting facts about their relations with man. Field trips.

301. Elements of Animal Biology.
(3-0) Cr. 3. F.W.
Prerequisite Junior standing Mr. Redmond

*Courses administered by the College of Agriculture. All others administered by the College of Sciences and Humanities.
358. Physiology of Reproduction. (2-3) Cr. 3. F.W.S.
Prerequisite: 101 or 155. Mrs. Fassel.
Physiological aspects of intra-uterine life; maternal-fetal relationships; reproductive hormones. Not open for credit to students who have had 234 or 434.

359. Kinesiology. (3-6) Cr. 3. F.W.S..S.SI.
Prerequisite: 102 or 155, P.E.M. 213.
Mr. Haupt.
Analysis of human motion in terms of skeletal, articular and muscular systems. For physical education students.

*370. Principles of Applied Entomology. (2-4) Cr. 4. W.
Prerequisite: 274 Messrs. Dahm, K. Knight.
Identification and biology of economic insects. Methods of insect control.

*371. Field Entomology. (4-12) Cr. 8. S.S.SI.
Prerequisite: 102 or 102. Mr. K Knight.
Offered only at the Iowa Lakeside Laboratory. Survey of insect world including classification, life histories, literature, and ecology. Emphasis on field observations, making and naming personal collection of insects. Field trips.

374. Agricultural Entomology. (3-3) Cr. 4. W.
Prerequisite: 101 or 102. Mr. Peters.
Life history, recognition and control of principal insects and other arthropods attacking plants and animals.

375. Horticultural Entomology. (2-4) Cr. 4. F.
Prerequisite: 101 Mr. Hbbis.
Concepts of applied entomology; life histories of major insect pests of horticultural crops; insect collection and identification. Not open for credit to students having taken 274, 370, 374, or 377.

*377. Forest Entomology. (For 377) (2-4) Cr. 4. F.
Prerequisite: 101 or 102. Mr. Campbell.
Concepts of applied entomology; life histories of major insect pests of forests; insect collection and identification. Not open for credit to students having had 274, 370, 374, or 375

*402. Animal Ecology. (3-3) Cr. 4. F.
Prerequisite: 16 credits in Biol., including 8 credits in Zool. Mr. Vohs.
Relation of animals to environment; geographical distribution, climatic factors, ecological succession. Field and experimental work.

407. Invertebrate Zoology. (2-6) Cr. 4. S.S.SI.
Prerequisite: 101 or 102 Mr. Shaw.
Advanced study of invertebrates stressing classification, morphology, life history and evolutionary relationships. Field trips.

424. Histological Techniques. (1-9) Cr. 4. F.W.S..S.SI.
Prerequisite: 101 or 102. Mr. Butten.
Methods of fixing, sectioning, mounting and staining tissues for microscopic study.

426. Physical Growth of Children. (3-0) Cr. 3. F.
Prerequisite: 358. Mr. Haupt.
For child development majors. Changes in body structure from infancy through childhood. Factors influencing body growth.

434. Embryology. (2-6) Cr. 4. W.S.SI. Mr. Arnold.
Prerequisite: 224, permission of instructor. Principles and processes of embryonic development.

*447. Mammalogy. (2-6) Cr. 4. F.
Prerequisite: 224, Mr. Weller.
Biology, identification and classification of major groups of mammals. Field trips.

*448. Wildlife Techniques. (2-6) Cr. 4. S.
Prerequisite: 340, 402, 407; Bot. 424. Mr. Vohs.
Survey and evaluation of techniques for studying life histories and populations of game birds and mammals; laboratory and field work, including extended trips.

464. Ichthyology and Herpetology. (3-6) Cr. 5. S.
Prerequisite: 224. Mr. Bachmann.
Biology, classification, and life histories of fishes, amphibians, and reptiles. Field trips.

465. Fisheries Management. (4-3) Cr 5. F.
Prerequisite: 464. Mr. Carlander.
Concepts and practices relating to maintenance and improvement of fishery resources. Lake and stream surveys for evaluations as fish habitat. Field trips.

490. Special Problems in Zoology. Cr. 2 to 5 each time taken. F.W.S.SI. II.
Prerequisite: 15 credits in Zool. permission of instructor Staff.
Individual problems for beginners in research.

*Courses administered by the College of Agriculture. All others administered by the College of Sciences and Humanities.

COURSES PRIMARILY FOR GRADUATE STUDENTS, major or minor, open to qualified undergraduates

500. Seminar. Cr. 1. F.W
Prerequisite Permission of instructor. Mr. Tauber.
Reports of original investigations, current literature, special features.

503. Primate Evolution. (3-0) Cr. 3. S.
Prerequisite: 15 credits in Zool. Mr. Hbbis.
Relationships and developmental history of primates.

Prerequisite: 20 credits in Biol. Mr. Hbbis.
Biology, morphology, ecology, phylogenetic relationships, and economic importance of arachnids, especially mites, ticks and spiders.

*505. Limnology. (3-6) Cr. 5. F.
Prerequisite: 402 or permission of instructor. Mr. Bachmann.
Physical, chemical, and biological processes of lakes and streams, and their relationships to biological productivity, ecological succession, and water quality Field trips.

507. Ethology. (3-3) Cr. 4. F.
Prerequisite: 16 credits in Zool. Mr. Shaw.
Comparative approach to study of animal behavior. Description, classification, analysis,
and evolution of behavioral patterns of invertebrates and vertebrates. Special emphasis on orientation, communication, stereotyped behavior patterns, and underlying mechanisms.

511. Protocology
(2-6) Cr. 4. W.S.SSI.
Prerequisite: 311. Mr. Buttery.
Survey of the free-living and parasitic protozoans; evolution, identification, life cycles, and host-parasite relationships.

512. Helminthology
(2-6) Cr. 4. F.S.SSI.
Prerequisite: 224, 311. Mr. Ulmer.
Survey of the cestodes, trematodes, and nematodes parasitic in wildlife, laboratory animals, and man; study of selected vectors; identification, life histories, and host-parasite relationships emphasized. Also taught SS1 at Iowa Lakeside Laboratory for 8 credits.

527. Normal Histology
(2-6) Cr. 4. W.S.SSI.
Prerequisite: 234. Mr. Bryan.
Microscopic structure of tissues and organs of vertebrates in relation to function.

528. Animal Cytology
(3-6) Cr. 5. F.
Prerequisite: 424 or 9 credits in Biol.; Gen. 301; permission of instructor. Mr. Bryan.
The cell as a structural and functional unit. Role of nucleus and cytoplasm in cellular processes, development, and inheritance.

529. Cytochemistry
(3-6) Cr. 5. S.
Prerequisite: 528 or Bot 504; organic chemistry; permission of instructor; microtechnique recommended. Mr. Bryan.
Theory and techniques for chemical analysis of individual cells. Interpretation of cell chemistry in relation to replication differentiation and growth.

538. Experimental Embryology
(3-6) Cr. 5. S.
Prerequisite: Permission of instructor. Mr. Arnold.
Physiology of germ-cells; parthenogenesis; marking and grafting experiments on living embryos; tissue-culture techniques.

550. Comparative Animal Physiology
(3-6) Cr. 5. S.
Prerequisite: 355. Mr. Redmond.
Functions in various phyla, with interpretations in terms of morphology, ecology and evolution.

551, 553. Advanced Vertebrate Physiology
(3-3) Cr. 4 each. 551: F; 552: W; 553: S.S.SII.
Prerequisite: 224 or V.Anat. 304 or equivalent; 355; 1 quarter organic chemistry; 1 quarter college physics. Mr. Griffith.
Primarily mammalian, systemic physiology with some cellular mechanisms. 551: Blood, nervous system, muscle. 552: Circulation, respiration, digestion. 553: Metabolism, excretion, endocrinology.

554. Comparative Endocrinology
(3-0) Cr. 3. W.
Prerequisite: 224 or V.Anat. 304 or equivalent; 355 recommended; 1 quarter organic chemistry; 1 quarter college physics. Mr. Griffith.
Structure and function of endocrine systems of invertebrate and vertebrate animals.

555. General Physiology
(3-6) Cr. 5. F.
Prerequisite: Math. 110; courses in college physics, organic chemistry, and plant or animal physiology. Mr. Dunham.
Animal physiology from study of isolated cells and tissues.

563. Fish Propagation
(2-3) Cr. 3. W.
Prerequisite: 465. Mr. Bachmann.
Principles and techniques of fish propagation, hatchery operation, nutrition, disease problems, and fish-pond management.

570. Insect Resistance in Crop Plants
(3-0) Cr. 3. Alt. W. Offered 1966.
Prerequisite: 274 or equivalent; Gen. 301. Messrs. Ballou, Ways.
Principles and mechanisms of insect control by host plant resistance.

572. Insect Morphology
(2-9) Cr. 5. F.
Prerequisite: 15 credits in Zool., including 274. Mr. K. Knight.
Intensive study of the external and internal anatomy and histology of insects.

574. Medical Entomology
(2-6) Cr. 4. S.
Prerequisite: 15 credits in Zool., including 274 or equivalent. Mr. K. Knight.
Identification, life histories and control of insects and near relatives attacking man, particularly those forms which are disease vectors. Field trips.

576, 577, 578. Systematic Entomology
(2-6) Cr. 4 each Yr.
Prerequisite: 572. Mr. Lafoon.

590. Special Topics
Cr. 2 to 5 each time taken. P.W.S.SSI, II. Prerequisite: 15 credits in Zool., permission of instructor.

COURSES FOR GRADUATE STUDENTS, major or minor

601. Zoological Literature
(3-0) Cr. 3. W.
Prerequisite: 15 credits in Zool. Mr H. Knight.
Review of literature and classical authors of zoology and entomology; nomenclators; rules of zoological nomenclature.

*603. Population Dynamics
(5-0) Cr. 3. Alt. W. Offered 1966.

Prerequisite: 402, Gen. 301. Messrs. Campbell, Carlander.
Discussion of role of environmental and genetic variation in fluctuation of animal populations.

*Courses administered by the College of Agriculture. All others administered by the College of Sciences and Humanities.
612. Advanced Parasitology.  
(3-0) Cr. 3. Alt. S. Offered 1966.  
Prerequisite: 511, 512. Mr. Ulmer.  
Special phases in host-parasite relationships of parasitic protozoa, worms and arthropods.

*645. Wildlife Management.  
(3-0) Cr. 3. Alt. W. Offered 1966.  
Prerequisite: 448. Mr. Weller.  
Theories and principles of wildlife conservation, management practices, and special topics.

655. Insect Physiology.  
(3-0 or 3-6) Cr. 3 or 5. W.  
Prerequisite: 355 or 555; equivalent of 572 or permission of instructor. Mr. Mutchmor.  
Life processes, organ functions of insects.

662. Techniques of Fisheries.  
(3-3) Cr. 4. Alt. S. Offered 1966.  
Prerequisite: 465; Stat. 402. Mr. Carlander.  
Critical analysis of methods for studying fish growth, food habits, population estimation and mortality rates.

663. Fisheries Resources.  
(3-0) Cr. 3. Alt. W. Offered 1967  
Prerequisite: 465. Mr. Carlander.  
Survey of fishery resources; analysis of problems concerned with commercial and sport fisheries and their management.

*675. Insect Toxicology.  
(3-3) Cr. 4. Alt. S. Offered 1966.  
Prerequisite: 555 or 655, 572. Mr. Dahm.  
Chemistry and mode of action of modern insecticides.

690. Research.  
A. Zoology. Messrs. Arnold, Bryan, Buttrey, Hicks, Ulmer.  

698. Seminar in Cell Biology.  
(B. and B. 698, Bot. 698E, Gen. 698) (1-0)  
Cr. 1. S.  
Prerequisite: Permission of instructor. Messrs. Bowen (Bot.), Bryan (Zool.), and Roth (B. and B.).  
Discussions of concepts and research in cell biology.

*Courses administered by the College of Agriculture. All others administered by the College of Sciences and Humanities.
The Technical Institute

Harold B. Ellis, Ph.D., Head of The Institute


OPPORTUNITIES AND OBJECTIVES

The technology programs offer opportunities to persons with mechanical and mathematical aptitudes who want an industrial career as an engineering technician. An engineering technician is a person who can carry out in a responsible manner either proven techniques which are common knowledge among members of the technician's field of engineering or those techniques which have been specially prescribed by professional engineers. His duties may include work on design and development of engineering plans; draftsmanship; the erection and commissioning of engineering equipment or structures; estimating, inspection and testing of engineering equipment; operating, maintaining and repairing engineering plants. Engineering technicians also work in activities connected with research and development, sales engineering and representation. The work of the engineering technician is classified as the technical functions of engineering.

In many instances the engineering technician may serve as the liaison between the professional engineer or scientist on the one hand and the skilled craftsman on the other. Surveys have indicated that during the present decade industry will double its requirement for engineering technicians. Many industries are finding that well-trained engineering technicians perform very successfully in positions traditionally occupied by graduates of engineering programs. In Iowa, industrial management has frequently expressed an urgent need for engineering technicians and with the increasing industrialization of the state, the need will continue to grow.

Admission Requirements

To qualify for admission to the Technical Institute, a student normally must be a graduate of an approved high school and have completed successfully one and one-half units of high school algebra and one unit of high school geometry. Prospective students are urged to present additional high school credits in English, mathematics, physics and chemistry. Those who have not been graduated from an approved high school and who wish to make application for admission to the Institute will be considered on an individual basis after completing certain tests and entrance examinations.
## PROGRAMS

### Chemical Industries Technology

Leading to a certificate as Associate in Applied Science. Total credits required, 107.

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### Construction Technology

Leading to a certificate as Associate in Applied Science. Total credits required, 116.

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Total credits required, 116.
### Electronics Technology

Leading to a certificate as Associate in Applied Science. Total credits required, 110.

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### Mechanical Technology

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Technical Institute/401

COURSES OPEN TO TECHNICAL INSTITUTE STUDENTS ONLY

**Courses in Applied Graphics**

40. Technical Drawing. 
   **(1-6) Cr. 3**
   Lettering, freehand sketching, use of scales and drawing instruments, theory of orthographic projection and pictorial drawing. Geometry of bearing, slope, true length and true size. Standards for sections, symbols and basic size specifications.

44. Electrical Drawing. 
   **(0-6) Cr. 2**
   **Prerequisite: 40.**
   Applications of the principles of technical drawing and development of skills in producing drawings of electronic circuits and equipment. Discussion of standard symbols and nomenclature, and short cuts in describing complex wiring layouts. Empirical equations derived from plots constructed from text data. Alignment charts. Practice in producing circuit diagrams for formal presentation.

45. Technical Geometry. 
   **(1-6) Cr. 3**
   **Prerequisite: 40.**
   Graphical solutions for geometrical problems encountered in layout and design. Clearance problems, dihedral angles, intersection of lines and planes with other planes, curved and warped surfaces.

46. Mechanical Detailing. 
   **(0-9) Cr. 3**
   **Prerequisite: 40.**
   Preparation of production drawings to be supplied to the shop or to be used wherever a product is manufactured, fabricated or erected. Specifications of size, shape, material, and manufacture. Standard fastener specifications, including threads, welds, rivets, keys, splines and springs. Allowance specifications for mating parts and standards of surface quality. Graphic illustration for interpretation and presentation.

47. Graphical Mathematics. 
   **(0-6) Cr. 2**
   **Prerequisite: 40, credit or classification in Math. 52.**

**Courses in Applied Mechanics**

   **(4-0) Cr. 4**
   **Prerequisite: Credit or classification in Math. 52, Phys. 72.**
   Analysis of forces acting in and upon structures. Reactions of structures and supporting bodies to applied loads. Friction. Geometrical properties, including moment of inertia, of shapes used in structural design.

   **(2-3) Cr. 3**
   **Prerequisite: Credit or classification in 32.**
   Study of general physical properties of materials such as modulus of elasticity, yield point, ultimate strength, endurance limit, etc. Specific physical properties of the ferrous metals, aluminum alloys, other metals, wood, and clay products. Laboratory tests to verify analytical expressions. Stress and load carrying capacities of beams, circular shafts in torsion, and columns.

   **(4-0) Cr. 4**
   **Prerequisite: 30.**
   Elements of stress analysis as applied to axially loaded members, riveted and welded joints, beams, circular shafts, helical springs and columns when subjected to static, repeated or impact loading.

33. Hydraulics. 
   **(1-0) Cr. 3**
   **Prerequisite: Credit or classification in 32.**
   Study of hydrostatic pressure, flow of water in a pressure conduit system, open channel flow, weirs, venturi meters, and a brief study of hydrology.

34. Concrete. 
   **(1-0) Cr. 3**
   **Prerequisite: 31.**

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**DESCRIPTION OF COURSES**

FALL QUARTER | WINTER QUARTER | SPRING QUARTER
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Introductory Mechanics | Metallurgy I | Public Speaking
A M. 30 | M Tch 79 | Sp 30
Power Application | Design Technology I | Survey of Accounting
E Tch 81 | M Tch 81 | I Ad 75
Mechanisms | Elements of Thermodynamics | Applied Thermodynamics
M Tch 78 | M Tch 85 | M Tch 86
Introduction to Business and Industrial Organization | | Measurements Laboratory
I Ad 99 | | M Tch 90

Credits
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19 | 17 | 19

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Courses in Chemical Industries Technology

10. Industrial Stoichiometry I. (1-3) Cr 2 F.
   Prerequisite Credit or classification in Chem 30, Math 50, Phys. 71.
   Methods of problem solving, use of slide rule, engineering units, systems of measurement, introduction to industrial stoichiometry.

11. Industrial Stoichiometry II. (2-0) Cr 1 W.
   Prerequisite 10 and credit or classification in Chem 31, Math 51, Phys 72.
   Engineering units and systems of measurement; material and energy balance calculations; industrial chemical problem solving techniques.

51. Basic Chemical Industries. (3-3) Cr 4 F.
   Prerequisite Chem 32.
   History, economics, raw materials, manufacturing processes, and products of selected chemical industries. Emphasis on the petrochemical, fertilizer, gypsum, pharmaceutical, plastics, rubber, corn milling and oil seed extraction industries of Iowa.

61. Unit Operations of the Chemical Industries I. (2-6) Cr 4 W.
   Prerequisite 11, Math 52.
   Principles of fluid flow, pipe fitting practice, pump characteristics and over-pressure safety devices. Principles of solids handling systems, storage, conveying and fluidization. Application of crushing, grinding, and size separation equipment.

62. Unit Operations of the Chemical Industries II. (2-6) Cr 4 W.
   Prerequisite 61.
   Applications of filters, centrifuges, flotation and cyclones. Principles of heat transfer applied to heat exchangers, evaporators and dryers.

63. Unit Operations of the Chemical Industries III. (2-6) Cr 4 S.
   Prerequisite 62.
   Physical-chemical separation operations including absorption, distillation, extraction and crystallization.

71. Control Instruments in the Chemical Industries. (2-6) Cr 4 W.
   Prerequisite Credit or classification in 61.
   Use and installation of basic mechanical, pneumatic and electrical measurement devices in the chemical industries. Flow level, temperature, pressure, and force measurements. Comparison of accuracy of alternate methods and recording devices.

72. Process Control in the Chemical Industries. (2-6) Cr 4 S.
   Prerequisite 71.
   Use of conventional pneumatic and electrical controllers in chemical process systems. Introduction to frequency response. Principles of operation of controllers. Inter-connection of pneumatics and electrical devices. Response of flow and level systems.

80. Process Layout in the Chemical Industries. (0.9) Cr 3 S.
   Prerequisite 51, credit or classification in 63 and 72.
   Materials of construction; design and layout of chemical manufacturing processes; estimation of capital and production costs.

Courses in Chemistry

30. 31. Fundamentals of Inorganic Chemistry. (2-6) Cr 4 each 30 F; 31 W.
   General chemical principles, the Periodic Table, separation of elements in mixtures.

32. Fundamentals of Organic Chemistry. (2-6) Cr 4 S.
   Principles of organic chemistry; aliphatic and aromatic compounds, functional groups, polymers.

60. Quantitative Chemical Analysis. (2-6) Cr 4 F.
   Principles of quantitative chemical analysis, gravimetric and volumetric methods of analysis.

61. Instrumental Quantitative Analysis. (2-6) Cr 4 W.
   The use of instruments in quantitative chemical analysis.

70. Industrial Chemistry. (3-3) Cr 4 S.
   Chemical principles applied to manufacturing, properties and uses of engineering materials for mechanical technology students.

Courses in Construction Technology

14. Construction Problems. (0-6) Cr 3 F.
   Development of computing skills and orderly methods of solving practical and technical problems; use of the slide rule, graphs, tables and logarithms. Practice in solving mathematical problems usually encountered in construction and surveying.

77. Construction Drawing. (0.9) Cr 3 F.
   Introduction to drawing techniques applicable to the construction industry, development of proficiency in drafting, lettering and layout.

80. Elementary Surveying. (2-9) Cr 5 S.
   Prerequisite Credit or classification in Math 52.
   Principles and theory of surveying. Care and use of surveying equipment. Chaining, differential and profile leveling, traversing, errors of closure, computation of areas, stadia and its application to topographic mapping.

81. Route and Construction Surveying. (2-12) Cr 6 SS.
   Prerequisite 80, credit or classification in Math 51.
   Theory and field practice in circular, spiral, and vertical curves. Field and office work involved in computation of earth quantities. Setting line and grade stakes used in the construction of engineering projects.
82. Structural and Building Drawing.
(2-9) Cr. 5. W
Prerequisite: 77 or A Gr. 40.
Preparation of shop drawings from plans for buildings and structures. Detailing of structural members including floor systems, beams, columns, retaining walls and footings.

83. Highway and Municipal Drawing.
(2-6) Cr. 4 F
Prerequisite: 77 or A Gr. 40.
Preparation of plan and profile drawings for highways, municipal street improvements, drainage ditches, transmission lines, and various types of pipe lines. Drafting work connected with topographic maps, culverts, drainage systems, and other structural drawings related to highway and route construction work.

84. Street and Highway Geometrics.
(2-3) Cr. 3 W
Prerequisite: 83, 87
Use of geometrics in the design and layout of residential streets, county and state highways.

85. Construction Methods (Buildings).
(2-3) Cr. 3 F
Prerequisite: 82

86. Construction Methods (Highways).
(2-3) Cr. 3
Prerequisite: 81, 83
Study of various types of equipment used in earth moving. Methods of excavation, compaction of fills, clearing and other operations related to earth moving. Use of explosives, pile driving, sheet piling, and construction of bases and wearing surfaces for highways and airports. Study of the construction industry and the organization and operation of construction companies and consulting engineers.

87. Advanced Surveying.
(2-12) Cr. 6 S
Prerequisite: 81, Math. 52
Study of the general instructions for the subdivision of public land in the United States. Resurveys including apportionment of excess and deficiency in rural and urban surveys, the legal aspects of boundaries as they affect the land surveyor. Plotting of new subdivisions. Determination of meridian by astronomical observations.

88. Structural Design (Steel, Concrete and Timber).
(3-6) Cr. 5 W.S
Prerequisite: Math. 52, A.M. 34
Theory and design of steel, reinforced concrete, and timber structures including beam design, connections, trusses, columns and footings.

89. Photogrammetry.
(4-0) Cr. 4 S
Prerequisite: 83, 87, Math. 52
Mapping by use of aerial photographs. Interpretation of aerial photographs for surveying and drainage.

90. Paving Materials.
(1-6) Cr. 3 F
Prerequisite: Second year classification.
Survey of current practice in selecting paving materials, properties and testing of bituminous materials, mineral aggregates and paving mixtures, quality control methods.

Courses in Electronics Technology

(1-5) Cr. 3 F
Development of computing skills and orderly methods of solving technical problems; use of the slide rule, graphs, tables and logarithms. Practice in solving problems in electrical fundamentals and circuits.

80. Shop Practice.
(0-6) Cr. 2
Prerequisite 89
Techniques and mechanics of building and installing electronic equipment. Familiarization with and comparison of available parts and tools and their use. Wiring and soldering techniques.

81. Power Application.
(3-3) Cr. 4
Prerequisite 86 or Phys 72 and Math. 51
Study of applications of electrical power to perform industrial operations. Performance characteristics, and control of electric motors and machinery.

82. Electronic Testing.
(1-3) Cr 2
Prerequisite Credit or classification in 95 and 98
A study of operational theory and utilization of electrical and electronic test equipment.

84. Technical Design.
(2-9) Cr 5
Prerequisite Credit or classification in 82
Application of design principles to a selected technical project. Laboratory experience in designing and constructing an item of electronic equipment. A written technical report and periodic oral progress reports are required.

86. D-C Circuits.
(2-9) Cr. 5
Prerequisite E Tch. 14, classification or credit in Math. 51, Phys. 71

87. A-C Circuits.
(3-6) Cr 5
Prerequisite 86, credit or classification in Math. 52
Solution of alternating current circuits and more complicated networks. Methods for mathematically handling real and imaginary quantities to develop the concepts of phase angle, power factor, resonance and transformer operation.
404/Description of Courses

89. Basic Electronics.  
(3-6) Cr. 5.  
Prerequisite: Credit or classification in 87,  
Phys. 82.  
A study of the basic physics involved in the  
operation of electronic tubes. Fundamentals  
of vacuum tube circuits and devices.

90. Digital Computers.  
(3-3) Cr. 4.  
Prerequisite: Credit or classification in 93.  
A study of the theory, practice and program-  
manship of digital computers. Applications of  
Boolean algebra to logical design.

(3-3) Cr. 4.  
Prerequisite: Credit or classification in 93.  
A study of the characteristics and properties  
of transmission lines and wave guides, ant-  
ennas and study of the generation, propaga-  
tion and reception of electromagnetic energy.

93. Electronics I.  
(4-3) Cr. 5.  
Prerequisite: 89.  
Introduction to semi-conductors and transistor  
amplifiers. A study of the design and analysis  
of transistor biasing circuits and switching  
circuits.

94. Electronics II.  
(4-3) Cr. 5.  
Prerequisite: 93.  
A study of the design and analysis of power  
amplifiers and small signal amplifiers.

Courses in English and Speech

(3-0) Cr. 3 each. 20: F.W; 21: W.S.  
Prerequisite: 21:20 or equivalent.  
Principles of written composition, including  
grahram, mechanics, punctuation, vocabulary  
and sentence structure. Practice in expository  
writing.

(3-0) Cr. 3 F.W.S  
Prerequisite: 21.

Courses in General Technology

10. 11, 12. Technical Orientation.  
(1-0) Cr. R.  
10: Lectures to aid the first year Technology  
student to adjust himself to his studies and  
to campus life. 11: Nature of the work of an  
engineering technician; relationship of the  
technician to the professional engineer and  
with the skilled craftsman. Nature of the  
various branches of engineering technology  
and the basic consideration in selecting a  
career in technology. 12: Inspection trips to  
nearby industrial plants to observe engineer-  
ing technicians at work in the student’s  
chosen field of study.

99. Special Topics.  
Cr 1 to 5 each time elected.  
Special topics in technology

Courses in Industrial Administration

75. Survey of Accounting.  
(2-3) Cr. 3. F.S.  
A survey of the purposes and procedures of  
general accounting; introductory survey of  
cost accounting objectives and procedures.  
The course is designed to introduce students  
to the effective use of accounting information.

Courses in Mathematics

50, 51, 52. Applied Mathematics I, II, III.  
(3-0) Cr 5 each. F.W.S.  
Prerequisite: One and one-half units of high  
school algebra and one unit of high school  
geometry.  
50: Simultaneous linear equations, coordinate  
51: Logarithms and exponents, trigono- 
metric functions. 51: Trigonometric func- 
tions, complex numbers, vectors, quadratic  
equations. 52: Analytic geometry of simple  
conics, differential and integral calculus.
Courses in Mechanical Technology

   (1-5) Cr. 3. F.
   Development of computing skills and orderly methods of solving mechanical problems; use of the slide rule, graphs, tables, logarithms. Practice in solving problems related to mechanical technology.

75. Mechanical Standards.
   (1-3) Cr. 2.
   Prerequisite: A. Gr. 45.
   The origin and purpose of standards. Responsibility for development and maintenance of standards. Familiarization with the National Bureau of Standards, American Standards Association, ASME and other technical organizations which prepare standards in mechanical and allied fields. Detailed study of selected codes and standards.

76. Mechanical Processes I.
   (0-6) Cr. 2.
   Metal cutting operations. Basic machine tools. Planning and selection of the best method of producing parts by machine tools.

77. Mechanical Processes II.
   (0-6) Cr. 2.

78. Mechanisms.
   (4-0) Cr. 4.
   Prerequisite: A. Gr. 46.
   Linkages, screws, gears, pulleys and belts, and combinations of such mechanical elements. Methods of predicting displacements and accompanying velocities and accelerations. Synthesis of mechanisms to solve design requirements.

79. Metallurgy I.
   (2-3) Cr. 3.
   Prerequisite: 77 and Chem. 70.
   Basic principles of physical metallurgy. Structure and solidification of metals, alloy systems and phase transformations of both ferrous and non-ferrous metals. Testing and microscopic examination of typical metals.

80. Metallurgy II.
   (2-3) Cr. 3.
   Prerequisite: 79.

81. Design Technology I.
   (2-6) Cr. 4.
   Prerequisite: 78, credit or classification in A.M. 32.
   Design of components of machines by the application of principles of mechanics and kinematics. Selection of standard components. Creative solutions to simple projects.

82. Design Technology II.
   (2-6) Cr. 4.
   Prerequisite: 81.
   Selected electives in the design of machines and systems. Project to be chosen in area of student's interest to provide practice in application of design principles, including specification of materials and estimates of cost of production.

83. Technical Elective.
   Cr. 2 to 6 each time elected.
   Elective material chosen with the advice and consent of the student's adviser. Electives must be chosen to provide background material for the student's Design Technology project.

85. Elements of Thermodynamics.
   (3-0) Cr. 3. W.
   Prerequisite: Phys. 71, Chem. 70.
   Properties of fluids. Thermodynamics laws and equations. Use of tables and charts of thermodynamic properties of important fluids. Heat and fluid flow.

86. Applied Thermodynamics.
   (3-0) Cr. 3. S.
   Prerequisite: M Tch. 85.
   Continuation of M. Tch. 85. Application of thermodynamics and flow relationships to the performance of machines and systems used for producing, transforming and applying heat and mechanical energy.

90. Measurements Laboratory.
   (1-6) Cr. 3. S.
   Prerequisites: M. Tch. 85, E. Tch. 81.
   Principles of measurement. Laboratory practice in the characteristics and use of instruments used for the measurement of temperature, pressure, flow, and other variables. Preparation of reports.

Courses in Physics

71. Applied Physics I.
   (2-5) Cr. 4. F.S.
   Prerequisite: Credit or classification in Math. 50.
   Principles of measurement, kinematics, dynamics, mechanical energy, heat and geometrical optics, with applications to engineering situations.

72. Applied Physics II.
   (2-5) Cr. 4. W.
   Prerequisite: Phys. 71.
   Principles of statics, elasticity, fluids, electricity and magnetism, with applications to engineering situations.

73. Applied Physics III.
   (2-5) Cr. 4. W.S.
   Prerequisite: Phys. 72 or credit or classification in E. Tch. 86.
   Principles of physical optics, thermodynamics, modern physics and energy conversion methods, with application to engineering situations.
Short Courses
George H Ebert, M.S., Chairman
Curtiss Hall

Short Courses at Iowa State University are conducted for two purposes:
1. To enable men and women with common interests to meet for discussions of mutual problems.
2. To give them an opportunity to discuss and study their problems with University specialists in the light of current research findings.

The Short Course Bulletin is published quarterly and may be obtained by writing the chairman. Before the opening of each course, information regarding rooms, registration, location of meeting, study program and speakers is available.

The distribution of Short Courses from 1962 to 1964 was:

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<tr>
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<th>Number of Courses</th>
<th>Attendance 1962-1963</th>
<th>Attendance 1963-1964</th>
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<td>College of Agriculture</td>
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<td>13,165</td>
<td>13,772</td>
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<td>College of Engineering</td>
<td>57 63</td>
<td>4,242</td>
<td>4,937</td>
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<td>College of Home Economics</td>
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<tr>
<td>College of Veterinary Medicine</td>
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<td>105</td>
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<td>TOTAL</td>
<td>149 154</td>
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<td>20,592</td>
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### Summary of Degrees Conferred

#### 1872-1964

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<td><strong>Baccalaureate Degrees (total)</strong></td>
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<td>778</td>
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<tr>
<td><strong>Doctor of Veterinary Medicine (total)</strong></td>
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<td>2,371</td>
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<td>Master of Engineering</td>
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<td>Master of Landscape Architecture</td>
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<td>Master of Science</td>
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<td>Master of Agriculture</td>
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<tr>
<td>Master of Forestry</td>
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<td>Master of Landscape Architecture</td>
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<tr>
<td>Doctor of Engineering</td>
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<tr>
<td>Discontinued Higher Degrees</td>
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<tr>
<td><strong>All Degrees Conferred</strong></td>
<td>1,891</td>
<td>57,659</td>
<td>2,119</td>
<td>59,778</td>
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## Summary of Enrollment

**ENROLLMENT 1962-63**
A summary of different individuals enrolled during the year

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Fiscal Year</th>
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</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td><strong>Women</strong></td>
</tr>
<tr>
<td>9,801</td>
<td>2,885</td>
</tr>
</tbody>
</table>

### I. Students in residence of college grade
- **College of Agriculture**
  - 2,155
- **College of Engineering**
  - 2,635
- **Technical Institute**
  - 185
- **College of Home Economics**
  - 34
- **College of Sciences and Humanities**
  - 2,422
- **College of Veterinary Medicine**
  - 246
- **Graduate College**
  - 1,726
- **Total**
  - 9,403

### II. Students not in residence of college grade: extension, off-campus
- 451

### III. Students in residence not of college grade:
- **Music**, **Driver Training**, and **Nursery School**
  - 85

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Summer &amp; Academic Year</th>
<th>Students Attending Summer Only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td><strong>Women</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>1,245</td>
<td>499</td>
<td>1,889</td>
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</table>

### SUMMER QUARTER STUDENTS 1962

<table>
<thead>
<tr>
<th>First Term Only</th>
<th>Second Term Only</th>
<th>Twelve Weeks</th>
<th>Total</th>
<th>Summer &amp; Academic Year</th>
<th>Students Attending Summer Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,196</td>
<td>499</td>
<td>1,889</td>
<td>3,584</td>
<td>2,518</td>
<td>1,066</td>
</tr>
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</table>

### I. Students in residence of college grade
- **Agriculture**
  - 114
- **Engineering**
  - 233
- **Technical Institute**
  - 14
- **Home Economics**
  - 144
- **Sciences and Humanities**
  - 233
- **Veterinary Medicine**
  - 4
- **Graduate**
  - 422
- **Total**
  - 1,164

### II. Students not in residence of college grade: extension, off-campus
- 42

### III. Students in residence not of college grade:
- 49
# Summary of Enrollment 1963-64

A summary of different individuals enrolled during the year

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Fiscal Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td><strong>Women</strong></td>
</tr>
<tr>
<td>10,339</td>
<td>3,112</td>
</tr>
</tbody>
</table>

## I. Students in residence of college grade

<table>
<thead>
<tr>
<th>College</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>2,301</td>
<td>39</td>
<td>2,340</td>
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<tr>
<td>Engineering</td>
<td>2,556</td>
<td>14</td>
<td>2,570</td>
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<tr>
<td>Technical Institute</td>
<td>279</td>
<td></td>
<td>279</td>
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<tr>
<td>Home Economics</td>
<td>67</td>
<td>1,685</td>
<td>1,752</td>
</tr>
<tr>
<td>Sciences and Humanities</td>
<td>2,641</td>
<td>891</td>
<td>3,532</td>
</tr>
<tr>
<td>Veterinary Medicine</td>
<td>254</td>
<td>3</td>
<td>257</td>
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<tr>
<td>Graduate College</td>
<td>1,936</td>
<td>267</td>
<td>2,203</td>
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<tr>
<td><strong>Total</strong></td>
<td>10,034</td>
<td>2,899</td>
<td>12,933</td>
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</tbody>
</table>

## II. Students not in residence of college grade:

- Extension, off-campus: 10,339
- Other: 10,339

## III. Students in residence not of college grade:

<table>
<thead>
<tr>
<th>Program</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music</td>
<td>34</td>
<td>5</td>
<td>39</td>
</tr>
<tr>
<td>Driver training</td>
<td>7</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Nursery school</td>
<td>107</td>
<td>10</td>
<td>117</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34</td>
<td>5</td>
<td>39</td>
</tr>
</tbody>
</table>

| Grand total of all students | 1,432 | 438 | 2,108 | 3,978 | 2,794 | 1,184 |

| Grand total of all students of college grade | 1,358 | 438 | 2,108 | 3,904 | 2,749 | 1,155 |

## Summer Quarter Students 1963

<table>
<thead>
<tr>
<th>First Term Only</th>
<th>Second Term Only</th>
<th>Twelve Weeks</th>
<th>Total</th>
<th>Students Attending Academic Year</th>
<th>Students Attending Summer Only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grand total of all students</strong></td>
<td>1,334</td>
<td>441</td>
<td>2,127</td>
<td>3,902</td>
<td>2,765</td>
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<tr>
<td><strong>Duplicate</strong></td>
<td>10</td>
<td></td>
<td>26</td>
<td>44</td>
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</tr>
<tr>
<td><strong>Net Total</strong></td>
<td>1,324</td>
<td>433</td>
<td>2,101</td>
<td>3,858</td>
<td>2,725</td>
</tr>
</tbody>
</table>

## II. Students not in residence of college grade:

- Extension, off-campus: 34
- Other: 34

## III. Students in residence not of college grade:

<table>
<thead>
<tr>
<th>Program</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>45</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>74</td>
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<td>74</td>
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Construction Technology ................................ 399
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