

BULLETIN  
OF THE  
AGRICULTURAL AND MECHANICAL  
COLLEGE OF TEXAS

---

Fourth Series, Vol. 12

June 1, 1941

No. 6

---

THE GRADUATE SCHOOL  
RECORD OF THE SESSION 1940-41

ANNOUNCEMENTS FOR THE SESSION 1941-1942



COLLEGE STATION, TEXAS

---

Published monthly by the Agricultural and Mechanical College of Texas.

Entered as second class matter August 7, 1913, at the Postoffice at  
College Station, Texas, under the Act of August 24, 1912.

---

**BOARD OF DIRECTORS**

**Members**

**TERM EXPIRES 1943**

F. M. LAW, President, First National Bank.....Houston  
H. L. KOKERNOT, Jr., Banker and Cattleman.....Alpine  
G. R. WHITE, Banker and Ranchman.....Brady

**TERM EXPIRES 1945**

EDWIN J. KIEST, Owner and Publisher, Dallas Times-Herald.....Dallas  
R. W. BRIGGS, Contractor .....San Antonio  
A. H. DEMKE, Poultryman.....Stephenville

**TERM EXPIRES 1947**

H. J. BREES, President, Fort Sam Houston National Bank....San Antonio  
D. S. BUCHANAN, Manager, Heep Dairy Farm.....Buda  
JOHN C. BURNS, Trustee, S. B. Burnett Estate.....Fort Worth

---

**Officers**

F. M. LAW, President  
G. R. WHITE, Vice-President

## **GRADUATE SCHOOL CALENDAR**

### **Summer Session 1941**

- June 9, Registration for first term.
- July 19, first term ends.
- July 21, Registration for second term.
- August 9, Candidates for degrees in August submit completed theses.
- August 30, Second term ends.

### **Regular Session 1941-1942**

#### **1941**

- September 9, Opening of the first term.
- September 9, Registration of graduate students.
- November 11, Observance of Armistice Day.
- December 20, Christmas recess begins at noon.

#### **1942**

- January 5, Classes resumed at 8 a. m.
- January 29, Close of first semester.
- February 2, Registration for second semester.
- February 3, Opening of second semester.
- April 3-6, Spring recess.
- May 1, Candidates for degrees in June submit completed theses.
- May 23-29, Semester examinations.
- May 29, Commencement Sermon.
- May 29, Commencement.

## OFFICERS OF ADMINISTRATION

- Thomas Otto Walton, LL.D., President of the College.  
Frank C. Bolton, M.S., LL.D., Dean of the College.  
E. L. Angell, Executive Assistant to the President.  
T. D. Brooks, Ph.D., Dean of the Graduate School.  
Homer L. Heaton, M.S., Acting Registrar.  
W. H. Holzmann, Comptroller of Accounts.  
Maurice D. Welty, B.S., Colonel, Infantry, U. S. Army, Professor of  
Military Science and Tactics and Commandant.  
Thomas F. Mayo, Ph.D., Librarian.

## GRADUATE COMMITTEE

- T. D. Brooks, Ph.D., Dean of the Graduate School, Chairman.  
Guy W. Adriaance, Ph.D., Professor and Head of Department of Horti-  
culture.  
F. C. Bolton, M.S., LL.D., Dean of the College.  
P. W. Burns, B.S., D.V.M., Professor and Head of Department of  
Veterinary Physiology and Pharmacology.  
A. B. Conner, M.S., Director, Texas Agricultural Experiment Station.  
Charles W. Crawford, M.S., Professor and Head of Department of Me-  
chanical Engineering.  
E. P. Humbert, Ph.D., Professor and Head of Department of Genetics.  
T. W. Leland, M.A., Professor and Head of Department of Accounting  
and Statistics.  
R. M. Sherwood, M.S., Chief of Division of Poultry Husbandry, Texas  
Agricultural Experiment Station.  
O. W. Silvey, Ph.D., Professor and Head of Department of Physics.  
T. R. Spence, B.S., C.E., Professor of Civil Engineering and Vice-Director  
Texas Engineering Experiment Station.  
George Summey, Jr., Ph.D., Professor and Head of Department of  
English.  
B. L. Warwick, Ph.D., Animal Husbandman, Texas Agricultural Experi-  
ment Station.  
C. H. Winkler, Ph.D., Professor and Head of Department of Psychology.

## MEMBERS OF COLLEGE STAFF PARTICIPATING IN GRADUATE INSTRUCTION

(Figures in parentheses indicate date of first appointment on the College Staff and date of appointment to present position, respectively.)

- Ira Gillespie Adams, Professor of Economics. (1927, 1935)  
A.B., Evansville College, 1923; A.M., Minnesota, 1927.
- Guy Webb Adriance, Professor and Head of Department of Horticulture.  
(1920, 1935)  
B.S., Agricultural and Mechanical College of Texas, 1915; M.S., California, 1917;  
Ph.D., Michigan State College, 1929.
- Elmer Ross Alexander, Professor and Head of Department of Agricultural Education. (1919, 1935)  
A.B., Baylor, 1919; B.S., Agricultural and Mechanical College of Texas, 1923;  
M.S., 1926.
- Wyndell Sherwood Arbuckle, Assistant Professor of Dairy Husbandry.  
(1941)  
B.S.A., Purdue, 1933; A.M., Missouri, 1937; Ph.D., 1940.
- Fred Hobson Arnold, Associate Professor of Agricultural Economics.  
(1936)  
B.S., George Peabody College for Teachers, 1925; M.A., 1928; Ph.D., North Carolina, 1936.
- John Brewer Bagley, Professor of Cotton Marketing. (1905, 1908)  
B.A., Wake Forest College, 1900.
- Charles Laurence Baker, Professor and Head of Department of Geology.  
(1935)  
S.B., Chicago, 1908; M.A., California, 1916.
- Oscar Melville Ball, Curator of the Museum. (1903, 1937)  
B.A., Virginia, 1898; M.A., Ph.D., Leipsig, 1903.
- Justus Wheeler Barger, Professor and Head of Department of Agricultural Economics. (1929, 1935)  
B.S., Kansas State College, 1922; M.S., 1923; M.A., Leland Stanford, 1929.
- Sherman Weaver Bilsing, Professor and Head of Department of Entomology. (1913, 1918)  
A.B., Ohio State, 1912; M.A., 1913; Ph.D., 1924.
- John Henry Binney, Professor of Mathematics. (1925, 1937)  
B.S., Sam Houston State Teachers College, 1924; M.A., Texas, 1925; Ph.D., Rice, 1933.
- Francis Frederick Bishop, Associate Professor of Chemical Engineering.  
(1923, 1935)  
B.S., Clarkson College of Technology, 1922; M.S., 1928.
- Frank Cleveland Bolton, Dean of the College and Professor of Electrical Engineering. (1909, 1937)  
B.S., Mississippi State College, 1905; M.S., Ohio State, 1928; LL.D., Austin College, 1932.
- Kelshaw Bonham, Assistant Professor of Fish and Game. (1938)  
B.S., Washington, 1931; M.S., 1933; Ph.D., 1937.
- Theodore Walter Bretz, Instructor in Biology. (1938)  
B.S., Ohio State, 1930; M.S., Iowa State College, 1931; Ph.D., Ohio State, 1937.

- Alexander Van Brewer, Professor of Mechanical Engineering. (1922, 1930)  
 B.S., Purdue, 1913; M.E., 1925; M.S., Agricultural and Mechanical College of Texas, 1937.
- Fred Robert Brison, Professor of Horticulture. (1921, 1938)  
 B.S., Agricultural and Mechanical College of Texas, 1921; M.S., Michigan State College, 1931.
- Thomas Dudley Brooks, Dean of the Graduate School; Dean of the School of Arts and Sciences. (1932)  
 A.B., Baylor, 1903; A.M., Chicago, 1920; Ph.D., 1921.
- Sidney Overton Brown, Assistant Professor of Biology. (1936, 1939)  
 B.A., Texas, 1932; Ph.D., 1936.
- Patton Wright Burns, Professor and Head of Department of Veterinary Physiology and Pharmacology. (1926, 1935)  
 B.S., Agricultural and Mechanical College of Texas, 1923; D.V.M., 1926.
- Charles Boyle Campbell, Professor and Head of Department of Modern Languages. (1903, 1914)  
 Ph.B., DePauw, 1900; Ph.D., Chicago, 1912.
- W. T. Carter, Chief, Soil Survey, Agricultural Experiment Station. (1927)  
 B.S., Agricultural and Mechanical College of Texas, 1898.
- Donald Christy, Assistant Professor of Agricultural Engineering. (1933, 1936)  
 R.S., Kansas State College, 1933; M.S., Agricultural and Mechanical College of Texas, 1938.
- Floyd Barzilia Clark, Professor and Head of Department of Economics. (1916)  
 A.B., Richmond College, 1907; M.A., 1908; Ph.D., Johns Hopkins, 1914.
- Cecil Hardee Connell, Associate Professor of Municipal and Sanitary Engineering. (1939)  
 B.S., North Texas State Teachers College, 1927; M.A., Texas Technological College, 1933; Ph.D., Iowa, 1937.
- James Russell Couch, Associate Poultry Husbandman, Agricultural Experiment Station. (1931)  
 B.S., Agricultural and Mechanical College of Texas, 1931; M.S., 1934.
- M. Eugene Cravens, Assistant Professor of Agricultural Economics. (1940)  
 B.S., Kentucky, 1935; M.S.A., Cornell, 1937; Ph.D., 1940.
- Charles William Crawford, Professor and Head of Department of Mechanical Engineering. (1919, 1929)  
 B.S., Agricultural and Mechanical College of Texas, 1919; M.S., 1929.
- Frank Iver Dahlberg, Assistant Professor of Animal Husbandry. (1936, 1937)  
 B.S., Agricultural and Mechanical College of Texas, 1925; M.S., Wisconsin, 1930.
- Albert Laurie Darnell, Professor of Dairy Husbandry. (1914, 1925)  
 B.S., Mississippi State College, 1913; M.A., Missouri, 1916.
- William B. Davis, Professor of Fish and Game; Collaborator, Biological Survey, United States Department of Agriculture. (1937)  
 A.B., Chico State College, California, 1933; M.A., California, 1936; Ph.D., 1937.
- Harley Clay Dillingham, Professor of Electrical Engineering. (1922, 1930)  
 B.S., Agricultural and Mechanical College of Texas, 1922; A.M., Columbia, 1933.

- Clifton Childress Doak, Professor and Head of Department of Biology. (1926, 1937)**  
 B.S., North Texas State Teachers College, 1922; M.S., Agricultural and Mechanical College of Texas, 1928; Ph.D., Illinois, 1938.
- Roy Luther Donahue, Associate Professor of Agronomy. (1939)**  
 B.S., Michigan State College, 1932; Ph.D., Cornell, 1939.
- Albert A. Dunlap, Chief, Division of Plant Pathology & Physiology, Agricultural Experiment Station. (1938)**  
 A.B., Bates College, 1923; M.S., Yale University, 1927; Ph.D., 1929.
- Ralph Clark Dunn, Professor and Head of Department of Veterinary Pathology and Bacteriology. (1911, 1937)**  
 D.V.M., Ohio State, 1911.
- Tildon Easley, Associate Professor of Agronomy. (1938)**  
 B.S., Mississippi State College, 1932; M.S., 1933.
- Nat Edmonson, Jr., Professor of Mathematics. (1931, 1937)**  
 B.A., Austin College, 1924; M.A., 1925; Ph.D., Rice, 1929.
- Walter N. Ezekiel, Plant Pathologist, Agricultural Experiment Station. (1928)**  
 B.S., Maryland State College, 1920; M.S., University of Maryland, 1921; Ph.D., 1924.
- Virgil Moring Faires, Professor of Mechanical Engineering. (1926, 1930)**  
 B.S., Colorado, 1922; M.E., 1926; M.S., 1927.
- Clarence Jack Finney, Professor of Architecture. (1926, 1934)**  
 B.S., Agricultural and Mechanical College of Texas, 1922; Ecole des Beaux-Arts, Fontainebleau, 1923.
- Robert Kemble Fletcher, Entomologist, Agricultural Experiment Station. (1927)**  
 B.A., University of Maine, 1917; M.A., Ohio State University, 1919; Ph.D., 1928.
- Walter S. Flory, Horticulturist, Agricultural Experiment Station. (1936)**  
 B.A., Bridgewater College, 1928; M.A., Ph.D., University of Virginia, 1931.
- Leroy Levi Fouraker, Associate Professor of Electrical Engineering. (1920, 1927)**  
 B.S., Agricultural and Mechanical College of Texas, 1914; M.S., 1927.
- George Stronach Fraps, Chief, Division of Chemistry and State Chemist, Agricultural Experiment Station. (1903, 1905)**  
 B.S., North Carolina Agricultural College, 1896; Ph.D., Johns Hopkins University, 1899.
- Letcher P. Gabbard, Chief, Division of Farm and Ranch Economics, Agricultural Experiment Station. (1922, 1923)**  
 B.S., University of Tennessee, 1915; M.S., University of Wisconsin, 1921.
- Samuel Rhea Gammon, Professor and Head of Department of History. (1925)**  
 A.B., Washington and Lee, 1911; A.M., 1913; Ph.D., Johns Hopkins, 1921.
- Elder Harris Gibbons, Associate Professor of Biology. (1925, 1939)**  
 B.S.A., Tennessee, 1925; S.M., Chicago, 1929.
- Frederick Ernest Giesecke, Research Professor Emeritus. (1886, 1939)**  
 M.E., Agricultural and Mechanical College of Texas, 1890; B.S., in Architecture, Massachusetts Institute of Technology, 1904; Ph.D., Illinois, 1924.
- Gibb Gilchrist, Dean of School of Engineering; Director Texas Engineering Experiment Station. (1937, 1939)**  
 C.E., University of Texas, 1909; D.Sc., Austin College, 1939.

- Edgar Wilson Glenn, Associate Professor of Industrial Education. (1928, 1930)  
B.S., Illinois, 1924; B.S., Agricultural and Mechanical College of Texas, 1930; M.S., 1931.
- Chauncey Barger Godbey, Professor of Genetics. (1926, 1936)  
B.S., Kentucky, 1925; M.S., Agricultural and Mechanical College of Texas, 1926.
- Samuel S. Goldich, Assistant Professor of Geology. (1936, 1938)  
B.A., Minnesota, 1929; M.A., Syracuse, 1930; Ph.D., Minnesota, 1936.
- Louis Lawrence Grandi, Assistant Professor of Electrical Engineering. (1937, 1939)  
B.S., California, 1934; M.S., 1937.
- Hillel Halperin, Professor of Mathematics. (1920, 1925)  
E.E., Liege, 1908; A.M., Columbia, 1915.
- Thomas Rowan Hamilton, Professor of Accounting and Statistics. (1929, 1937)  
A.B., Washington and Lee, 1917; M.S., Columbia, 1924; Ph.D., 1938.
- F. Edwin Hanson, Associate in Dairy Manufacture, Agricultural Experiment Station. (1936)  
B.S. South Dakota State College, 1930; M.S., University of Wisconsin, 1932; Ph.D., 1937.
- William Donald Harris, Assistant Professor of Chemical Engineering. (1935, 1937)  
B.S., Iowa State College, 1929; M.S., 1931; Ph.D., 1934.
- Lewis McDowell Haupt, Jr., Associate Professor of Electrical Engineering. (1930, 1939)  
B.S., Agricultural and Mechanical College of Texas, 1927; M.S., 1935.
- Charles Cleveland Hedges, Professor and Head of Department of Chemistry. (1912, 1913)  
B.S., Kentucky, 1906; A.B., Cornell, 1908; Ph.D., 1912.
- Frederick William Hensel, Jr., Professor and Head of Department of Landscape Art. (1913, 1925)  
B.S., Agricultural and Mechanical College of Texas, 1907; M.S., Cornell, 1914.
- R. L. Hensel, Agronomist, Agricultural Experiment Station. (1936)  
B.S.F., Iowa State College, 1913; M.S.F., 1922.
- Sewell Hepburn Hopkins, Assistant Professor of Biology. (1935, 1937)  
B.S., College of William and Mary, 1927; M.A., Illinois, 1929; Ph.D., 1933.
- Martin Collins Hughes, Professor and Head of Department of Electrical Engineering. (1923, 1932)  
B.S., Illinois, 1917; E.E., 1926.
- William Lycurgus Hughes, Professor and Head of Department of Education. (1920, 1924)  
B.A., Howard Payne College, 1920; B.S., Agricultural and Mechanical College of Texas, 1921; M.S., 1922.
- Eugene Peter Humbert, Professor and Head of Department of Genetics. (1916, 1923)  
B.S.A., Iowa State College, 1906; M.S., Cornell, 1908; Ph.D., 1910.
- Robert Lee Hunt, Professor of Agricultural Economics. (1927, 1935)  
B.S., Agricultural and Mechanical College of Texas, 1924; M.S., North Carolina State College, 1927; Ph.D., Wisconsin, 1934.
- Frederick Putnam Jaggi, Jr., Professor and Head of Department of Veterinary Hygiene. (1937)  
B.S., Agricultural and Mechanical College of Texas, 1924; D.V.M., 1926.

- Arne Arthur Jakkula, Professor of Civil Engineering. (1937, 1939)**  
B.S., University of Minnesota, 1926; M.S., 1927; Ph.D., University of Michigan, 1933.
- Frederick William Jensen, Professor of Chemistry. (1925, 1930)**  
B.S., Nebraska, 1920; M.S., 1923; Ph.D., 1925.
- Fred Rufus Jones, Professor and Head of Department of Agricultural Engineering. (1921, 1940)**  
B.S., Wisconsin, 1915; M.S., Iowa State College, 1931.
- John McKinley Jones, Chief, Division of Animal Industry, Agricultural Experiment Station. (1914, 1918)**  
B.S., University of Wyoming, 1911; A.M., University of Wisconsin, 1912.
- Luther Goodrich Jones, Professor of Agronomy. (1919, 1926)**  
B.S., Princeton, 1917; M.S., Agricultural and Mechanical College of Texas, 1921; Ph.D., Cornell, 1927.
- D. T. Killough, Agronomist, Agricultural Experiment Station. (1914, 1925)**  
B.S., Agricultural and Mechanical College of Texas, 1914; M.S., 1925.
- Edmund Chester Klipple, Assistant Professor of Mathematics. (1935, 1937)**  
B.A., Texas, 1926; Ph.D., 1932.
- Edwin Jackson Kyle, Dean of the School of Agriculture, Professor of Horticulture. (1902, 1911)**  
B.S., Agricultural and Mechanical College of Texas, 1899; B.S.A., Cornell, 1901; M.S.A., 1902.
- Charles LaMotte, Professor of Biology. (1930, 1939)**  
B.A., Texas, 1929; M.A., 1929; Ph.D., Illinois, 1937.
- Ernest Langford, Professor and Head of Department of Architecture. (1915, 1929)**  
B.S., Agricultural and Mechanical College of Texas, 1913; M.S., Illinois, 1924.
- Thomas William Leland, Professor and Head of Department of Accounting and Statistics. (1922, 1926)**  
B.A., Wisconsin, 1921; M.A., 1922; C.P.A., 1928.
- August Albert Lenert, Professor and Head of Department of Veterinary Medicine and Surgery. (1919, 1937)**  
B.S., Agricultural and Mechanical College of Texas, 1914; D.V.M., Kansas City Veterinary College, 1917.
- James D. Lindsay, Professor and Acting Head of Department of Chemical Engineering. (1938, 1940)**  
B.S., Michigan, 1924; M.S., 1925; Ph.D., 1934.
- Van Allen Little, Professor of Entomology. (1923, 1937)**  
B.A., Sam Houston State Teachers College, 1922; M.S., Agricultural and Mechanical College of Texas, 1925.
- Wayne Eggleston Long, Professor of Mechanical Engineering. (1930, 1938)**  
B.S., Agricultural and Mechanical College of Texas, 1927; M.S., 1936.
- Willard Homer McCorkle, Professor of Physics. (1924, 1939)**  
B.A., Iowa, 1924; M.S., 1928; Ph.D., 1935.
- John Thomas Lamar McNew, Professor and Head of Department of Civil Engineering. (1920, 1940)**  
B.S., Agricultural and Mechanical College of Texas, 1920; M.S., 1926; C.E., Iowa State College, 1925.

- Elias Ward Markle, Professor of Electrical Engineering. (1921, 1930)  
B.S. Pennsylvania State College, 1913; M.S., Agricultural and Mechanical College of Texas, 1930.
- Ross Perry Marsteller, Dean of the School of Veterinary Medicine, Professor of Veterinary Medicine and Surgery. (1905, 1937)  
D.V.M., Ohio State, 1905.
- James Carlton Miller, Professor of Animal Husbandry. (1940)  
B.S.A., Missouri, 1928; A.M., 1929; Ph.D., 1937.
- <sup>1</sup>James Marshall Miller, Instructor in Architecture. (1937)  
B. Arch., Southern California, 1933; M.A., 1937.
- John Henry Milliff, Professor and Head of Department of Veterinary Anatomy. (1931, 1941)  
B.S., Agricultural and Mechanical College of Texas, 1931; M.S., 1934; D.V.M., 1936.
- Joseph Sayers Mogford, Professor of Agronomy. (1925, 1937)  
B.S., Agricultural and Mechanical College of Texas, 1916; M.S., 1920.
- <sup>2</sup>John Lambert Molyneaux, Assistant Professor of Rural Sociology. (1939)  
B.S., Virginia, 1936; M.A., 1938.
- Albert Vernon Moore, Associate Professor of Dairy Husbandry. (1937)  
B.S., Purdue, 1927; M.S., 1933.
- Joseph Morgan, Instructor in Physics. (1938)  
B.A., Temple, 1931; M.A., 1933; Ph.D., Massachusetts Institute of Technology, 1937.
- Thurmond Armour Munson, Professor of Hydraulic Engineering. (1920, 1926)  
B.S., Agricultural and Mechanical College of Texas, 1910; C.E., Iowa State College, 1924; M.S., 1925.
- John Malcolm Orchard, Assistant Professor of Agricultural Education. (1935, 1937)  
B.S., Texas College of Arts and Industries, 1934; M.S., Agricultural and Mechanical College of Texas, 1936.
- Leland Shumway Paine, Associate Professor of Agricultural Economics. (1927, 1930)  
B.A., Nebraska, 1922; M.A., Wisconsin, 1926.
- Edward D. Parnell, Associate Professor of Poultry Husbandry. (1938)  
B.S., Agricultural and Mechanical College of Texas, 1923; M.S., 1934.
- Walter Ernest Paulson, Marketing Research Specialist, Agricultural Experiment Station. (1920, 1923)  
Ph.B., University of Wisconsin, 1917; Ph.D., 1923.
- Paul Brown Pearson, Professor of Animal Husbandry. (1937)  
B.S., Brigham Young, 1928; M.S., Montana State College, 1930; Ph.D., Wisconsin, 1937.
- F. W. Peikert, Associate Professor of Agricultural Engineering. (1940)  
B.S., University of California, 1933; M.S., Iowa State College, 1934.
- Walter Lee Porter, Professor and Head of Department of Mathematics. (1918, 1932)  
A.B., Howard College, 1911; M.S., Agricultural and Mechanical College of Texas, 1926.
- George Edwin Potter, Professor of Zoology. (1939)  
B.S., Ottawa, 1921; M.S., Iowa, 1923; Ph.D., 1927.

<sup>3</sup>On leave, 1940-1941.

<sup>2</sup>On leave, beginning January 31, 1941.

- William McDaniel Potts, Professor of Chemistry. (1926, 1938)  
B.S., Chicago, 1921; S.M., 1927; Ph.D., 1937.
- John Henry Quisenberry, Associate Professor of Genetics. (1936)  
B.S., Agricultural and Mechanical College of Texas, 1931; M.S., Illinois, 1933;  
Ph.D., 1936.
- Robert Gatlin Reeves, Professor of Biology. (1928)  
B.S., Mississippi State College, 1922; M.S., 1923; Ph.D., Iowa State College, 1928.
- Duncan Henry Reid, Professor and Head of Department of Poultry  
Husbandry. (1923)  
B.S., Wisconsin, 1919; M.S., 1922.
- E. B. Reynolds, Chief, Division of Agronomy, Agricultural Experiment  
Station. (1915, 1923)  
B.S., Oklahoma A. & M. College, 1914; M.S., Iowa State College, 1915; Ph.D., 1929.
- <sup>1</sup>John Jefferson Richey, Professor of Civil Engineering. (1912, 1922)  
B.S., Illinois, 1903; C.E., 1910.
- Norman Frederick Rode, Professor of Electrical Engineering. (1922,  
1930)  
B.S., Clemson College, 1919; M.S., Agricultural and Mechanical College of Texas,  
1929; E.E., Clemson College, 1939.
- Henry Ross, Professor of Agricultural Education. (1935)  
B.S., Agricultural and Mechanical College of Texas, 1923; M.S., 1935.
- Daniel Russell, Professor and Head of Department of Rural Sociology.  
(1926, 1927)  
A.B., Baylor, 1922; A.M., Chicago, 1931.
- Isaac Christopher Sanders, Associate Professor of Physics. (1921, 1927)  
B.A., Rice, 1917; M.A., Texas, 1925.
- Carl Edward Sandstedt, Professor of Civil Engineering. (1923, 1938)  
A.B., Leland Stanford, 1910; M.S., Agricultural and Mechanical College of Texas,  
1928.
- Arthur Schipper, Assistant Professor of Biology. (1937, 1940)  
B.A., Coe College, 1930; M.S., Iowa, 1932; Ph.D., 1937.
- George Wilhelm Schlesselman, Professor of Agricultural Economics.  
(1934, 1938)  
B.A., Iowa State Teachers College, 1927; M.A., Clark, 1928; Ph.D., Nebraska, 1935.
- Hubert Schmidt, Chief, Division of Veterinary Science, Agricultural  
Experiment Station. (1913, 1936)  
B.S., Agricultural and Mechanical College of Texas, 1908; D.V.M., Royal Veter-  
inary School, Berlin University, 1912.
- Norman George Schuessler, Associate Professor of Animal Husbandry.  
(1935)  
B.S., Agricultural and Mechanical College of Texas, 1921; M.S., Iowa State Col-  
lege, 1939.
- Charles Noah Shepardson, Professor and Head of Department of Dairy  
Husbandry. (1928)  
B.S., Colorado State College, 1917; M.S., Iowa State College, 1924.
- Ross M. Sherwood, Chief, Division of Poultry Husbandry, Agricultural  
Experiment Station. (1919, 1924)  
B.S., Iowa State College, 1910; M.S., Agricultural and Mechanical College of  
Texas, 1924.

<sup>1</sup>On leave, First Semester, 1940-1941.

- Oscar William Silvey, Professor and Head of Department of Physics. (1916)  
A.B., Indiana, 1907; A.M., 1910; Ph.D., Chicago, 1915.
- Joseph Harrell Sorrels, Associate Professor of Municipal and Sanitary Engineering. (1941)  
A.B., Texas Christian University, 1924; M.S., Vanderbilt University, 1925.
- Thomas Reese Spence, Professor of Civil Engineering; Vice-Director Texas Engineering Experiment Station. (1938, 1939)  
B.S., Agricultural and Mechanical College of Texas, 1913; C.E., Cornell, 1917.
- Ernest William Steel, Professor and Head of Department of Municipal and Sanitary Engineering. (1925)  
C.E., Cornell, 1920.
- Albert B. Stevens, Professor of Petroleum Engineering. (1934, 1937)  
B.S., California, 1927; M.S., Southern California, 1932.
- George Summey, Jr., Professor and Head of Department of English. (1922)  
A.B., Southwestern Presbyterian, 1897; M.A., 1898; Ph.D., Columbia, 1919.
- Paul Judson Talley, Associate Professor of Biology. (1934, 1939)  
A.B., Baylor, 1928; M.S., Iowa, 1930; Ph.D., Wisconsin, 1932.
- Walter Penn Taylor, Professor and Head of Department of Fish and Game. (1935, 1937); Chief, Division of Wildlife Research, Texas Agricultural Experiment Station; Senior Biologist, Biological Survey, United States Department of Agriculture.  
B.S., University of California, 1911; Ph.D., 1914.
- Frank L. Thomas, Chief, Division of Entomology, State Entomologist, Agricultural Experiment Station. (1924)  
B.S., Massachusetts Agricultural College, 1910; Ph.D., 1917.
- <sup>1</sup>Milam Frank Thurmond, Associate Professor of Agricultural Engineering. (1927, 1930)  
A.B., Baylor, 1919; B.S., Agricultural and Mechanical College of Texas, 1922; M.S., 1931.
- Ide Peebles Trotter, Professor and Head of Department of Agronomy. (1936)  
B.A., Mississippi College, 1915; B.S., Mississippi State College, 1918; M.S., 1921; Ph.D., Wisconsin, 1933.
- Francis Earl Turner, Associate Professor of Geology. (1934, 1937)  
B.S., California Institute of Technology, 1927; M.S., 1928; Ph.D., California, 1934.
- Harold Vance, Professor and Head of Department of Petroleum Engineering. (1934)  
B.S., California, 1923.
- Horatio Luther Van Volkenberg, Professor and Head of Department of Veterinary Parasitology. (1937)  
D.V.M., Cornell, 1918; B.S., 1919; M.S., 1921.
- Edward Earl Vezey, Professor of Physics. (1920, 1938)  
B.S., Oklahoma Agricultural and Mechanical College, 1910; M.S., Agricultural and Mechanical College of Texas, 1927.
- Bruce L. Warwick, Animal Husbandman, Agricultural Experiment Station. (1930)  
D.V.M., Iowa State College, 1919; M.S., University of Wisconsin, 1922; Ph.D., 1925.

<sup>1</sup>On leave, 1940-1941.

- George Barton Wilcox, Professor of Education. (1920, 1927)  
 B.S., Agricultural and Mechanical College of Texas, 1923; A.M., Columbia, 1926.
- David Willard Williams, Professor and Head of Department of Animal Husbandry. (1919, 1923)  
 B.S., Ohio State, 1915; M.S., Illinois, 1916.
- Edward LaFayette Williams, Professor and Head of Department of Industrial Education. (1925)  
 B.S., Pittsburgh, 1925; M.S., Agricultural and Mechanical College of Texas, 1930.
- Roy Matthew Wingren, Associate Professor of Mechanical Engineering. (1928, 1940)  
 B.S., Agricultural and Mechanical College of Texas, 1927; M.S., 1934.
- Samuel Robert Wright, Assistant Professor of Municipal and Sanitary Engineering. (1923, 1937)  
 B.S., Agricultural and Mechanical College of Texas, 1922; M.S., 1928.
- Sidney H. Yarnell, Chief, Division of Horticulture, Agricultural Experiment Station. (1930)  
 B.S., Michigan State College, 1922; M.S., Cornell University, 1926; Sc.D., Bussey Institution, 1930.
- Samuel Bernard Zisman, Assistant Professor of Architecture. (1935, 1937)  
 B.S., Massachusetts Institute of Technology, 1930.

## THE GRADUATE SCHOOL

General Statement—The Graduate School of the Agricultural and Mechanical College of Texas was established in 1924. Prior to that time graduate work was administered by the general faculty, acting through a committee on graduate studies. The faculty of the Graduate School consists of such members of the teaching staff and the staff of the Agricultural Experiment Station as the academic council may determine, and has general jurisdiction over all matters relating to graduate work.

Administration.—Matters of general policy are considered by the Graduate Committee consisting of thirteen members, which reports its recommendations to the faculty of the school concerned. In cases in which prompt action is desirable the committee is authorized to act, reporting its action to the faculty for ratification.

The Dean of the Graduate School is the representative of the faculty in dealing with individuals, and is charged with the execution of its regulations. Petitions are acted upon by the Dean, or by the Graduate Committee if any matter is involved concerning which a policy has not been definitely established.

All communications relating to graduate work should be addressed to the Dean of the Graduate School.

Character of Graduate Work.—The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; the graduate student is not expected to get from lecture and laboratory courses all of the knowledge and training necessary to meet the requirements for his degree.

Graduate study presupposes a higher standard of excellence than undergraduate study. No graduate credit is granted for work of lower grade than "C," and to receive either the M.S. or Ph.D. degree, the candidate must have earned a grade point ratio of not less than 1.5 on all graduate courses taken.

Degrees.—Approved courses of study in the Graduate School may lead to the degree of Master of Science, Master of Education, or Doctor of Philosophy. Professional degrees in Engineering—Agricultural Engineer, Architectural Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Mechanical Engineer, Petroleum Engineer—are offered on the basis of acceptable professional experience, a thesis, and an examination.

The Master of Science degree with "Municipal Administration" designated as the major field is awarded to eligible students on the completion of programs of courses which in the judgment of the Graduate Committee are appropriate thereto. These programs will be built around courses in Municipal and Sanitary Engineering and will be differentiated for students who have done undergraduate work in engineering and for others.

Courses Offered by Experiment Station Staff.—In addition to the courses offered by the several departments of instruction, there are graduate courses offered by members of the Agricultural Experiment Station staff and described under the respective departments of instruction.

Extension Class Work.—Work done in extension classes may be allowed graduate credit to the extent of not more than six credit hours, provided:

1. That in each case both the courses and the instructor be approved by the Graduate Committee and by the Academic Council of the Agricultural and Mechanical College of Texas.

2. That before taking such a course the applicant be accepted for admission to the Graduate School and admitted to the course by the Graduate Committee.

3. That no such credit be finally allowed as part of the requirements for a degree in this institution until the student has demonstrated, by work done in residence at the Agricultural and Mechanical College of Texas, that he can pursue graduate study with profit.

Special Opportunity for the Study of Cotton.—The College offers unusual opportunity for the thorough study of cotton in all its phases. The following graduate courses in that field are described under the respective departments: Advanced Cotton Production, Genetic Studies in Cotton, Research in Cotton Breeding, Cotton Insects, Cotton Seed Oil, Cotton Machinery, Cotton Marketing Problems. Undergraduate courses in this field include: The Cotton Plant, Fiber Crops, Cotton Insects, Cotton Research Problems, Cotton Machinery, Cotton Marketing.

Application.—Application for admission should be made at least one month in advance, and in case the candidate comes from another institution, his application must be accompanied by a complete transcript of his undergraduate record, properly certified.

Admission to Candidacy.—Admission as a graduate student does not imply admission as a candidate for a degree. In order to become a candidate for an advanced degree, the student must make formal application—in the regular session before December 15 and in the summer session one week before the close of the first term. The application will be approved only in case the student has demonstrated his ability to do graduate work in a creditable manner.

Registration.—Graduate students must register at the beginning of each semester at the office of the Registrar and of the Dean.

Quality of Work.—In order to be allowed to go on with his course, a graduate student must give continued satisfaction in his work.

Initiative.—In carrying on his work in Graduate School, the student is expected to keep himself informed as to the regulations and to assume the initiative in complying with them.

Examinations.—At the close of the semester, written examinations are held in each graduate course. In addition to the semester examinations, a student must pass a final examination covering his entire course of study and his thesis. The final examination may be oral or written, or both, and is open to the committee and to members of the Academic Council.

Leaves of Absence or Withdrawal.—Requests for authority to be absent from the College or to withdraw permanently must be presented to the Dean through the Commandant.

Graduation.—Candidates for advanced degrees who expect to complete their work at the end of a given semester must give written

notice to the Dean and to the Registrar to that effect at least one month in advance. When a candidate has, to the satisfaction of the Graduate Committee, completed the requirements for an advanced degree, he will be recommended to the Academic Council for his degree.

#### REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

General.—The Master of Science degree denotes that attainment which a student of good native ability, who has received an appropriate bachelor's degree, may reasonably expect to achieve in one year of entire and successful devotion to advanced studies, with adequate facilities and under competent direction. The courses of study leading to this degree do not make research the chief consideration, but are intended to serve as an introduction to the methods and discipline of research.

Specification as to Courses.—The course of study pursued is specified in the diploma. In his application for admission the student must designate his major and minor courses of study.

Admission.—In order to be admitted to a course of study leading to the Master of Science degree, the candidate must satisfy the following requirements:

1. He must be a graduate of this College or of some other approved institution whose requirements for graduation are substantially equivalent to those of this College.

2. To major in any department, a candidate for the Master of Science degree must meet the requirements of that department for the bachelor's degree at this College. This is especially important as regards basic sciences and fundamental technical subjects.

To minor in any department the candidate must meet such undergraduate requirements as, in the opinion of the head of the department concerned, are prerequisite to the graduate courses selected.

3. His undergraduate record must be of such high order as to satisfy the committee that he is qualified by native ability and by training to pursue graduate studies with profit and with credit. In case it does not fully meet this requirement, the committee may require the completion of additional undergraduate work with a grade of at least "B".

Amount of Work.—The candidate for the degree of Master of Science must do at least one full year's work. Full time members of the College staff are not permitted to register in any one semester for more than one-fourth of a full semester's work.

All work accepted in fulfillment of the requirements for the Master of Science degree must have been completed within a period of six years prior to the award of the degree.

Course of Study.—The subjects constituting the student's complete course of study are to be chosen subject to the approval of the Graduate Committee. Of the eight full-semester courses required, at least seven must be done in this College.

In general, the work must be made up of graduate courses. In cases in which it may be deemed advisable, as much as twelve credit hours may consist of courses listed herein "For graduates and advanced undergraduates." Each hour of theory involves two hours of preparation.

**Major and Minor Subjects.**—For the degree of Master of Science the candidate must choose a major subject and one or two minor subjects. A major or a minor denotes the field of knowledge of a department. With the approval of the Graduate Committee, the major may be taken in two closely-allied departments. In his major subject the student must take at least two full-semester courses each semester, in addition to his thesis. Courses in minor subjects must be chosen by the student after consultation with the head of his major department.

**Residence.**—The Master of Science degree will not be conferred except after a residence of at least one year at the College. For candidates engaged in teaching or other regular employment, the period of residence will be increased to such extent as the committee may determine.

**Work in Summer Session.**—The residence requirement may be satisfied by residence during four summer terms of six weeks each. Courses offered in the summer session cover essentially the same ground as that covered by the corresponding courses of the regular session. The maximum amount of work for which a student may register in a summer term is six credit hours, except that a graduate student who, as a graduate student, in the term next preceding made a grade point ratio of 2.25 may be allowed to register for seven credit hours. In the summer session, each hour of theory involves three hours of preparation.

The candidate who spends only four summer terms in residence may fulfill the requirements for the Master of Science degree, provided that in the ad interim period between summer sessions he does the greater part of the work on his thesis. Authority to do thesis work in this way must be obtained through the Dean, and the student must make such reports of progress as the head of his major department may require.

A graduate student desiring to fulfill residence requirements for the Master of Science degree by doing the greater part of the work on his thesis in absentia in the ad interim period between summer sessions must register for such work in at least one long session, and pay a fee of \$7.50 each semester.

**Thesis.**—The candidate must submit a thesis, which shall be based upon his work in the department in which he takes his major subject. The thesis project must be submitted to the committee for approval, through the head of the department in which it is to be written, by December 15. In matter and style, the thesis must be acceptable to the head of the department in which it is written and to the committee. It must show that the candidate has the ability to do independent work; and, by correct citation of authorities, must show that he has satisfactory acquaintance with the literature of his field.

The thesis must be typewritten on paper 8½ inches by 11 inches; four weeks before commencement it must be presented to the Dean through the head of the department in completed form, ready for binding. Before the degree is conferred, a bound copy for the College library must be deposited with the Dean.

**Special Committee.**—The instructors under whom a graduate student takes work constitute a special committee to direct and advise him concerning his work and to represent him before the Graduate Committee. The instructor in charge of the major subject shall be chairman of the special committee in each case.

*M of Educ*  
\*REQUIREMENTS FOR THE MASTER OF EDUCATION DEGREE

Graduate students majoring in Agricultural Education, Education, or Industrial Education may, on recommendation of the heads of their major departments, become candidates for the Master of Education degree. The requirements for this degree shall be the completion of thirty-two hours of course work, done in residence in not less than five six-weeks summer terms, and a satisfactory comprehensive final examination. The preparation of a thesis embodying original research will not be required for this degree.

Except as noted above, the requirements for the Master of Education degree are identical with those for the Master of Science degree.

REGULATIONS GOVERNING THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY

By authorization of the Board of Directors, programs of graduate study and research leading to the degree of Doctor of Philosophy are provided in certain fields related to agriculture, veterinary medicine, and engineering. The programs are administered cooperatively by departments of pure and applied science and divisions of the Texas Agricultural Experiment Station and the Texas Engineering Experiment Station. Only those candidates will be accepted whose interest can be cared for by this cooperative arrangement.

1. For each student seeking to enter on work leading to the doctorate, there will be appointed a special committee representative of the student's several fields of study and research. This committee shall recommend to the Graduate Committee approval or disapproval of the student's request. In the event of approval the committee will also outline a proposed program of study on the satisfactory completion of which, together with a satisfactory dissertation, the degree will be awarded. The committee will also have full authority to modify, with the approval of the Graduate Committee, this program of courses by addition, reduction, or substitution.

2. The program of study established for a student entering on work for the Ph.D. shall be such as will require a minimum of three years of graduate study and research. The proportion of time allotted to courses and research shall be fixed upon the recommendation of the student's special committee. Acceptable graduate study done in other reputable graduate schools may, in so far as it is consistent with the student's program, be applied to lessen this period of study. In such cases, the student's special committee shall determine the minimum time which he shall be required to spend in resident study, but in no case shall the degree be awarded to a student who has done less than two consecutive semesters of resident graduate work in the Agricultural and Mechanical College of Texas. For part time students, the residence period shall be fixed equitably at a longer period than for full time students.

While there are certain minimum requirements, pertaining to length of resident study, number of credits, etc., these are not the primary considerations in the granting of the Ph.D. degree. The student must prove his ability to do scholarly work by mastering the previously published work in his major field, by having acquired a broad and sound knowledge of the closely related fields of science, and by research of an original nature with a minimum amount of supervision. This degree does not rest on any computation of time, nor on any enumeration of courses.

3. The student's complete program may include one or two minor fields, if, in the opinion of the student's committee, their relation to his

major or his professional purposes justifies such a program. These minors shall in the total occupy not more than half of the time the student will be expected to devote to course work. It will be the responsibility of the special committee to assure adequate undergraduate preparation for both major and minor fields.

4. A student's special committee shall not be restricted to members of the Academic Council, but shall consist of members of the teaching and the research personnel of the College who are in charge of the fields of work which compose the student's program of studies. The Dean of the Graduate School shall be ex officio member of each such committee. The member of the committee on whom the supervision of the student's research will devolve and who will serve as the student's chief adviser will be chairman of the committee.

5. At least one year prior to the receipt of the degree, the student must qualify as a candidate for the Ph.D. degree by passing successfully an examination to be arranged by the Dean of the Graduate School on application of the student, approved by his special committee. The committee will be in charge.

6. No student shall be eligible to such qualifying examination until he has evidenced the ability to read French and German literature in his own field of study, by examinations given by the representatives of the Department of Modern Languages.

7. Publication of the dissertation or an approved abstract thereof, either privately or by a standard scientific publication, shall be required, and one hundred copies or reprints shall be deposited with the library. In the event of publication in abstract, there shall also be deposited with the library one complete bound, typewritten copy of the thesis in such form and style as shall be required by the Graduate Committee.

If publication has not been completed when the degree is sought and the required printed copies cannot be deposited with the library, the candidate must give assurance that the required publication and deposit will be made either by presenting a written statement of acceptance for publication of the thesis or abstract or by filing with the Fiscal Office of the College cash forfeit or acceptable bond in the amount of \$100, which shall be returned to the candidate within thirty days after the requirement of publication and deposit has been met.

#### EXPENSES

The necessary expenditures of the graduate student for the regular session of nine months are as follows:

	First Semester	Second Semester
Matriculation Fee .....	\$25.00	\$25.00
Medical Service Fee .....	5.00	5.00

While residence in the college dormitories is not required of graduate students, a great majority of the unmarried men prefer to room in the dormitories, in sections set apart exclusively for their use. Room rent is \$25.00 for the first semester, and \$20.00 for the second semester.

Graduate students who elect to take their meals at the College Mess Hall pay Maintenance Fees, covering board and laundry, totaling \$171.90 for the academic year.

Refund of maintenance will be made only in case the student is required to withdraw by Faculty action or in the case of sickness disqualifying him for the discharge of his duties for the rest of the term. When such sickness takes place at the College, it must be attested by the College Physician before the student can receive the refund of the unused portion of his maintenance fee.

All students registering for 12 or more credit hours are required to pay the \$25.00 matriculation fee. All students registering for less than 12 credit hours will pay a matriculation fee of \$2.00 per credit hour, but the minimum may not be less than \$7.50.

All recipients of advanced degrees are required to pay a diploma fee of \$5.00.

For expenses in the Summer Session, reference should be made to the Summer Session number of the College Bulletin.

Expense of Non-resident Students.—The matriculation fee for a non-resident student shall be an amount equivalent to that charged students from Texas by a similar school in the State of which the student is a resident and shall not be less than the amount charged resident students. A non-resident student is defined to be a student of less than twenty-one years of age, living away from his family and whose family resides in another State, or whose family has resided within this State for a period of time less than twelve months prior to the date of registration, or a student of twenty-one years of age or over who resides out of the State, or who has resided within the State for a period of less than twelve months prior to the date of registration.

Expense of Day Students.—Day students pay all specified fees and charges, except maintenance and room rent.

#### PROFESSIONAL DEGREES IN ENGINEERING

The professional degrees in engineering, Agricultural Engineer, Architectural Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Mechanical Engineer, Petroleum Engineer, are open only to men who have received from this College the degree of Bachelor of Science or Master of Science in an engineering course.

The requirements for any one of these degrees normally include acceptable professional experience, a thesis, and an examination. In detail the requirements are as follows:

The candidate must have been engaged in acceptable professional work for a period of not less than six years after graduation, and must have been in responsible charge of such work for at least two years. The applicant who holds the degree of Master of Science in an engineering course is regarded as having met the time requirement if he has devoted five years to professional practice or to teaching engineering subjects.

In connection with his application for authority to register, the candidate must submit an orderly and detailed statement of his professional experience for the consideration of the Graduate Committee. He must also submit the title and a general outline of the thesis.

At a time to be designated by the Dean he must report at the College for an examination covering his professional experience, his thesis and the research or study which forms it basis.

The thesis must correspond in form to the Master's thesis described above. It must not be simply a descriptive discussion of some ordinary engineering project, nor a digest of engineering literature, but must constitute a scientific treatment of an engineering problem. The thesis in final form must be in the hands of the Dean four weeks before commencement.

At the discretion of the Graduate Committee, the applicant's prior publications of a technical nature may be accepted in lieu of the thesis and examination. In such case there shall be submitted a list of such publications and reprints or copies of papers for filing in the Library of the College.

The degree is conferred only at commencement or at a special convocation. In case an applicant does not complete work for his degree within two years after registration, his registration will be cancelled.

The matriculation fee of \$5.00 is to be paid upon registration.

#### SCHOLARSHIPS AND FELLOWSHIPS OFFERED BY THE COLLEGE

The College offers annually a limited number of graduate assistantships and fellowships, each carrying a stipend, for the nine-months session, of \$450.00 in the first year of service or \$540.00 in the second.

An applicant for an assistantship or a fellowship must meet the requirements for admission to the Graduate School and must express his intention of completing in this College the requirements for a graduate degree. He must also agree, in consideration of the award, to render approximately half time service, to be assigned by the Dean of the Graduate School and the head of the department in which he takes his major work.

Application must be made on forms to be obtained from the Dean of the Graduate School. Letters from three persons well acquired with the applicant and his work should be sent direct to the Dean of the Graduate School.

Nominations to assistantships or fellowships are made on the basis of worthiness of character, scholastic attainments, and promise of success in the principal field of study to which the applicant proposes to devote himself. They are made by the Dean of the Graduate School, subject to the approval of the President.

#### ADDITIONAL FELLOWSHIPS

From time to time graduate fellowships for research in industrial problems have been made available to students of the A. & M. College by the Texas Power and Light Company, The Texas Cottonseed Crushers' Association, Anderson Clayton & Co., The National Cottonseed Products Association, and The American Soya Products Corporation. Information concerning these will be supplied on request.

## COURSES OF INSTRUCTION BY DEPARTMENTS

The courses of instruction are described on the following pages under the departments in which they are given. Certain advanced undergraduate courses listed are accepted for graduate credit under the restriction that not more than twelve credits in these courses may be offered in fulfillment of the requirements of the master's degree. Courses numbered 601 to 699 are for graduate students only. First-semester courses are, as a rule, given odd numbers, second-semester courses even numbers.

The figures in parenthesis, following the name of a course, indicate the number of hours per week, theory and practice, respectively, devoted to the course. The credit value of the course is also indicated.

### ACCOUNTING AND STATISTICS

#### FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Theory and Practice of Accounting. (3-3). Credit 4.  
Fundamental processes of accounting, specific special phases of corporation accounting, introduction to actuarial accounting, asset and liability accounts, consignments, installment sales, depreciation, appreciation. Prerequisite: Accounting and Statistics 202.
302. Theory and Practice of Accounting. (3-3). Credit 4.  
A continuation of course 301. Specific asset, liability, and net worth accounts; comparative statements; analysis of financial condition, application of funds, partnership accounting; insurance; branch accounting; correction of errors. Prerequisite: Accounting and Statistics 301.
303. Statistical Method. (3-3). Credit 4.  
Collection, tabulation, presentation, and analysis of data. A study of sampling, graphics, averages, ratios and coefficients, dispersion, skewness, probability and error, index numbers, seasonal and long-time trend, barometers and linear correlation. Prerequisite: Mathematics 101.
317. Cost Accounting. (2-3). Credit 3.  
Development of cost accounting; principles relating to material, labor, and manufacturing expense; inventory controls, payroll and wage systems; job order cost systems and introduction to process cost systems. Prerequisite: Accounting and Statistics 202.
318. Advanced Cost Accounting. (2-3). Credit 3.  
Process costs, joint and by-product costs, estimated and standard costs, distribution costs, cost accounting reports and analysis of cost data; budgetary control; uniform cost accounting systems. Prerequisite: Accounting and Statistics 317.
402. Accounting Systems. (3-0). Credit 3.  
A study of special features of accounting for various types of enterprises, an analysis of the accounting systems devised and recommended by government agencies and trade associations. Each student is expected to develop a system for some business organization. Prerequisite: Accounting and Statistics 301.
403. Income Tax. (2-3). Credit 3.  
Income tax legislation; the present income tax law and regulations; treasury decisions, court decisions and departmental rulings; income tax problems and returns. Prerequisite: Accounting and Statistics 202.
405. Theory and Practice of Accounting. (3-3). Credit 4.  
Accounting for insolvent concerns; estates and trusts; foreign exchange; introduction to parent and subsidiary accounting; introduction to consolidations; introduction to budgeting; introduction to bank accounting. Prerequisite: Accounting and Statistics 301, 302.
406. Agricultural and Business Cycles. (3-0). Credit 3.  
An empirical and statistical study of economic fluctuations; relationship of agriculture to industry; theory, causes and control of business cycles; business barometers and forecasting. Study of economic and statistical services such as Babson, Brookmire, Standard Statistics Company, etc. Prerequisite: Accounting and Statistics 303.

**407. Auditing. (3-3). Credit 4.**

Theory and practice of auditing; types of audits; audit procedure for individual assets, liabilities, net worth, and nominal accounts; working papers and reports; case studies. Prerequisite: Accounting and Statistics 301.

**409. Survey of Accounting Principles. (3-0). Credit 3.**

Accounting and business administration to supply the needs of students taking work in engineering, architecture, agriculture and veterinary medicine. Accounting principles, record keeping, financial statements, problems of income and valuation, and interpretation of accounts are surveyed. Emphasis is placed on the viewpoint of the special groups and in so far as enrollment permits, separate sections will be used to meet their respective needs. The course is not as comprehensive as Accounting and Statistics 201, 202 and is not open to students enrolled in Agricultural Administration or Liberal Arts. Prerequisite: Junior Standing.

**410. Accounting Seminar. (3-0). Credit 3.**

Current accounting literature, research on valuation, income, budgeting, or other accounting problems. Prerequisite: Accounting and Statistics 401, 407.

**430. Cost Accounting Survey. (3-0). Credit 3.**

An introductory cost accounting course following accounting and statistics 409, for architects, engineers, and agricultural students. Purposes and uses of cost accounting; elements of cost; unit costs for use in bidding on contracts, comparison of cost procedures; job order and process costs, budgets, and standard costs; cost reports. Prerequisite: Accounting and Statistics 409.

**FOR GRADUATES**

**601. Statement Analysis. (3-3). Credit 4.**

An analytical study of the different kinds of statements for the guidance of executives, investors and creditors; balance sheet and profit and loss ratios. Prerequisite: Accounting and Statistics 201, 202. Professor Leland.

**603. Price Analysis. (3-2). Credit 4.**

Economic concepts relating to prices, statistical methods of analyzing prices, supply and demand curves, elasticity of demand, price forecasting, study and criticism of works on price analysis. Term paper required on factors affecting the price of an agricultural commodity. Prerequisite: Accounting and Statistics 303, Economics 203, 204. Professor Hamilton.

**604. Advanced Statistics. (3-2). Credit 4.**

Curve fitting and empirical formulas. Study of measurements of relationship. Multiple correlation, linear and non-linear; part and partial correlation; research studies involving the application of multiple correlation. Sampling and measures of unreliability. Mathematical fitting of normal curves. Analysis of variance. Prerequisite: Accounting and Statistics 303, Mathematics 101. Mathematics 110 is recommended. Professor Hamilton.

**605, 606. Advanced Problems. (2-3). Credit 3 each semester.**

Advanced accounting problems in accounting theory and practice and in auditing. Solution of problems in the classroom under examination conditions followed by analysis and discussion. The problems considered will be of the type currently stressed in accounting examinations. Prerequisite: Permission of instructor.

**610. Statistical Research in the Social Sciences. (3-0). Credit 3.**

Logical interpretation of research methods, the application of statistical methods to economics and other social sciences, the design of experiments, sampling, laws of probability, and reports on current research projects. Prerequisite: Accounting and Statistics 303 and permission of instructor.

**611, 612. Research and Thesis Problems. Credit 2 to 6 each semester.**

**614. Specialized Accounting. (1-3). Credit 2.**

Consideration of the accounting problems and the practices peculiar to specific industries. Class work on bank, insurance, and public utility accounting. Prerequisite: Accounting and Statistics 301.

**616. Municipal and Governmental Accounting. (1-3). Credit 2.**

Consideration of the accounting principles and procedures peculiar to governmental units. Prerequisite: Accounting and Statistics 202, Economics 412 is recommended.

# AGRICULTURAL ECONOMICS

## FOR GRADUATES AND ADVANCED UNDERGRADUATES

### 410. Transportation. (3-0). Credit 3.

The development of the various agencies of transportation in the United States; history of governmental regulation; survey and analysis of present day transportation trends and problems; special attention to transportation problems. Prerequisite: Economics 203 and 204; or Agricultural Economics 312.

### 413. Principles and Practices of Cooperation. (3-0). Credit 3.

Analysis of the past and present practices and problems of cooperatives in the United States and foreign countries, with major attention to farmers' cooperative marketing and purchasing activities. Prerequisite: Agricultural Economics 314.

### 420. Consumption and Market Analysis. (3-0). Credit 3.

Nature of consumer demand; private and public policies relative to consumption; methods of conducting marketing surveys and the use of findings by concerns handling agricultural or industrial products. Prerequisite: Agricultural Economics 425.

### 423. Conservation of Natural Resources. (3-0). Credit 3.

A general survey of the economic problems of land with emphasis on conservation. Prerequisite: Agricultural Economics 312, or Economics 203 and 204, or 403.

### 425. Wholesale and Retail Merchandising. (3-0). Credit 3.

A systematic description and a critical analysis of the fundamental operations of wholesale and retail concerns, particularly those handling farm products or operating in agricultural communities. Prerequisite: Economics 203 and 204, or 403.

### 426. Sales Organization. (3-0). Credit 3.

A consideration of the general principles of successful personal selling, sales organization and sales management; analysis of some carefully selected sales problems of concerns handling industrial and agricultural products. Prerequisite: Economics 203 and 204, or 403.

### 429. Economic Policy for Agriculture. (2-0). Credit 2.

A critical analysis of the past and present programs of governmental agencies and farmers' organizations for the economic betterment of agriculture. Prerequisite: Economics 203 and 204, or Agricultural Economics 312.

### 430. Farm Credit. (3-0). Credit 3.

Analysis of the credit requirements of individual farmers and farmers' cooperative organizations; investors and depositors as sources of credit; principles upon which each type of farm credit is extended; the instruments and legal aspects of farm credit; the cost of credit; description of financial institutions which serve agriculture, with major attention to the component units of the Farm Credit Administration. Prerequisite: Economics 311.

### 432. Farm and Ranch Organization and Operation. (2-3). Credit 3.

Detailed problems involved in the organization and management of specific farms and ranches, covering such matters as efficiency analysis, budget preparation, layout and improvement. Survey of research literature in farm and ranch organization and management. Prerequisite: Agricultural Economics 421.

### 436. Rural Tax Problems. (3-0). Credit 3.

A factual survey of the development and present situation regarding the taxation of farm property; a critical consideration of the system of taxing farm property as compared with the taxation of other property; a study of the administrative aspects in the taxation of farm property; possible and proposed methods of improving the taxation of farm property. Prerequisite: Economics 412.

## FOR GRADUATES

### 601, 602. Advanced Marketing Problems. (4-0). Credit 4 each semester.

A thorough study of the problems involved in marketing farm products such as price determining factors; costs affecting distribution; operation of produce exchanges and futures markets; governmental regulation of middlemen and marketing services; and adjustment of supply to demand individually, cooperatively, and by governmental aid. Prerequisite: Agricultural Economics 314. Professor Hunt.

**603. Land Problems. (4-0). Credit 4.**

An extensive study of problems involved in developing state and national policies for the proper utilization of our land resources. Prerequisite: Agricultural Economics 423. Associate Professor Paine.

**604. Historical Development of Agricultural Economics. (4-0). Credit 4.**

Agricultural Economics defined and described; origin and development of agricultural economics; evolution of ideas regarding economic problems of agriculture; modern concepts in agricultural economics; relation of agricultural economics to other fields. Prerequisite: Agricultural Economics 512 and 429. Associate Professor Arnold.

**611. Farm Management Surveys. (2-4). Credit 3.**

Methods of making surveys of regional systems of farming; analysis of survey data; use of findings in formulating farm organization and management programs. Practice work consists of surveying actual farms and ranches. Prerequisite: Agricultural Economics 421. Assistant Professor Cravens.

**612. Cotton Marketing Problems. (4-0). Credit 4.**

Extensive study of potential cotton areas of the world, trends in production, trends of consumption of cotton and substitutes for cotton in the various consuming areas; national and international policies that affect the cotton farmers; price determining factors in the various markets; governmental aid in estimating supply and demand, regulations of standards, and control of futures market; cooperative versus individual sale of cotton. Prerequisite: Agricultural Economics 427. Professor Hunt.

**614. Contemporary Problems in Agricultural Economics. (4-0). Credit 4.**

A critical consideration of some of the most important contemporary problems in agricultural economics. Prerequisite: Agricultural Economics 312 or 429; and 430. Associate Professor Arnold.

**616. Agricultural Geography. (4-0). Credit 4.**

A regional survey of the world distribution of major agricultural commodities and associated industries, with particular attention to the casual influences of natural, social and economic factors. Professor Schlesselman.

**618. International Trade in Agricultural Products. (4-0). Credit 4.**

History of world trade in agricultural products; recent effects on American agriculture of our tariff policies, and of the nationalistic economic policies of foreign countries; the effect on American agriculture of our present governmental policies with respect to trade agreements and restricted domestic production; the future of American agriculture under possible governmental policies in foreign trade. Prerequisite: Economics 409. Associate Professor Arnold.

**671, 672. Research Methods and Problems. (2-6). Credit 4 each semester.**

Research method and procedure in agricultural economics. Individual research on approved problem. Staff.

## AGRICULTURAL EDUCATION

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**401, 402. Teaching Vocational Agriculture. (2-6). Credit 4 each semester.**

Analysis of the agricultural teacher's job; courses of study; annual plan; lesson plans; project outlines and supervision; equipment; reports; observations and directed teaching.

**410. Methods in Adult Agricultural Education. (2-0). Credit 2.**

Methods to use in developing understanding and ability on the part of adult farm people to adopt improved agricultural practices.

### FOR GRADUATES

(Agricultural Education 401, 402 are prerequisites to the following courses.)

**601, 602. Advanced Methods in Agricultural Education. (2-0). Credit 2 each semester.**

An advanced course in methods of teaching vocational agriculture. Assistant Professor Orchard.

605. Supervised practice. (2-0). Credit 2.  
An advanced study of supervised practice in vocational agriculture. Assistant Professor Orchard.
606. Supervised Farming. (2-0). Credit 2.  
Advanced study of methods of supervising students in carrying out their supervised farming programs. Assistant Professor Orchard.
607. Future Farmer Activities. (2-0). Credit 2.  
Methods of conducting future farmer activities of statewide importance. Professor Ross.
608. Promotional Activities in Vocational Agriculture. (2-0). Credit 2.  
Principles of news writing, plans for collective exhibits, instructional booths, fairs and contests. Open only to teachers of Vocational Agriculture. Professor Ross.
609. Part Time Classes. (2-0). Credit 2.  
Methods of organizing and conducting part-time classes in vocational agriculture. Professor Ross.
610. Evening Schools. (2-0). Credit 2.  
Methods of organizing and conducting evening schools in vocational agriculture on a participation basis. Professor Ross.
611. Evening School Problems. (2-0). Credit 2.  
Supervision of practice work, determining course content, follow-up work, setting up publicity programs, and evaluating improved practices resulting from evening school instruction. Professor Ross.
612. Agricultural Outlook Material. (2-0). Credit 2.  
Methods of using agricultural outlook material. Open to teachers of agriculture and county agents who have had a course in cooperative marketing. Professor Alexander.
613. Administration and Supervision of Agricultural Education. (2-0). Credit 2.  
Problems of organization, administration, and supervision of vocational agriculture, experiment station and extension work. Professor Alexander.
614. Research and Thesis Problems. (2-0). Credit 2.
615. Philosophy and Agricultural Education. (2-0). Credit 2.  
A study of the development of agricultural education in the United States with emphasis on the socio-economic influences responsible for the establishment of the U. S. D. A., Land Grant College System, and vocational education in agriculture. Professor Alexander.
616. Program Building in Agricultural Education. (2-0). Credit 2.  
Organization of programs in agricultural education on local, state, and national basis. Securing assistance of public school administrators, farmers, and county, state, and national agricultural agencies in program building. Professor Alexander.

## AGRICULTURAL ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

324. Automotive Machinery. (3-3). Credit 4.  
Sources of farm power with particular emphasis on the construction, operation, care, adaptability, and economic utilization of stationary internal combustion engines, tractors, and motor trucks. Prerequisite: Agricultural Engineering 323.
410. Irrigation. (1-3). Credit 2.  
Principles of irrigation practice; sources of water supply; methods of obtaining water; distribution systems; application of water to crops; measurement and duty of water; control of alkali.
413. Farm Buildings. (2-3). Credit 3.  
Design and location of farm buildings; building materials; construction; arrangement. Prerequisite: Civil Engineering 305.

418. Farm Home Utilities. (2-3). Credit 3.

Types, installation, operation, care and repair of the following utilities for farm buildings: ventilation, heating, lighting, water supply and sewerage disposal, refrigeration, air conditioning. Prerequisite: Agricultural Engineering 413.

425, 426. Seminar. (1-0). Credit 1 each semester.

A review and presentation of the results of research in Agricultural Engineering. Prerequisite: Senior Classification.

428. Conservation and Reclamation Engineering. (3-4). Credit 4.

Principles of engineering practice as applied to soil conservation with respect to runoff, terrace and terrace outlet design and construction. Principles of farm drainage as applied to open ditches, tile drains and terraces; drainage districts and laws; land clearing and reclamation methods. Prerequisite: Civil Engineering 201, 311.

430. Rural Electrification. (2-3). Credit 3.

Economic application and utilization of electric power on farms and in rural communities.

FOR GRADUATES

601, 602. Advanced Drainage and Irrigation. (3-3). Credit 4 each semester.

Advanced study of farm drainage and irrigation with special emphasis on recent developments. Prerequisite: Agricultural Engineering 305 or 423. Assistant Professor Christy.

603, 604. Advanced Farm Machinery. (3-3). Credit 4 each semester.

Advanced study of farm machinery with special emphasis on recent developments. Prerequisite: Agricultural Engineering 201 or 208. Professor Jones and Associate Professor Peikert.

605, 606. Advanced Farm Buildings. (2-6). Credit 4 each semester.

Advanced study of farm buildings and farm home utilities. Prerequisite: Agricultural Engineering 205, 413, and 418.

607. Cotton Machinery. (1-3). Credit 2.

An advanced course in cotton machinery used for preparation of seed bed, seeding, cultivating, harvesting and ginning, with special emphasis on recent developments. Professor Jones.

609, 610. Advanced Farm Power. (2-6). Credit 4 each semester.

Advanced study of farm power with special emphasis on recent developments. Prerequisites: Agricultural Engineering 323 and 324. Professor Jones and Associate Professor Peikert.

611. Advanced Farm Shop. (3-3). Credit 4.

Advanced study of farm shop with special emphasis on problems relative to teaching the course; i. e., equipment, methods, supplies and projects. Prerequisite: Agricultural Engineering 321, 322. Associate Professor Thurmond.

613, 614. Advanced Soil Erosion Engineering. (3-3). Credit 4 each semester.

The advanced study of design, construction, and layout of terraces and other structures used for the control of soil erosion, as well as the outlet structures for same, with special emphasis on late developments. Prerequisite: Agricultural Engineering 428. Assistant Professor Christy.

615, 616. Technical Research. Credit 2 to 6 each semester.

Projects subject to the approval of the head of the department.

617. Advanced Soil and Water Conservation Engineering. (3-3). Credit 4.

Advanced study of the engineering phases of wind and water erosion and water conservation and utilization, with particular reference to rainfall and runoff measurement, terrace planning, design, and construction, gully control methods, and other related problems. (For non-engineering students only.) Prerequisite: Agricultural Engineering 305 or 424. Assistant Professor Christy.

## AGRONOMY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**410. Soil Classification and Mapping. (3-4). Credit 4.**

A study of the principles underlying the genesis, morphology, classification, and mapping of soils. Prerequisite: Agronomy 301.

**413. Soil and Crop Management. (3-0). Credit 3.**

A study of the special problems in the utilization and management of soils under varying soil and climatic conditions. Independent work in solving eight current agronomic problems in different parts of the Southwest required. Prerequisite: Agronomy 106, 301, Junior Standing.

**418. Soil Conservation. (3-3). Credit 4.**

A course dealing with the importance of soil conservation from the standpoint of different soil types in the agricultural regions of Texas and the United States. Conservation methods are presented according to climatic regions, cropping systems, topographic locations, and other influencing factors. Field practice in making a map of a farm, its soil and a plan of reorganization for soil conservation. Prerequisite: Agronomy 301.

**422. Soil Fertility. (3-4). Credit 4.**

An advanced course, dealing with the more technical considerations of the physical, chemical, and biological factors influencing the crop producing power of the soil. Prerequisite: Agronomy 301, 413; Biology 313, 314; Chemistry 212, 214.

**424. Studies of Quality in Cotton. (2-2). Credit 3.**

Production factors affecting cotton quality including length, strength and uniformity as caused by methods of production, soil types, plant growth conditions, one variety communities, fiber properties, harvesting methods, weather damage, preparation for market, ginning effects, utilization by industry, value of different length of fiber produced, and quality of finished product. On completion of the foregoing a comparison is made of the characteristics of various fibers, their competition and possibilities. Laboratory study covers staple length measurements, fiber arrays, bundle wrapping, strength testing, and microscopical fiber structure. Prerequisite: Agronomy 315.

### FOR GRADUATES

**601, 602. Advanced Farm Crops. (3-4). Credit 4 each semester.**

An advanced study of field crops production and breeding, including a review of the more recent and noteworthy investigations in this field.

**605. Pedology. (3-0). Credit 3.**

An advanced study of the origin, constitution and classification of soils.

**606. Soil Literature. (3-0). Credit 3.**

An advanced course designed to direct the student in a critical study of outstanding contributions to soil science.

**607, 608. Advanced Cotton Production. (3-4). Credit 4 each semester.**

An advanced study of cotton from the standpoint of species, varieties, breeding, fertilization, tillage, practices and harvesting. Extended use is made of recent cotton literature in scientific journals, experiment station bulletins, and such reference books on cotton as are available.

**609. Special Crop Problems. Credit 1 to 2 each semester.**

Advanced laboratory or field problems not related to the student's major thesis.

**610. Crop Research. Credit 1 to 4 each semester.**

Investigations leading to the student's major thesis.

**611. Special Soil Problems. Credit 1 to 2 each semester.**

Advanced laboratory or field problems not related to the student's major thesis.

**612. Soil Research. Credit 1 to 4 each semester.**

Investigations leading to the student's major thesis.

**625. Range Management and Ecology.\* (2-4). Credit 3.**

Attention will be directed toward range problems of that great livestock region lying west of the 100th meridian. The productive and carrying capacity of range land, types of native vegetation, possibilities of revegetation, principles of management and restoration as well as the research work under way and projected will be studied.

\*—Offered occasionally as special summer courses.

**626. Fundamentals of Grass and Pasture Improvement.\* (2-4). Credit 3.**

The pasture problem of the great plains and the eastern half of the United States will be studied in the light of all known pasture work in the world. The botany, genetics, and improvement of pasture plants and the principles of pasture research, ecology, and management will be studied exhaustively.

**627. Forest Soils.\* (3-0). Credit 3.**

An advanced study of the application of basic principles to the problems of forest soils. Special emphasis will be placed on the climatic, physiographic, and biotic relationships which determine the success of long-time programs for timber production in the southwest.

Field trips will be made to study these forest soil problems in both the typical southern pine forests and the temperate zone where the humid forest area meets the semi-arid tall grass prairie of the southwest.

## **ANIMAL HUSBANDRY**

### **FOR GRADUATES AND ADVANCED UNDERGRADUATES**

**303. Animal Nutrition. (3-2). Credit 4.**

Chemical composition of feeding stuffs, composition of farm animals; digestion; metabolism; functions of nutrients; vitamins; coefficients of digestibility, energy in feeds and its uses; feed requirements of animals; maintenance; growth; fattening; milk production; wool production; work; computation of rations; manurial values of feeds; nature and uses of feed stuffs including cereal by-products, legumes and legume seeds, oil bearing seeds and by-products, packing house by-products, hays, fodders, straws, pastures, forage, silage, and miscellaneous feeds. Prerequisite: Chemistry 212, 214.

**406. Beef Cattle Production. (3-2). Credit 4.**

The world beef cattle situation; historical development; systems of production and determination of the place of each; distribution and value in comparison with other meat animals; location of beef enterprise; establishment of the herd; improvement methods; mating and reproduction; calving; feed and care of calf; development of stock for the breeding herd; wintering; summer management; cattle feeding; selection of feeds; value of feeds; financial aspect of beef production; equipment; parasites and diseases; fitting and showing; marketing. Prerequisite: Animal Husbandry 303 or 409.

**410. Sheep and Angora Goat Production. (3-2). Credit 4.**

Present status; history in United States; methods and types of sheep raising; pure bred business; breeding; management and feeding of the breeding stock; growing young lambs; fattening sheep and lambs; marketing sheep and lambs; fitting and showing; parasites and diseases. Prerequisite: Animal Husbandry 303 and 409.

**412. Swine Production. (3-2). Credit 4.**

Historical; feeding and handling the breeding herd during various seasons; culling; records; the sow and the litter; growing and fattening pigs; forage crops; feeding on forage; dry lot feeding; choice and value of feeds; garbage disposal plants; prevention of diseases; slaughtering and curing; the pure bred herd; fitting and showing. Prerequisite: Animal Husbandry 303 or 409.

**413. Horse and Mule Production. (3-2). Credit 4.**

Review of situation; historical development; mechanical vs. horsepower; anatomy; unsoundness; ailments and diseases; feeding the brood mare; stallions; growing and developing colts; feeding and handling horses at work; stables and equipment; harness; shoeing; fitting and showing; polo and saddle horse breeding and training; horse markets; jacks and jennets; mule production. Prerequisite: Animal Husbandry 303 or 409.

**418. Wool and Mohair. (2-3). Credit 3.**

Microscopic structure; chemical composition; production; preparation for market; market reports; marketing; comparison with other textile materials; measurement; grading; sorting; scouring; pullaries; process of manufacture of fabrics.

**421. Advanced Studies of Breeds of Livestock. (2-0). Credit 2.**

Methods used in the development of outstanding animals; popular lines of breeding; breed improvement; characteristics and breeding of show winners. Students will be given a choice of one breed of each class of livestock for intensive study. Prerequisite: Animal Husbandry 202.

\*—Offered occasionally as special summer courses.

424. Range Live Stock Production. (3-0). Credit 3.

Review of historical development; types of ranges; types of breeds of livestock used; range livestock improvement; handling cattle, sheep and goats during various seasons of the year; culling of herds and flocks; range livestock losses including parasites, deficiency, diseases, droughts; stocking of the range under various conditions; carrying capacity determination; over and under grazing; water development; salting; feeding both regular and under emergency conditions; finishing on the range; equipment; labor; cost of productions; marketing. Prerequisite: Animal Husbandry 303 or 409.

427, 428. Seminar. (1-0). Credit 1 each semester.

429. Advanced Sheep, Wool, and Mohair Studies. (2-2). Credit 3.

A continuation of courses 410 and 418. Prerequisite: Animal Husbandry 410 and 418.

FOR GRADUATES

605a, 606a. Advanced Beef Cattle Production. (3-3). Credit 4 each semester.

A continuation of course 406. Associate Professor Schuessler.

605b, 606b. Advanced Sheep Production. (3-3). Credit 4 each semester.

A continuation of course 410. Professor Miller.

605c, 606c. Advanced Swine Production. (3-3). Credit 4 each semester.

A continuation of course 412. Assistant Professor Dahlberg.

605d, 606d. Advanced Horse Production. (3-3). Credit 4 each semester.

A continuation of course 413. Professor Williams.

611. Advanced Animal Nutrition. (3-0). Credit 3.

The occurrence of proteins, lipids, and carbohydrates in feeds and body tissues, their function in nutrition and their intermediary metabolism. Prerequisite: Elementary organic and analytical chemistry. Professor Pearson.

612. Advanced Animal Nutrition. (0-3). Credit 1.

A laboratory course designed to familiarize the student with the application of chemical and biological methods to the solution of fundamental problems of nutrition. Must be preceded or accompanied by course 611. Professor Pearson.

613. Advanced Animal Nutrition. (2-0). Credit 2.

The role of vitamins and minerals in animal nutrition, and their occurrence in feeds and animal tissues; energy metabolism. Prerequisite: Elementary organic and analytical chemistry. Professor Pearson.

614. Advanced Animal Nutrition. (0-3). Credit 1.

A continuation of course 612. Must be preceded or accompanied by course 613. Professor Pearson.

615. Advanced Animal Nutrition. (0-3). Credit 1.

A laboratory course involving the management, preparation of purified rations, and the production and cure of nutritional diseases. Must be taken simultaneously with or preceded by 613 and 614. Professor Pearson.

617, 618. Research in Animal Husbandry. Credit 2 to 6 each semester.

Research problems on selected topics related to animal production other than breeding or nutrition. The student must show that he is well grounded in basic animal husbandry courses before being admitted. Meats research may be included. Animal Husbandry 605, 606 will ordinarily be considered prerequisite.

625. Feeding of Farm Animals.\* Credit 3.

The application of the fundamental principles of nutrition to practical livestock feeding; functions of nutrients in the animal body; milk production; wool production; feed requirements in animals; maintenance, growth, fattening, milk production, wool production; the nature and composition and feeding value of various farm-grown feeds, mill feeds, and packing house by-products; summaries of American and foreign feeding trials. F. B. Morrison, Head, Department of Animal Husbandry, Cornell University.

\*--Offered in summer of 1940 only.

**626. Animal Breeding.\* Credit 3.**

Physiology of reproduction; factors determining fertility; control of fertility; systems of animal breeding; artificial insemination. Frederick F. McKenzie, Department of Animal Husbandry, University of Missouri.

**671, 672. Wool and Mohair Research. Credit 1 to 4 each semester.**

Offered only by individual agreement, to graduate students qualified by previous training to do thesis work on some portion of an organized wool or mohair research project. Studies under way include a determination of the grades and shrinkage of wool and mohair from registered and unregistered flocks. The wool and mohair grading and scouring laboratory is at the disposal of graduate students taking this course.

**673, 674. Research in Animal Breeding. Credit 1 to 4 each semester.**

Research problems in mammalian genetics and reproduction physiology, available as thesis material, to students majoring in animal husbandry, biology, genetics, veterinary physiology, or other related departments. Problems may either be organized as Experiment Station Projects or they may be assigned portions of projects already organized. Lines of work already in progress include inheritance studies with sheep and goats, cytology of farm animals, species hybridization, reproductive physiology of sheep and goats, and the inheritance of resistance to disease. Prerequisite: Genetics 603. The student must also be well grounded in anatomy and physiology, before being admitted. Offered only by consent of the man in charge and with the approval of the head of the department in which the student majors.

**675, 676. Research in Animal Nutrition. Credit 1 to 4 each semester.**

Research problems on a selected topic in animal nutrition. The student must show that he is well grounded in chemistry and animal nutrition before being admitted. A portion of the experimental data obtained may be used as material for a thesis.

## ARCHITECTURE

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**412. Steel Structures. (2-3). Credit 3.**

Design of steel frames in building construction; beams and girders, columns and footings; roof trusses. Prerequisite: Architecture 313 and 314.

**415, 416. The Fine Arts. (2-0). Credit 2 each semester.**

The fine arts, their history and appreciation; Greek and Roman sculpture and painting; their revival in the Renaissance; seminars in the modern painters. Prerequisite: Senior classification.

**417. Concrete Structures. (3-0). Credit 3.**

Theory of reinforced concrete design and its application in the design of slabs, beams, girders, columns, and footings; concrete buildings. Prerequisite: Architecture 314, or Civil Engineering 305.

**455. Home Planning and Design. (2-6). Credit 4.**

A study of home, housing and community planning; educational procedure in teaching home design, construction, and consumer problems; special problems in presentation and model making.

### FOR GRADUATES

**601, 602. Design and Construction. Credit 2 to 5 each semester.**

Intensive study by means of criticisms, consultations, and practical applications of the theory and practice in the design and construction of buildings and groups of buildings. Professors Finney and Langford, and Assistant Professor Zisman.

**603, 604. Design and Construction. Credit 2 to 5 each semester.**

A continuation of courses 601, 602. Professors Finney and Langford, and Assistant Professor Zisman.

**611, 612. History and Archaeology. (2-0). Credit 2 each semester.**

Individual problems of study and research in the field of American Architecture and Archaeology.

\*—Offered in summer of 1940 only.

## BIOLOGY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

- 313, 314. Plant Physiology. (2-4). Credit 3 each semester.  
Survey of the physiology of the green plant with special emphasis on nutrition, synthesis, storage, growth, and reproduction. Prerequisite: Biology 101 or 111, 112, and Chemistry 102.
341. General Physiology. (3-4). Credit 4.  
Structure of the human body; physiology of the skeletal, muscular, nervous, circulatory, and respiratory systems. Prerequisite: Biology 105, 106, or 107, or 111, 112.  
Elective for students in Science and Physical Education.
342. General Physiology. (3-4). Credit 4.  
Physiology of digestion, nutrition, metabolism, secretion, excretion, endocrines, and reproduction. Prerequisite: Chemistry 301, 302.  
Elective for students in Science.
345. Aquatic Biology. (2-4). Credit 3.  
Principles of fresh water biology; identification of aquatic organisms with emphasis on forms of importance in sanitation.
- 417, 418. Seminar in Botany. (1-0). Credit 1 each semester.
- 419, 420. Seminar in Zoology. (1-0). Credit 1 each semester.
422. Microtechnique. (1-6). Credit 3.  
Standard methods in the preparation of permanent microscope slides of plant and animal tissues. Prerequisite: 12 hours of biological science.
424. The Biology of the Endocrine Glands. (3-2). Credit 4.  
A study of the structure, development, comparative anatomy and physiology of the endocrine glands in the different animal groups. Prerequisite: Biology 217, 218 or the equivalent.

### FOR GRADUATES

603. Advanced Vertebrate Zoology. (1-5). Credit 3.  
Phylogeny of vertebrates based on comparative anatomy, histology, and embryology. Professor Potter.
604. Advanced Embryology. (1-5). Credit 3.  
Comparative and experimental studies of the mechanics of embryonic development. Professor Potter.
- 605, 606. Advanced Bacteriology. (2-6). Credit 4 each semester.  
Advanced methods of bacteriological analysis. These courses carry separate credit and are varied to suit the needs of students in sanitary engineering and other special fields. Associate Professor Gibbons.
609. Plant Physiological Methods and Materials. (2-6). Credit 4.  
Methods employed in the various types of physiological investigations and the interpretation of results obtained by them. Prerequisite: Biology 313, 314 or equivalent. Associate Professor Talley.
610. Plant Physiological Topics. (2-6). Credit 4.  
Special topics in plant physiology, including the history and recent developments of current active phases of the field. The laboratory work consists of chosen or assigned minor projects. Prerequisite: Biology 609. Associate Professor Talley.
612. Biochemistry of Plants and Plant Products. (2-6). Credit 4.  
The application of biochemical techniques to plants of economic importance. The plants and processes considered will depend upon the demands of the group served. Prerequisite: approval of instructor. Assistant Professor Brown.
613. Advanced Plant Pathology. (2-6). Credit 4.  
Designed for the student desiring more detailed information on the diseases of specific crop plants. Prerequisite: Biology 416 or equivalent. Dr. Bretz.
614. Plant Disease Control. (2-6). Credit 4.  
A comprehensive study of the principles of plant disease control. Prerequisite: Biology 416. Dr. Bretz.

- 615, 616. Cytology. (2-6). Credit 4 each semester.  
An intensive study of the organization and activities of the cell; cytological technique. Emphasis is placed upon topics related to heredity. Professor Reeves.
617. Advanced Invertebrate Zoology. (2-6). Credit 4.  
Morphology, taxonomy, biology, and phylogeny of invertebrate animals. Prerequisite: Biology 105, 106 or equivalent. Assistant Professor Hopkins.
618. Animal Parasitology. (2-6). Credit 4.  
Study of parasitic worms and protozoa; laboratory methods in parasitology. Prerequisite: Biology 617 or equivalent. Assistant Professor Hopkins.
- 619, 620. Advanced Systematic Botany. (2-6). Credit 4 each semester.  
Classification and identification of Spermatophytes with emphasis on the difficult families. Independent credit will be allowed for the terms, which may be taken in reverse order. Prerequisite: Biology 102, or 346, or equivalent. Professor Reeves.
- 621, 622. Research. Credit 1 to 4 each semester.  
Problems in the various phases of plant and animal science; subject to approval by head of department. See also Biology 673, 674.
623. Advanced Plant Morphology. (1-3). Credit 2.  
Comparative morphology of plants with emphasis on vascular forms. Professor Doak or Professor LaMotte.
624. Advanced Plant Morphology. (1-3). Credit 2.  
A continuation of Biology 623. Professor Doak or Professor LaMotte.
625. Limnology. (1-4). Credit 2.  
A study of lakes and streams with reference to physical and biological cycles, in natural waters; emphasis on factors of importance in sanitation. Prerequisite: Approval of instructor. Assistant Professor Schipper.
- 673, 674. Research. Credit 2 to 6 each semester.  
Same as 621, 622 except administered by some member of the staff of the Texas Agricultural Experiment Station. Offered by individual agreement only.

## CHEMICAL ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

303. Industrial Stoichiometry. (3-0). Credit 3.  
Interpretation and correlation of laboratory quantitative analyses with industrial data, emphasizing the quantity relationships of materials and energies. Prerequisite: Chemistry 216 and Physics 204.
304. Unit Operations. (3-3). Credit 4.  
A study of the operations and equipment involved in the processing of materials as represented by conveying, crushing and grinding, filtration and other separations, extractions, agitation and crystallization. Material balances, physical tests, and chemical analyses on separate processes or a combination of several operations are an important part; power tests will be made when feasible. The student will be trained to plan and correlate his work with others. Prerequisite: Chemical Engineering 303.
409. Oil and Gas Technology. (3-3). Credit 4.  
Application of principles of Chemistry and engineering to evaluation and treatment of petroleum and its products. Prerequisite: Chemistry 302 and Chemical Engineering 304.
414. Sanitary Chemistry. (3-4). Credit 4.  
Sanitary examination of food, milk, and milk products, and the sanitary analysis of water, including water treatment methods. Methods of purification of water, as the use of sand filters, coagulants, and algicides; sources of pollution of water and milk supplies and their relation to public health, problems common to the sanitary chemist and the engineer. Prerequisite: Chemistry 206 or 301.
422. Animal and Vegetable Oils. (3-4). Credit 4.  
Chemical examination of animal and vegetable oils with special reference to the detection of adulterants. Prerequisite: Chemistry 302.

**423. Unit Operations. (3-3). Credit 4.**

This is a continuation of Chemical Engineering 304, taking flow of fluids, heat transfer, evaporation, drying, absorptions and distillation. Prerequisite: Chemical Engineering 304.

**424. Unit Operations. (3-3). Credit 4.**

Industrial applications of cements, soaps, pulp and paper, organic synthetics, fuels, glass, rubber and many others. Library work, leading to preparation of oral and written reports. Prerequisite: Chemical Engineering 423.

**426. Design. (3-3). Credit 4.**

Special problems in the design of chemical engineering equipment and investigation of process development including specifications, drawings and estimates. Prerequisite: Chemical Engineering 423.

**FOR GRADUATES**

**603, 604. Advanced Chemical Engineering. (2-6). Credit 4 each semester.**

A study of industrial operations and processes. Prerequisite: Chemical Engineering 424. Professor Lindsay.

**609, 610. Cotton Seed Oil. (2-6). Credit 4 each semester.**

A study of cotton seed oil production and refining. Prerequisite: Chemical Engineering 424. Associate Professor Bishop.

**613, 614. Research. Credit 1 to 4 each semester.**

**CHEMISTRY**

**FOR GRADUATES AND ADVANCED UNDERGRADUATES**

**301, 302. Organic Chemistry. (3-4). Credit 4 each semester.**

An introduction to the chemistry of the compounds of carbon. A study of general principles, and their application to various industrial processes. The laboratory work serves as the basis of the course. The student here familiarizes himself with the reactions, properties and relations of typical organic compounds. Prerequisite: Chemistry 102 or 104.

**323. Physical Chemistry. (3-4). Credit 4.**

Explanation and mathematical development of the theories and principles of chemistry. Topics discussed are atomic structure, gas laws, thermodynamics, thermochemistry, liquids, solutions, osmotic pressure, colloids. Experiments in the laboratory substantiate the theories and the principles developed in the classroom. Prerequisite: Chemistry 216, Mathematics 204.

**324. Physical Chemistry. (3-4). Credit 4.**

Intensive study of homogeneous and heterogeneous equilibria, the phase rule, chemical kinetics, catalysis, hydrogen-ion concentration, electrolytic and galvanic cells and electrochemistry, photochemistry, and radio activity. Prerequisite: Chemistry 323.

**342. Physical Chemistry. (3-4). Credit 4.**

Explanation of basic chemical theories and principles with reference to their relationship to transformations in living matter. Special development is made of such topics as atomic structure, diffusion and osmotic pressure, colloids, chemical equilibrium, catalysis, reaction velocity, hydrogen-ion concentration and its importance in biological process. Prerequisite: Chemistry 206, 207, or 216.

**443, 444. Animal Biochemistry. (3-3). Credit 4 each semester.**

The chemistry of cell constituents and their utilization in the animal body. Prerequisite: Chemistry 302.

**445, 446. Plant Biochemistry. (3-3). Credit 4 each semester.**

A study of the chemical processes in the growth and development of plants. Prerequisite: Chemistry 302.

**448. Electrochemistry. (2-2). Credit 3.**

A study of the theory of galvanic and electrolytic cells and their applications. Prerequisite: Chemistry 324.

**449. Energetics. (4-0). Credit 4.**

Study and mathematical treatment of energy relationships involved in chemical and physical transformations. Special attention given to free energy, fugacity, and activity. Prerequisite: Chemistry 302 and 324.

**450. Colloidal Chemistry. (3-3). Credit 4.**

A study of the theories and preparation of disperse systems. Prerequisites: Chemistry 302 and 324.

**FOR GRADUATES**

**601, 602. Advanced Agricultural Chemistry. (2-6). Credit 4 each semester.**

Similar to course 212, 214, with more advanced work. Professor Hedges.

**607, 608. Advanced Organic Chemistry. (2-6). Credit 4 each semester.**

Analysis and preparation of organic compounds. Prerequisite: Chemistry 302. Professor Potts.

**611, 612. Advanced Physical Chemistry. (3-3). Credit 4 each semester.**

An intensive study of physical and electro chemistry. Prerequisite: Chemistry 324. Professor Jensen.

**613, 614. Research. Credit 1 to 4 each semester.**

**671, 672. Special Topics in the Chemistry of Animal Nutrition. (2-6). Credit 4 each semester.**

Vitamins, amino acids; mineral contents of feeds, productive protein, and productive energy as related to animal nutrition. The laboratory work is under Agricultural Experiment Station conditions and includes analysis of feeds, experiments, and a thesis on the chemistry of animal nutrition.

**673, 674. Special Topics in the Chemistry of Animal Nutrition. (2-6). Credit 4 each semester.**

A continuation of course 671, 672.

**675, 676. Special Topics in the Chemistry of Soils. (2-6). Credit 4 each semester.**

The study of soil acidity, phosphoric acid, potash, and nitrogen related to crops, and similar topics by means of books, bulletins, original articles and the preparation of reports. The laboratory work accompanying the course will depend upon the experiences of the student.

**677, 678. Special Topics in the Chemistry of Soils. (2-6). Credit 4 each semester.**

A continuation of course 675, 676.

**CIVIL ENGINEERING**

**FOR GRADUATES AND ADVANCED UNDERGRADUATES**

**305. Mechanics of Materials. (4-0). Credit 4.**

The resistance of materials, and the mechanics of pipes, riveted joints, beams, columns, shafts. Elastic curve and the deflection of beams, combined stresses, resilience, and impact. Prerequisite: Mathematics 204; Mechanical Engineering 212 or equivalent.

**311. Hydraulics. (3-0). Credit 3.**

The laws governing the action of water at rest and in motion, as related to engineering problems; the flow of water in pressure mains, sewers, aqueducts, open channels, and in rivers; measurement of the flow of water by nozzles, orifices, weirs and meters; elements of the theory of pumps and water wheels. Prerequisite: Mechanical Engineering 212, or equivalent.

**336. Hydraulics Laboratory. (0-2). Credit 1.**

Calibration of nozzles, orifices, water meters, weirs, pressure gauges; measurement of pipe friction; measurement of pipe flow with Pitot instrument and Venturi meter; efficiency tests on impulse motor, hydraulic ram, and centrifugal pump; solution of assigned problems. Prerequisite: Civil Engineering 311, or registration therein.

**344. Mechanics of Reinforced Concrete. (2-0). Credit 2.**

Theory of stress distribution in plain and reinforced concrete beams; derivation of working formulas for rectangular reinforced beams and T-beams; stress determination with elementary design of beams; theory, investigation, and design of reinforced columns. Prerequisite: Civil Engineering 305.

**345. Structural Analysis. (3-0). Credit 3.**

The study and evaluation of loads on structures; graphical and algebraic determination of reactions on structures; graphical and algebraic determination of dead and live load stresses in roof trusses, bridge trusses with simple panels, mill bents, and three-hinged arches used as roof trusses. Prerequisite: Civil Engineering 305 or registration therein.

**346. Structural Design. (3-3). Credit 4.**

The theory and practice of the design of tension members, compression members, members subject to direct stress and bending, beams, girders; riveted, bolted, and welded connections. Practice period devoted to the design of structural members of steel as found in buildings and bridges in accordance with current specifications. Prerequisite: Civil Engineering 345, 347.

**347. Structural Drafting. (0-3). Credit 1.**

Practice in the detailing of structural members and joints. Prerequisite: Civil Engineering 305 or registration therein.

**407. Roads and Pavements. (3-0). Credit 3.**

A brief study of country roads and city pavements. Highway location, design, construction and maintenance; road laws, finances, organization and supervision briefly considered. The text is supplemented by lectures, the use of bulletins, models and samples of materials. Prerequisite: Senior classification.

**414. Reinforced Concrete Design. (2-3). Credit 3.**

A study of the design of various types of reinforced concrete structures, such as buildings, bridges, retaining walls, culverts. Practice in the making of simple designs and working drawings. Prerequisite: Civil Engineering 344.

**417. Bituminous Materials. (2-3). Credit 3.**

Origin, production, specifications and tests of bituminous materials and mixtures used in the construction and maintenance of roads and pavements. Prerequisite: Senior classification in engineering.

**443. Materials of Construction. (0-4). Credit 1.**

A laboratory study of the suitability of various materials of engineering including brick, stone, sand, gravel, cement, mortars, concrete. Prerequisite: Civil Engineering 407.

**448. Engineering Economy. (3-0). Credit 3.**

Comparison of engineering plants or projects on basis of first cost, ultimate economy comparisons involving depreciation, operating expense, etc.; accounting records and cost records; estimating costs. Prerequisite: Junior classification in engineering.

**456. Highway Administration and Design. (2-3). Credit 3.**

Study of highway laws, the administration of street and highway improvements and the procedure followed in planning and executing municipal street improvements. Problems in pavement design. Prerequisite: Civil Engineering 407.

**458. Hydraulic Engineering. (3-0). Credit 3.**

An elementary study of the control and utilization of water resources for irrigation, power, and flood protection; correlation of rainfall and stream flow by means of isohyets and hydrographs; channel improvement, levee design, detention basin operation; design of pumping plants and other hydraulic structures. Prerequisite: Civil Engineering 311.

**463. Hydrology. (3-0). Credit 3.**

A study of the occurrences and measurement of precipitation and stream flow; relations between precipitation and run-off; estimating seepage, evaporation, run-off, storage, and flood discharges for drainage basins. Prerequisite: Civil Engineering 311.

**465. Masonry and Foundations. (2-2). Credit 3.**

An elementary study of the manufacture and use of stone, brick, cement; methods of proportioning, placing and curing concrete; a study of the different types of dams, retaining walls, bins and chimneys. The student is given an introduction to Soil Mechanics in which the different types of foundations are studied and problems involving settlement and rate of settlement are considered. Practice consists in solution of problems parallel to theory assignments. Prerequisite: C. E. 305.

**466. Professional Relations. (2-0). Credit 2.**

A study of the responsibilities, duties, and opportunities of the engineer in his various capacities, such as inspector or junior engineer, salaried executive; independent consulting engineer, with special reference to the civil engineering field; brief study of contracts and engineering specifications; lectures, partly by visiting professional men, planned to enable the young engineer to fit most advantageously into the professional, industrial, and civic life of his community. Prerequisite: Senior classification in Civil Engineering.

**467. Steel Bridge Structures. (2-3). Credit 3.**

Analysis of bridges with sub-divided panels; with double web systems; three-hinged arch bridges; cantilever bridges; the causes of secondary stresses; the reduction of secondary stresses by proper attention to design; discussion of the economics of bridge types. Practice period devoted to the design and analysis of highway and railway bridges in keeping with current specifications. Prerequisite: Civil Engineering 346.

**468. Statically Indeterminate Structures. (2-3). Credit 3.**

Study of methods for finding deflections of structures, including the moment-area, conjugate beam, Maxwell-Mohr, Castigliano's, and slope-deflection methods; application of these methods to the solution of the simpler statically indeterminate problems; solution of highly indeterminate structures by methods of successive approximation. Practice period devoted to the solution of problems by the preceding methods. Prerequisite: Civil Engineering 346.

**469. Steel Building Structures. (2-3). Credit 3.**

Roof loads, roofing, and roof construction; study of buildings of the mill type, including the design of crane runways, columns loaded at different elevations, and column bases; buildings of the office type, including the design of beams, girders, columns, and a discussion of floor construction; analysis of wind stresses in tall buildings by approximate methods; design of wind-bracing; brief study of bins, tanks, and towers. The practice consists in making the design of industrial and office building elements. Prerequisite: Civil Engineering 346.

**FOR GRADUATES**

**625, 626. Highway Construction and Materials. (3-3). Credit 4 each semester.**

Highway design and construction, including location, drainage, foundations, types, costs. Laboratory and field investigations of highway materials and pavement mixtures. Professor McNew.

**627, 628. Hydraulic Engineering. (3-3). Credit 4 each semester.**

Advanced hydrology, water power development, flood control, irrigation. Professor Munson.

**631. Advanced Structural Analysis. (3-3). Credit 4.**

Review of methods of finding the deflection of structures including the double-integration, moment-area, conjugate beam, Maxwell-Mohr, Castigliano's, trigonometric series and slope-deflection methods; application of the preceding methods to a variety of problems such as the deflection of beams and trusses, solution of statically-indeterminate beams, trusses, and simple frames with emphasis on selection of the most advantageous method; study of the two-hinged braced and solid-rib arch, the latter by the method of elastic weights. Professor Jakkula.

**632. Advanced Structural Design. (2-6). Credit 4.**

A continuation of Civil Engineering 631. Analysis of the fixed reinforced concrete arch; solution of simultaneous equations by Seidal's method of iteration; analysis of rigid frames by methods of successive approximation and slope-deflection; secondary stresses in bridges; design of statically indeterminate structures. Practice includes complete design of a fixed concrete arch and solution of secondary stresses in a truss. Professor Jakkula.

**633. Advanced Mechanics of Materials. (4-0). Credit 4.**

Principal stresses and theories of failure of elastic action; stress concentration; unsymmetrical bending; mechanical methods for study of internal stresses; special problems such as bending in flat plates, buckling of webs, bending in curved beams and hooks. Professor Sandstedt.

**635, 636. City Street Paving. (2-0). Credit 2 each semester.**

Financing municipal street improvements, methods of assessment, Texas paving laws. Pavement types, costs, designs and traffic characteristics. Street grades, widths, intersections and appurtenances. Special problems. Professor McNew.

637, 638. Advanced Materials of Construction. (1-3). Credit 2 each semester.

Sub-grade soil studies and laboratory investigations of engineering materials. Special problems. Professor McNew.

641, 642. Research. Credit 2 to 6 each semester.

Technical research; project subject to approval of head of department.

644. Structural Model Analysis. (1-3). Credit 2.

The mechanical analysis of stresses in statically indeterminate structures by means of models. The use of the Beggs' apparatus in analyzing complicated structures will be given particular attention. Practice period will be devoted to the making and testing of structural models. Professor Jakkula.

646. Photoelasticity. (1-3). Credit 2.

An introduction to the theory and technique of stress-determination in two-dimensional objects by means of polarized light. Practice period devoted to the making and testing of models. Professor Jakkula.

649. Soil Mechanics. (3-4). Credit 4.

A study of foundation materials as they exist and of the various types of soils, their physical properties, testing procedure, and principles of classification. Professor McNew.

650. Soil Mechanics. (3-4). Credit 4.

A study of theory and practice in foundation explorations, laboratory investigations of undisturbed foundation samples, stress distribution through soils; problems in foundation design, correlation of settlement data from actual observations on the behavior of existing structures, stability of embankments, backfill pressures. Professor McNew.

## COTTON MARKETING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

413, 414. Cotton Classing. (1-3, 0-3). Credit 2, 1.

Recitations and lectures on classification and stapling of cotton, buying spot cotton, papers used in the cotton trade and cotton exchanges.

## DAIRY HUSBANDRY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Market Milk. (3-2). Credit 4.

Nutritional value of milk; milk and public health; organization of city milk supplies; processing and distribution and inspection of market milk supplies. Prerequisite: Dairy Husbandry 202, Biology 206.

306. Butter Making and Factory Management. (3-2). Credit 4.

Types of creameries; raw products; grading, pasteurization; use of commercial starters; ripening; churning; salting and working butter; explanation of various physical phenomena in making, packing, and storing butter. Creamery location and plans; business accounting as applied to management in various types of creameries. Prerequisite: Dairy Husbandry 202.

311. Technical Control of Dairy Products. (2-6). Credit 4.

Methods of analysis of milk and milk products, and their use in controlling the composition and purity of dairy products and in the detection of adulterations. Prerequisite: Dairy Husbandry 202, Chemistry 212, 214.

320. Bacteriology of Dairy Products. (3-4). Credit 4.

Relation of micro-organisms to quality in milk products; a study of the actions of micro-organisms in the ripening of cheese, butter and fermented milk. Prerequisite: Dairy 206.

322. Advanced Dairy Bacteriology. (2-3). Credit 3.

A study of bacteriological problems in connection with dairy products. Prerequisite: Dairy Husbandry 320.

**407. Ice Cream Making and Refrigeration. (3-2). Credit 4.**

Mixing and freezing ice cream, sherbets and other frozen products and the physical principles involved; types of freezers; flavoring materials; fillers, binders, ice cream standards; the theory and practice of artificial refrigeration and its use in the ice cream plant. Prerequisite: Dairy Husbandry 202.

**408. Cheese Making. (2-3). Credit 3.**

A study of the manufacture, ripening and marketing of the various types of cheese. Prerequisite: Dairy Husbandry 202.

**409. Advanced Study of Dairy Breeds. (1-4). Credit 2.**

Historical study of prominent dairy families and individuals of the major dairy breeds. Prerequisite: Dairy Husbandry 202, Genetics 301.

**415. Condensed Milk and Milk Powder. (3-0). Credit 3.**

The food value, manufacture and distribution of condensed and evaporated milk, milk powder, milk sugar, casein and other milk products; a study of milk substitutes. Prerequisite: Dairy Husbandry 301.

**417. History and Development of Dairy Cattle. (3-3). Credit 4.**

A general history of dairy farming and its place in a permanent system of agriculture; history, origin and classification of dairy cattle and dairy cattle breeds. Consideration of the selection of breeds, individual cows and herd sires; dairy cattle breeding and other problems of the breeder. Prerequisite: Dairy Husbandry 202 and Genetics 301.

**418. Feeding and Management of Dairy Cattle. (3-2). Credit 4.**

The care, feeding and management of the dairy herd; calf raising, developing the dairy heifer, herd records and record keeping. Prerequisite: Animal Husbandry 303, Dairy Husbandry 202.

**421, 422. Seminar. (1-0). Credit 1 each semester.**

A review of current dairy literature and presentation of papers on selected dairy topics.

#### FOR GRADUATES

**601, 602. Advanced Dairy Production. (2-6). Credit 4 each semester.**

An advanced study of general production problems. Prerequisite: Dairy Husbandry 409, 417 and 418. Professor Darnell.

**603, 604. Advanced Dairy Manufactures. (2-6). Credit 4 each semester.**

An advanced study of general manufacturing problems. Prerequisite: Dairy Husbandry 301, 306, 407 and 415. Associate Professor Moore.

**605, 606. Research in Dairy Production. Credit 2 to 6 each semester.**

A study of research methods and a review of scientific literature dealing with special dairy production problems. Students will select individual problems, subject to the approval of the head of the department. Prerequisite: Dairy Husbandry 417, 418. Professors Shepardson and Darnell.

**607, 608. Research in Dairy Manufactures and Plant Sanitation. Credit 2 to 6 each semester.**

A study of research methods and review of scientific literature dealing with special problems in dairy manufacture and dairy plant sanitation. Students will select individual problems subject to the approval of the head of the department. Special attention will be given to the needs of milk sanitarians taking this course. Prerequisite: Dairy Husbandry 301, 320. Associate Professor Moore and Assistant Professor Arbuckle.

**610. Endocrinology of Milk Secretion.\* (3-0). Credit 3.**

A study of the various endocrine organs with special emphasis on their relation to milk secretion.

#### ECONOMICS

##### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**311. Money and Banking. (3-0). Credit 3.**

The evolution of money, the various forms of credit, the history of banking institutions, banking in other countries, the Federal Reserve System, and current monetary and banking problems. Prerequisite: Economics 203, 204, or 403.

\*Offered in the summer of 1941 by Dr. Chas. W. Turner of the University of Missouri.

**318. Labor Problems. (3-0). Credit 3.**

Theories of wages, development of trade unions and labor unions, proposals for solution of labor problems, labor legislation, and other problems growing out of modern industrial development. Prerequisite: Economics 203, 204, or 403.

**408. Corporation Finance. (3-0). Credit 3.**

The common forms of business organizations with special attention to corporations. Advantages of incorporation, formation and organization of corporations, capital stock and bonds, legal status of corporations, bankruptcy and reorganization.

**409. Foreign Trade and Exchange. (3-0). Credit 3.**

The principles of international commerce, methods of conducting foreign trade, and the theory and practice of foreign exchange.

**412. Public Finance and Taxation. (3-0). Credit 3.**

The purpose of the course is to give a working knowledge of public financial institutions and practices. Among the topics considered are: The amount and growth of public expenditures; the sources of revenue; budgetary methods; principles which should govern appropriations; public industries and price making; the principles of taxation; the important kinds of taxes; the principles of borrowing; the management of public debts.

**413, 414. Advanced Economic Theory. (3-0) Credit 3 each semester.**

This course is based on two assumptions, namely (1) the nature of economic theory is such that maturity of judgment is essential to its comprehension, and (2) contact with practical economic problems is highly valuable in grasping economic concepts. The advanced course in economic theory, therefore, covers the same ground as that covered in other courses in economic principles but covers it more exhaustively. The course is open only to students who have had Economics 203, 204, or its equivalent, and in addition at least one course in applied economics.

**416. Public Utility Economics. (3-0). Credit 3.**

A general survey course examining: historical development; legal and economic principles; evolution in methods and types of regulation; financial policies; labor policies; taxation and rate making, public ownership.

**421. Government and Industry. (3-0). Credit 3.**

A comprehensive survey and a critical analysis of the reasons for the depression; legislation designed to afford temporary relief, stimulate recovering, regulate commerce and industry, and formulate long-term plans for better social use of our economic resources. Prerequisite: Economics 203, 204, or 403.

**422. Banking Principles and Practices. (3-0). Credit 3.**

A critical study of the principal credit institutions of the United States and other nations. The major emphasis is placed on commercial credit. Some attention, however, is given to other credit institutions. Prerequisite: Economics 311 or its equivalent.

**423. Advertising. (3-0). Credit 3.**

Place of advertising in business; advertising media, such as the newspaper, trade paper, magazine, direct mail, poster, and the radio; description of the various methods of advertising; development of copy and layout of advertisements; consumer habits and psychology; methods of investigation for advertising campaigns; cost of advertising; legal and technical problems involved in advertising; consideration of advertising from the standpoint of consumers. Prerequisite: Economics 203 and 204, or 403.

**424. Modern Transportation. (3-0). Credit 3.**

A comprehensive survey of rail, motor, water, air and pipe line transportation, including the special operating, administrative, rate, financial, and regulatory problems of each and the problems and the technique of coordination. Prerequisite: Economics 403 or its equivalent.

**425. Insurance Law. (3-0). Credit 3.**

Study of methods of administrative control by the state. Distinguishing features of the insurance contract. Insurable interest in life and property insurance. The common law doctrine of warranty and its modification by statute and judicial interpretation. Representations and tests of materiality to the risk. Prerequisite: Economics 315, 316.

**426. Real Estate Titles and Conveyances. (3-0). Credit 3.**

The ownership and transfer of titles to real property. Special attention is given the economic and legal problems with oil and gas leases. Also a study is made of problems associated with urban realty. Prerequisite: Economics 316, and 403 or its equivalent.

**427. Domestic and Foreign Trade Policies. (3-0). Credit 3.**

A critical examination of governmental policies toward international trade both at home and abroad. An effort is made to view these policies in the light of accepted economic doctrines with regard to international trade. Prerequisite: Economics 409.

**FOR GRADUATES**

**601, 602. History of Economic Doctrines. (4-0). Credit 4 each semester.**

The purpose of this course is to study in detail, beginning with the Physiocrats, the growth of the science of economics. A careful study is made of the various schools of economists and an analysis is made of such fundamental concepts as production, value, capital, interest and profits, as they have appeared from time to time in the writings of the leading economists. Gide and Rist's History of Economic Doctrines serves as a guide to these authorities. Professors Clark and Adams.

**605. Public Finance. (4-0). Credit 4.**

An account of the evolution of financial systems; a chronological review of the discussion of the theories and principles of finance; a study of current theory and practice in public borrowing and levying, financial administration and expenditure of public revenues in the United States and the principal European countries. Professor Clark.

**606. Labor Problems. (4-0). Credit 4.**

A historical survey of the evolution of labor movements and programs, with a critical examination of their underlying philosophies. The economic principles involved in the leading problems of labor and wages. Professor Clark.

**607. Comparative Economic Theory. (4-0). Credit 4.**

This is a comparative study of the doctrines as they appear in modern economic literature. The purpose is, so far as possible, to associate the modern economists with any of the older schools to which they may logically belong or to give them distinctive positions to which their writings may entitle them. Professor Clark.

**609, 610. Research. Credit 2 to 4 each semester.**

For graduate students whose major is economics. Critical examination in seminar of the subject matter of these and dissertations.

**EDUCATION**

**FOR GRADUATES AND ADVANCED UNDERGRADUATES**

**321. Secondary School Methods. (3-0). Credit 3.**

Methods of teaching high school subjects; for students who expect to teach in city high schools.

**322. Secondary School Administration. (3-0). Credit 3.**

The administrative problems of the high school; for teachers who expect to administer school systems.

**422. History of Education. (3-0). Credit 3.**

The history of modern education, with special attention to the history of education in the United States.

**426. Tests and Measurements. (3-0). Credit 3.**

A study of the use of intelligence and achievement tests in administration and supervision of public schools. Prerequisite: Junior or Senior standing.

**427. Administration of Pupil-Personnel. (3-0). Credit 3.**

A study of the teacher's responsibilities in pupil adjustments, case studies, clinical procedures, and remedial measures.

**428. Junior High School Methods. (3-0). Credit 3.**

This course will introduce the student to the modern practices of teaching in the Junior High School.

**430. Curriculum Construction. (3-0). Credit 3.**

Problems and lectures in revising and adjusting the public school curriculum to meet the needs of modern society. Prerequisite: Junior or Senior standing.

## FOR GRADUATES

601. Problems in Rural Education. (4-0). Credit 4.  
The rural school problem in the United States, including problems in related fields. Professor Hughes.
602. Problems in Rural School Administration. (3-0). Credit 3.  
Organization, supervision, and administration of rural schools. Professor Hughes.
604. Development of Education in Texas. (2-0). Credit 2.  
The origin and development of public school education in Texas. Professor Hughes.
607. Programs and Procedures in Supervision. (2-0). Credit 2.  
Types of supervision and the organization of supervisory programs. Professor Wilcox.
608. Administration of Local School Finance. (2-0). Credit 2.  
A study of school funds on the local school level; sources, budgeting, systems of accounting as related to school efficiency. Professor Wilcox.
609. Public School Laws. (2-0). Credit 2.  
A review of the constitutional provisions, statute laws, court decisions, and regulations governing the public schools, with special reference to Texas.
610. Pupil Accounting. (2-0). Credit 2.  
A study of devices to record and improve census taking and attendance; classification and promotional schemes; school record systems; school reports and pupil appraisal studies; marking systems. Professor Wilcox.
611. The Newer Techniques in Teaching. (4-0). Credit 4.  
A critical evaluation of such techniques as supervised study, the project, the problem, the Dalton Plan, the Winnetka Plan, the Activity Movement, the appreciation lesson, the Morrison Plan, and the use of work books. Professor Wilcox.
612. Interpreting the Schools to the Public. (2-0). Credit 2.  
A study of types of programs designed to give to the public comprehensive information of the local school; devices and media used in presenting information. Professor Wilcox.
613. The School Plant. (2-0). Credit 2.  
A study of plans for determining the extent and character of present and future building and equipment needs of a school unit; efficiency of present plant; operation and maintenance; planning the building program. Professor Wilcox.
614. State School Finance. (2-0). Credit 2.  
A study of taxation for school support; apportionment of state school funds; endowments and subsidies; equalizing educational opportunities and tax burdens. Professor Hughes.
615. State School Administration. (2-0). Credit 2.  
A study of state school administrative organizations; origin and development of local units; proper relationships of the State to local units; state boards of education and their functioning; training and certification of teachers. Professor Hughes.
616. Administration of Teacher-Personnel. (2-0). Credit 2.  
A study of selection, tenure and promotion of teachers, including in-service training; efficiency records and ratings. Professor Hughes.
- 617, 618. Research and Thesis. Credit 1 to 4 each semester.  
Individual research on problems selected with the approval of the head of the department, or on approved thesis projects. Staff.

## ELECTRICAL ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

315. Alternating Currents. (3-6). Credit 5.  
Principles of alternating currents. The steady-state relations of voltage and current in simple circuits containing resistance, self inductance, mutual inductance and capacitance. Power and power factor, polyphase circuits. The practice consists of laboratory studies of the topics mentioned above. Prerequisite: Electrical Engineering 208 and Mathematics 204, or consent of Head of Department.

405. Electrical Transmission. (3-0). Credit 3.

Lectures and recitations on the transmission of electricity by wires. The subject is treated by the use of hyperbolic functions and covers the fundamental principles of electric transmission which are applicable to either telephone or power transmission. Prerequisite: Mathematics 305, Electrical Engineering 316.

406. Electrical Distribution and Transmission. (2-2). Credit 3.

Lectures and recitations on the transmission and distribution of power by electrical methods, including the design and cost estimate of several transmission and distribution systems. Prerequisite: Electrical Engineering 405.

409. Radio Communication. (3-3). Credit 4.

An introduction to radio engineering, including a basic study of radiation and radiation devices, thermionic tubes and their application in radio receiving and transmitting circuits. Prerequisite: Electrical Engineering 315.

410. Electron Tubes. (2-3). Credit 3.

An introduction to the theory and industrial application of electron tubes and devices, including thermionic, gaseous, light sensitive, and cathode ray tubes. The laboratory shall consist primarily of experimental studies of the performance characteristics of electron tubes. Prerequisite: Electrical Engineering 305, or 308, or 315.

416. Motor Applications. (3-0). Credit 3.

The determination of the proper sizes and types of motors to be applied in various industrial loads. Special emphasis is laid on the preliminary study of duty cycles and numerical calculation of starting duty and motor ratings. The study of industrial controllers. Prerequisite: Electrical Engineering 401 or 308.

426. Illumination Engineering. (3-3). Credit 4.

The principles of illumination; the design of lighting systems for buildings of various types. Tests of lighting units and of complete systems both for interior and exterior use. Prerequisite: Electrical Engineering 208 or 308 or 305.

428. Communication Circuits. (3-3). Credit 4.

A study of the engineering principles used in telephone communication, including transmission theory, inductive interference, networks, and filters, loading, repeater and carrier systems. Laboratory investigations include transmission measurements on artificial lines and repeaters involving the use of vacuum tube measuring devices and impedance bridges. Prerequisite: Electrical Engineering 405.

431. Engineering Administration. (2-0). Credit 2.

A brief study of problems of engineering administration, including the law of contracts, records to be kept in engineering construction and operation, systems of organizations required. Prerequisite: Senior classification.

432. Public Utility Problems. (3-0). Credit 3.

The problems of operation of public utilities with particular attention to methods of organization, the fixing of rates, and the economic features of new lines and extensions. Prerequisite: Electrical Engineering 401, 431.

FOR GRADUATES

601, 602. Advanced Alternating Currents. (3-4). Credit 4 each semester.

Wave analysis—mechanical and electrical wave analyzers; non-linear circuits; multiple winding transformer theory; transient solution of general networks; operational calculus and its application to electrical circuits. The study of transients with oscillographs. Professor Rode.

603. Electrical Machine Design. (1-3). Credit 2.

The design of electrical machines and the predetermination of their characteristics. Professor Hughes.

604. Electrical Plant Design. (1-3). Credit 2.

The design of power plants with special emphasis on the electrical machinery. Professor Hughes.

607, 608. Advanced Alternating Current Machinery. (2-6). Credit 4 each semester.

A study of complicated alternating current machines. (See Note A.) Professors Hughes and Rode.

609. Advanced Communication Engineering—Telephony. (3-3).  
Credit 4.

A study of the design and operation of telephone repeater and carrier systems, filters, networks, and transmission measuring devices; laboratory investigations to include frequency characteristics of telephone lines, and transmission measurements on typical networks, lines and repeaters. (See Note A.) Professor Dillingham.

610. Advanced Communication Engineering—Radio. (3-3). Credit 4.

A detailed study of the design and operation of sound amplifiers, and of radio frequency systems with particular reference to radiating devices. Oscillographic studies and field strength measurements are the major laboratory investigations. (See Note A.) Professor Dillingham.

611. Symmetrical Components Applied to Electrical Engineering. (3-4).  
Credit 4.

The solution of unbalanced electrical circuits by means of symmetrical components; the study and measurement of machine constants by means of the oscillograph. (See Note A.) Professor Hughes and Assistant Professor Grandi.

612. Application of Electrical Machinery to Industrial Operations.  
(4-0). Credit 4.

A study of characteristics of electrical motors with special emphasis on their application to different types of loading, electrical control and the development of electrically operated drives; study of rate charges for service. Professors Hughes and Markle.

613, 614. Public Utility Administration. (4-0). Credit 4 each semester.

A study of the development of public service regulations by commission, status of public service corporations in the courts, the fixing of rate bases and analyses of methods used in determining cost of service, and other problems pertaining to Public Utility Administration. Professor Bolton.

616. Acoustic Devices in Sound Reproducing Systems. (3-3). Credit 4.

A detailed study of microphones and loud speakers with an introduction to the basic theory of vibrating systems, and a brief study of architectural physiological acoustics incident to the proper application of sound reproducing systems. Laboratory work includes measurements of speakers and microphones, noise surveys, and acoustical treatment of small auditoria. (See Note A.) Professor Dillingham.

617, 618. Research in Electrical Engineering. Credit 2 to 6 each semester.

Technical research projects approved by the head of the department.

620. Advanced Illuminating Engineering. (3-3). Credit 4.

A study of fundamentals of illuminating engineering concepts; advanced design of various types of lighting installations; problems of a research character. (See Note A.) Associate Professor Fouraker.

621. High Voltage Phenomena. (2-0). Credit 2.

A study of dielectrics as applied to the insulation of high voltage systems; lightning and lightning protection. Associate Professor Haupt.

622. High Voltage Laboratory. (0-6). Credit 2.

60 cycle and impulse testing; measurement of impulse voltages and currents with a high voltage cathode ray oscillograph. Associate Professor Haupt.

## ENGINEERING RESEARCH

### FOR GRADUATES

On available projects requiring graduate personnel, credit ranging from 2 to 6 hours may be gained in Engineering Research. All projects of this class are to be approved in advance by the Dean of the Graduate School, the Director of the Engineering Experiment Station, and the head of the engineering department in which the research project is to be conducted.

NOTE A.—In the summer session these courses may be divided into two parts, a and b, each with two hours of credit.

## ENGLISH

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**307. Technical Writing. (2-0). Credit 2.**

The composition of reports, recommendations, and scientific articles suitable for publication, with some opportunity for oral presentation. Prerequisite: English 203, 210, or 231, 232.

**309. The English Language. (3-0). Credit 3.**

A study of the history, vocabulary, syntax, and sounds of the English language. Prerequisite: English 231, 232, or 203, 210.

**310. Phonetics and Pronunciation. (3-0). Credit 3.**

A study of the formation of English sounds and the usage in pronunciation. Prerequisite: English 231, 232, or 203, 210.

**312. Shakespeare. (3-0). Credit 3.**

The life, environment, and major dramatic works of Shakespeare. Prerequisite: English 231, 232, or 203, 210.

**328. American Literature Since 1870. (2-0). Credit 2.**

A study of recent American writing, chiefly prose, with attention to the intellectual and social movements reflected in the literature. Limited to students who have made a grade of C in the prerequisite course. Prerequisite: English 203 or 231.

**413, 414. Contemporary Literature. (2-0). Credit 2 each semester.**

A study of the most significant British and American novelists, poets, and dramatists from about 1890 to the present, with lectures on the social, political, economic, and intellectual backgrounds. Among the authors studied are Bernard Shaw, Samuel Butler, John Galsworthy, Rudyard Kipling, H. G. Wells, Sinclair Lewis, Joseph Conrad, Eugene O'Neill, and Edna St. Vincent Millay. Prerequisite: English 231, 232, or 203, 210.

**415. Contemporary Continental Drama. (2-0). Credit 2.**

A study of representative plays (in translation) by Ibsen, Strindberg, Hauptmann, Sudermann, Schnitzler, Maeterlinck, Rostand, Hervieu, Brieux, Benavante, and Pirandello. Prerequisite: English 231, 232, or 203, 210. (Not offered in 1940-41.)

**416. Contemporary English Drama. (2-0). Credit 2.**

A study of representative plays by Pinero, Jones, Wilde, Galsworthy, Shaw, Barrie, Synge, Yeats, Lady Gregory, Dunsany, and O'Neill. Prerequisite: English 231, 232, or 203, 210. (Not offered in 1940-41.)

**431. The Novel. (3-0). Credit 3.**

Its origin and development and its reflection of life and personality. A study of English prose fiction from the romance of the sixteenth century through the great novels of the eighteenth and nineteenth centuries. Prerequisite: English 231, 232.

## ENTOMOLOGY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

**301, 302. Systematic Entomology. (2-4). Credit 3 each semester.**

A systematic study of the various orders of insects. The student has free access to the entomological library, which contains bound volumes of standard publications on entomology; and to a considerable insect collection for identification purposes.

**305, 306. Morphology. (1-4). Credit 2 each semester.**

The external and internal anatomy of insects; a study is made of the exoskeleton types of mouth parts and internal anatomy. The second term is devoted to a comparative study of wing venation.

**401, 402. Advanced Economic Entomology. (2-4). Credit 3 each semester.**

For students who desire a knowledge of insect life histories, the physical and chemical properties of insecticides and their effects on insects, and methods of entomological research. Prerequisite: Entomology 201 and 301.

**412. Entomological Literature. (3-0). Credit 3.**

A summary of the most important works on the classification of insects; a survey of the entomological publications of the United States Department of Agriculture, and state experiment stations.

417, 418. Special Problems. (3-2). Credit 4 each semester.

The taxonomy, ecology, and biology of a specific family of insects; or the life history, anatomy or biology of some one insect. Prerequisite: Entomology 301, 302.

#### FOR GRADUATES

601, 602. Systematic Entomology. (3-3). Credit 4 each semester.

A taxonomic study is made of the orders, families and sub-groups of the class Hexapoda. The student is required to make a special study of some particular group. Professor Bilsing.

603, 604. Cotton Insects. (3-3). Credit 4 each semester.

A detailed study of the life history of the most important insects affecting cotton; survey of the literature on this subject. The use of cultural methods, dusting and sterilizing machinery and insecticides is considered. Professor Little.

605, 606. Advanced Apiculture. (3-3). Credit 4 each semester.

A problem in apiary management or in the study of one or more of the diseases affecting bees; grading and marketing honey, foul brood laws, and methods of eradicating bee diseases. Professor Little.

607, 608. Economic Entomology. (3-3). Credit 4 each semester.

A detailed study of the life history of the most important insects affecting cotton; the structure of insects belonging to the same group which attack our more important crops. Cultural methods, trap crops, insecticides, and fumigation. Professor Bilsing.

609, 610. Microtechnique. (3-3). Credit 4 each semester.

A study of insect tissue; methods of making microscopic slides, making section and staining tissues. Professor Bilsing.

611, 612. Research Entomology. Credit 2 to 6 each semester.

Research work on taxonomy, insect life histories, biological control, insect ecology; the toxicology of insecticides.

613, 614. Morphology. (3-3). Credit 4 each semester.

Study of the morphological characteristics which are of taxonomic value, including wing venation, genitalia and other external characteristics. Professor Bilsing.

615, 616. Insect Physiology. (3-3). Credit 4 each semester.

A study of the mechanical and chemical senses of insects; the physiology of respiration, circulation, digestion, and excretion. Professor Bilsing.

#### FISH AND GAME

##### FOR GRADUATES AND ADVANCED UNDERGRADUATES

400s. Practical Fish Culture. Credit 6.

A field course, conducted in cooperation with the fish hatcheries maintained by the Texas Game, Fish and Oyster Commission. Attention will be given to the life histories, ecology, embryology and propagation of fishes important for sporting and food purposes in Texas. Prerequisite: Approval of the instructor.

401. General Mammalogy. (2-6). Credit 4.

An introduction to the study of mammals. The structure, classification and economic relations of mammals with special reference to deer, antelope, elk, squirrel, rodents, flesh-eaters, furbearers, and others of economic importance. Methods of collection and preparation of study skins of mammals. Foundation for wildlife management or museum work. Prerequisite: Biology 203, 204, or 207.

402. General Ornithology. (2-6). Credit 4.

Introduction to the study of birds, their structure, classification, geographic distribution, ecologic relations and economic status. Special attention will be given to game species. Methods of collection and preparation of study skins. Foundation for wildlife management on the farm, in the forest, and on the range; also for museum work. Prerequisite: Biology 203, 204, or 207.

403. Ecology of Animals and Plants. (2-3). Credit 3.

Animal-plant interrelationships. The web of life. The importance of taking full account of animal, plant and environment. The place of action and reaction, zonation, succession, numbers, limiting factors, biological control, the balance of nature in wildlife management. Prerequisite: Fish and Game 401, 402; may be taken concurrently with 402.

404. Pond and Stream Improvement. (2-6). Credit 4.

A study of lakes, ponds, and streams, with special reference to food and life habits of fishes and maintenance of production at optimum figures. Prerequisite: Fish and Game 403.

405. Systematic Study of Fishes. (2-6). Credit 4.

The collection, identification, and life histories of American marine and fresh water fishes, with special reference to the fishes of Texas. Prerequisite: Biology 105, 106, or 107.

FOR GRADUATES

601, 602. Advanced Vertebrate Systematics. (1-6). Credit 3 each semester.

Individual problems on classification and distribution of selected groups of vertebrates; problems in nomenclature of birds, mammals, fishes, reptiles, based on Texas Cooperative Wildlife Research Collection. Survey of the literature of vertebrate taxonomy, particularly as related to the group selected; a study of vertebrate material from the systematic standpoint. Professor Davis.

603, 604. Advanced Vertebrate Ecology. (1-6). Credit 3 each semester.

Advanced work in the ecology and life histories of vertebrates, with special reference to birds and mammals. The role of native vertebrates in relation to range, forest, and farm problems. Professor Taylor.

605s. Advanced Field Studies. Credit 7.

A field course designed to give students advanced work in field techniques. Emphasis will be placed upon collecting plants and animals, cover mapping, population studies, and life histories. Prerequisite: Fish and Game 403 or 404, and approval of the instructor. The staff.

606s. Techniques of Wildlife Management. Credit 7.

A field course designed to acquaint students with methods and techniques in maintaining and increasing desirable wildlife and regulating populations generally. The course will emphasize practical aspects. Special attention will be given to conditions of use of natural vegetation, the place and methods of census, re-stocking, game preserves, predatory animal control, provision of food and cover, farmer-sportsman relations, significance of succession, and other ecologic concepts to practical game management and related enterprises. The class will be organized not later than May 15. Prerequisite: Fish and Game 403 and approval of head of department. Professor Taylor.

673, 674. Research on Wildlife Problems. Credit 2 to 6 each semester.

Credit to be adjusted in accordance with requirements of each individual case. The staff.

675. Seminar in Wildlife Research and Management. No credit.

Prerequisite: Senior or graduate standing. The staff.

GENETICS

FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Genetics. (3-2). Credit 4.

Fundamental principles of genetics; heredity; variation; the physical basis of inheritance; the chromosome theory of inheritance; the expression and interaction of genes; linkage; sex and its inheritance; introduction to biometrical methods; laboratory work with *Drosophila*. Prerequisite: Biology 101 or Biology 207.

304. Plant Breeding. (3-2). Credit 4.

Improvement of field, forage and horticultural crops by hybridization and selection. Prerequisite: Genetics 301.

FOR GRADUATES

605, 606. Advanced Biometry. (3-4). Credit 4 each semester.

A study of the elementary statistics; Chi square; design of simple experiments; analysis of variance; covariance; design and analysis of complex experiments. This course is designed to meet the needs of students majoring in either plant or animal science. Professor Godbey.

607, 608. Genetic Studies in Cotton. (3-4). Credit 4 each semester.

A detailed study of cotton genetics and breeding for students especially interested in cotton. Professor Humbert.

609, 610. Research Problems. Credit 1 to 4 each semester.

Technical research problems subject to approval of head of department.

611, 612. Advanced Plant Genetics. (3-0). Credit 3 each semester.

Specialized study of plant genetics. Opportunity to specialize in some commercial crop. Standard textbooks and current scientific literature used. Students not majoring in genetics may receive credit for 611 without taking 613. For students majoring in genetics, courses 611 and 612 must be taken simultaneously with 613 and 614. Professor Humbert.

613, 614. Laboratory Methods in Plant Genetics. (0-4). Credit 1 each semester.

Technics and laboratory methods used in plant genetics, including data analysis. Professor Humbert.

615, 616. Advanced Animal Genetics. (3-0). Credit 3 each semester.

Specialized study of animal genetics; advanced genetic theory, including certain phases of cyto-, pheno-, and physiological genetics; opportunity to specialize on some breed or class of farm animal; standard textbooks and current scientific literature used. Students not majoring in genetics may receive credit for 615 without taking 617; students majoring in genetics are required to take Genetics 615 and 616 simultaneously with 617 and 618. Associate Professor Quisenberry.

617, 618. Laboratory Methods in Animal Genetics. (0-4). Credit 1 each semester.

Genetic experiments with laboratory animals; technics and problems involved in maintaining a colony of laboratory animals for genetic purposes; artificial insemination; pregnancy diagnosis; genetic analysis of pedigrees and results of various systems of breeding.

671, 672. Research in Cotton Breeding. Thesis.

A thesis course for students who are majoring in genetics or agronomy and who desire to become familiar with the method of commercial cotton breeding. The problem given to the student will cover, in its completion; in relation to cotton breeding, the biometrical methods; progeny analysis; germination, seeding and maturity tests procedure; stapling; ginning. Students electing this course must first be familiar with the fundamentals of genetics and agronomy. Mr. Killough.

## GEOLOGY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

303, 304. Petrology. (3-4). Credit 4 each semester.

Rocks, their textures, mineral composition, chemical characters, classification, occurrence and origin. The laboratory work includes a study of hand specimens and microscopic study of thin sections of rocks and minerals. Prerequisite: Geology 204 and approval of head of department.

305. Invertebrate Paleontology. (3-3). Credit 4.

A study of the chief characteristics, successions, and environmental conditions of the various invertebrate phyla recorded in the rocks. Prerequisite: Geology 210 or 302, Biology 106 or 107, or equivalent.

306. Tertiary Stratigraphy and Paleontology. (3-3). Credit 4.

Stratigraphy of the Tertiary formations of the Gulf Coastal Plain and their correlation by means of invertebrate fossils. Numerous field trips are made to representative outcrops to study the formations and collect fossils. Laboratory work consists of identifying the fossils collected and determining the index fossils for the various stratigraphic units. Prerequisite: Geology 305.

312. Structural Geology. (3-2). Credit 4.

The interpretation of rock structures caused by earth movements. The relation of rock structures to stratigraphic, physiographic and economic problems. Prerequisite: Geology 210 or 302 and approval of head of department.

## FOR GRADUATES

605, 606. Special Geology. Credit 2 to 6 each semester.

Advanced work along specialized lines for properly qualified students. May include independent investigation of problems in various phases of geology. Primarily a thesis course. Prerequisite: Approval of head of department.

607, 608. Mineral Deposits. (4-0). Credit 4 each semester.

Genesis, occurrence, characteristics and associations of mineral deposits other than petroleum and gas. A consideration of the uses and economics of these deposits. Prerequisite: Geology 406, and approval of head of department. Professor Baker.

609, 610. Advanced Field Geology. Credit 2 to 6 each semester.

Systematic geologic surveying of selected areas. The course is designed as a field basis for thesis for advanced degrees and will be varied to meet the needs of individual students. Staff.

612. Advanced Structural Geology. (3-4). Credit 4.

A detailed study of geologic structures and a consideration of theories regarding earth movements; with selected readings. Laboratory work will emphasize subsurface geology. Prerequisite: Geology 307, or equivalent, and approval of head of department. Professor Baker.

616. Micropaleontology. (1-6). Credit 3.

Study of microscopic fossils and their uses in correlation. Laboratory work in the examination of well samples. Prerequisite: Approval of head of department. Associate Professor Turner.

618. Sedimentation. (2-6). Credit 4.

Investigation of processes of sedimentation with analytical laboratory work on sedimentary rocks. Seminar. Prerequisite: Approval of head of department. Assistant Professor Goldich.

619. Problems in Petroleum Geology. Credit 2 to 6.

Seminar dealing with some of the problems in petroleum geology; such as, compaction, convergence, and regional stratigraphic features. Methods of exploration, reserves, and future possibilities. Prerequisite: Approval of head of department. Professor Baker.

620. Geology of Ground Water. (3-0). Credit 3.

Principles of determining quality, quantity, and movement of water beneath the earth's surface. Geologic and geophysical methods of locating ground water supplies. Factors applying to estimates of supply. Interaction of water, minerals, petroleum and gas. Prerequisite: Approval of head of department. Professor Baker.

621. Problems in Micropaleontology. Credit 2 to 6.

Research in micropaleontology for properly qualified students. Associate Professor Turner.

622. Advanced Stratigraphy. (3-0). Credit 3.

Sources and depositional environment of sediments, character and relations of sedimentary strata, and the principles involved in delimiting, correlating and naming stratigraphic units. Prerequisite: Geology 618. Associate Professor Turner and Assistant Professor Goldich.

623, 624. Thesis. Credit 4 each semester.

For students preparing a thesis in residence.

## HISTORY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

315. The United States from Roosevelt to Roosevelt, 1901-1941. (3-0). Credit 3.

A study of the United States history during the twentieth century. Emphasis is laid primarily on the development and application of progressive principles from the "square deal" of the first Roosevelt to include the "new deal" of the present administration; secondary emphasis is on the international relations of the United States as the nation became a world power, moved from isolation to leadership and back, followed by the development of the "good neighbor" policy toward Latin-America and our national approach to the World War II.

316. The Institutional Background of Texas, 1519-1845. (3-0). Credit 3.

A study of the history of Texas from the Spanish period to annexation to the United States. Particular stress is placed upon the Spanish legal and administrative system, the Mexican administrative system, the establishment of Anglo-Americans in Texas, the revolution, the republic, and the fight for annexation. In each of these topics emphasis is placed upon principles and developments of this period which are reflected in the state's present-day society.

318. International Developments since 1918. (3-0). Credit 3.

A general survey of world politics since the close of the Great War. Particular attention will be given to the problems and ideologies of the great powers of Europe and to those factors which condition and explain present political tendencies and policies. Due consideration will also be given to colonial problems in Asia and Africa including the Sino-Japanese question and to the outbreak of war in 1939.

423, 424. American Foreign Relations. (3-0). Credit 3 each semester.

The history of United States foreign relations and development of our leading foreign policies down to the Civil War; a study of contemporary foreign policies and relations against the background of American political and industrial expansion from the Civil War to 1940.

## HORTICULTURE

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

309, 310. Commercial Vegetable Crops. (2-2). Credit 3 each semester.

The production of vegetables for market as influenced by climate, soil, equipment and storage. The history, anatomy, taxonomy, seed production, and plant improvement of vegetable crops. Practice: the production, harvesting, and marketing of vegetable crops and the study of the plants as to taxonomy technique of breeding, and seed selection. Prerequisite: Horticulture 202.

311, 312. Fruit and Vegetable Products. (1-3). Credit 2 each semester.

Methods of preservation of fruits and vegetables, including dehydration, canning, pickling, and freezing. Special attention will be given to the preparation of fruit and vegetable juices and to the processing of pecans.

317, 318. Principles of Fruit Production. (2-3). Credit 3 each semester.

Orchard management, including problems of location, soils, planning, cultivating, protection from insects and diseases, pruning, harvesting and marketing. Practice: Practical orchard work from planting to marketing. Prerequisite: Horticulture 201.

401. Systematic Pomology. (3-2). Credit 4.

Fruits, their identification, classification, distribution, importance and history; a detailed study of the more important species and varieties. Practice is given with such fruits as can be obtained during the season. Prerequisite: Horticulture 317, 318.

418. Nut Culture. (1-3). Credit 2.

Early history; distribution of native nuts; development of native groves to improved varieties. Practice: Budding and grafting pecans in the nursery row; top-working native pecans to improve varieties by means of budding and grafting; systematic study of the standard varieties of nuts; study of graft and bud unions. Prerequisite: Horticulture 201.

422. Subtropical Fruits. (3-2). Credit 4.

A study of subtropical fruits, with attention to citrus fruits, figs, olives, and dates. Practice: Study of varieties of subtropical fruits and their products; propagation and care of the various subtropical fruits. Prerequisite: Horticulture 317, 318.

423. Geography of Horticultural Industries. (2-0). Credit 2.

A study of horticultural sections of the United States; with emphasis on producing centers in Texas; various fruits and vegetables considered with regard to point of origin and time of movement to market. Study of competition between domestic shipping centers as well as the influence of importations. Certain horticultural commodities considered with respect to the commercial varieties of different producing sections.

425. History and Literature of Horticulture. (2-0). Credit 2.

The development of the art and science of horticulture with emphasis on American horticulture. The men who have made outstanding contributions to the development of the various horticultural enterprises receive special attention. Books and periodicals are also considered critically. A brief summary of the development of European horticulture will be followed by a careful study of the different eras in its development in America.

426. Commercial Propagation. (2-3). Credit 3.

Fundamental problems in propagation of horticultural plants, principally fruit trees and ornamentals. Physiological responses in rooting of stem and leaf cuttings, including artificial treatments to stimulate rooting; morphology and physiology of graft unions; congeniality between stocks and scions; and adaptation of stocks to their environment. Commercial nursery practice, including methods of budding and grafting, and care of nursery stock after propagation. Commercial production of bulbs for planting will also be considered. Practice in laboratory and greenhouse, and in the College orchards.

427, 428. Seminar. (1-0). Credit 1 each semester.

Review of current experimental work in the field of horticulture, presented by staff members, graduate and senior students. Required of all graduate and senior students in horticulture, and restricted to these students.

430. Bush and Vine Fruits. (2-2). Credit 3.

A detailed study of the growing and handling of grapes, dew berries and blackberries, strawberries, and similar fruits. Varieties and their adaptation to different regions of the State will be considered. Laboratory work to consist of the actual growing and handling of the fruits on the college grounds.

#### FOR GRADUATES

601, 602.\* Advanced Fruit Growing. (3-3). Credit 4 each semester.

Problems of cultivation, fertilization, pruning, thinning of fruit and protection from frost and insect pests and diseases; the improvement of fruit by means of bud selection and breeding. Prerequisite: Horticulture 317, 318, or equivalent work. Professor Adriance.

603, 604.\* Advanced Vegetable Gardening. (3-3). Credit 4 each semester.

Recent developments in the production of vegetables for market and truck gardening purposes; irrigation; forcing plants for early market, and the development of plants by breeding and selection. Prerequisite: Horticulture 310, 404, 420, or equivalent work. Professor Brison.

607, 608. Horticultural Problems. Credit 1 to 4 each semester.

Various problems concerning recent developments in horticulture are considered, both in theory and in laboratory. Recent work at other stations is reviewed. Professor Adriance.

671, 672. Research in Horticulture. (3-4). Credit 4 each semester.

Research in horticultural problems, supervised through the cooperation of the Division of Horticulture of the Texas Agricultural Experiment Station.

#### INDUSTRIAL EDUCATION

##### FOR GRADUATES AND ADVANCED UNDERGRADUATES

406. Vocational Guidance. (2-0). Credit 2.

The meaning and purpose of guidance. Methods of investigation in guidance. Methods of guiding students.

409. Methods of Introducing Industrial Organization and Management into Industrial Schools. (2-0). Credit 2.

The management of modern industrial enterprises and the possible adaptation to industrial schools.

419. Laboratory of Industries Methods. (1-5). Credit 3.

The student will make a study of the units of industries as generally recommended for public school industrial arts and will select, plan, and design problems and projects to meet these requirements.

420. Follow-up, Visitation and Coordination in Part-Time Schools. (2-0). Credit 2.

Selecting occupations suitable for young people to learn, placing students in suitable employment on a part-time basis and coordinating their school studies with their work activities.

\*—Either semester's work may be offered as an independent two-hour unit in summer terms.

422. Social, Economic and Educational Influences Affecting the Junior Worker. (2-0). Credit 2.

A study of the supply and demand of workers in various occupations; pay and opportunities for advancement and their relation to society as a whole.

423. Analysis Procedure. (1-2). Credit 2.

Each student will make an analysis of his occupation to determine contents for courses in that occupation. Type jobs within the occupation will be analyzed to determine the order and content of lessons to be taught.

424. Organization of Instructional Material. (1-2). Credit 2.

A study will be made of published material available in the student's occupational field. Those parts found suitable for vocational classes will be indexed and organized for class use. Types of instruction sheets found necessary for efficient teaching will be written.

FOR GRADUATES

607a. Organization of Industrial Arts Departments. (2-0). Credit 2.

Problems in determining the type and size of industrial arts programs for the various types and sizes of schools with plans for the organization of each.

607b. Organization of Vocational Industrial Schools and Classes. (2-0). Credit 2.

Methods of making surveys, determining possible vocational education programs to meet the needs of different types of communities and the proper organization for these classes under the State Plan for Vocational Education.

608. Administration and Supervision in Industrial Education. (4-0). Credit 4.

Problems of the local director or supervisor of departments of industrial education.

609, 610. Methods of Teaching High School Drawing. (2-4). Credit 3 each semester.

A survey of the field of drawing. The designing and organizing of problems and teaching devices. The first semester is devoted to general mechanical drawing as taught in the first two years of high school; the second semester to machine drawing. Either semester may be taken separately.

611. Industrial Education Problems. (4-0). Credit 4.

A study of current problems in Industrial Education. Research and organization of material to assist in the solving of individual problems.

614. Guidance Seminar. (2-0). Credit 2.

The organization of occupational information; educational and vocational guidance; counseling case problems. Prerequisite: I. E. 406 or a similar course.

615. Research in Industrial Education. (1-3) or (2-6). Credit 2 or 4.

616. Methods of Teaching Industrial Arts in Secondary Schools. (2-0). Credit 2.

Selecting and organizing instructional material for problems is a particular arts activity. This course must be taken with one of the following courses: Industrial Education 620a, 620b, 620c, 620d.

618. Tests and Measurements in Industrial Education. (2-0). Credit 2.

A study of testing and measuring devices and their application to industrial education subjects.

619. Related Subjects in Part-Time Cooperative Programs. (2-0). Credit 2.

The organization and presentation of content material necessary in Part-time Cooperative Programs, and the direction of the study of the students engaged in such programs.

620a. Auto Mechanics. (1-4). Credit 2.

620b. Electricity. (1-4). Credit 2.

620c. Cabinet Making. (0-5). Credit 2.

620d. Machine Shop. (0-5). Credit 2.

620e. Ornamental Metal Work. (1-4). Credit 2.

The designing, building, and testing of laboratory problems in one of the above fields of public school industrial arts. Prerequisite: Industrial Education 616 or registration in the course. These courses given in cooperation with the engineering departments that have the laboratories.

621. Philosophy of Vocational Education. (2-0). Credit 2.

The basic principles involved in the development and operation of industrial education programs under the State and Federal Vocational laws.

622. Philosophy of Industrial Arts Education. (2-0). Credit 2.

The principles involved in the development and operation of industrial arts courses and their purpose and function in the field of general education.

623. Vocational Guidance Procedures.\* (3-0). Credit 3.

A "work shop" approach to the study of vocational guidance, programs, relationships, group techniques, techniques and methodology of the clinical approach.

624. Seminar in Industrial Arts Education. (1-0). Credit 1.

625. Seminar in Vocational Industrial Education. (1-0). Credit 1.

## INDUSTRIAL ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

405. Industrial Case Analysis. (1-0). Credit 1.

Gives the student an opportunity to learn the methods of analysis commonly used in reaching decisions in industrial situations, and affords the student practice in writing an effective presentation of a decision.

An average of one written report on an actual situation taken from industry is required every three weeks.

Although it is not a prerequisite, the course will be a good preparation for Industrial Engineering 501. It will be helpful for anyone who expects to deal with industrial situations that require careful analysis.

406. Industrial Case Analysis. (1-0). Credit 1.

A continuation of Industrial Engineering 405 with tri-weekly written reports.

This course gives the student a working knowledge of presenting his recommendations for following through an actual industrial situation, and gives him an opportunity to develop his own manner of approaching and taking hold of an industrial situation.

501. Management Problems. (3-4). Credit 4.

This course is designed to develop within the student a capacity for making his own analysis of actual situations taken from industry and for giving him practice in presenting his decisions effectively. One concise, written report on an actual industrial case will be required each week. A report will make a recommendation of specific action, and will support this with reasons that recognize the controlling factors and the alternatives.

Cases will cover a wide range of industrial management problems, and no problem will be considered apart from its actual setting.

The student will make his own discovery of the problem and his own estimate of the situation from facts given him in the case material and from facts he learns to search out for himself concerning the industry in which the company is engaged.

This course is designed for students who are following the fifth-year curriculum because they will be taking the background work that they will need to grasp an involved industrial situation. The course is also open to other fifth-year and fourth-year students who secure the consent of their department heads. However, it is advised that absence of practical experience or of a suitable background for comprehending an industrial situation will prove an obstacle to the necessary understanding.

The time required per report will depend upon the student's intelligence and writing ability rather than on his ability to remember facts. A student is expected to complete a report in about fifteen hours, including any class time. However, if the student fails to grasp the situation quickly, or fails to determine the controlling factors promptly, or fails to see the alternatives that are open for action, or fails to reach a logically based recommendation—he may require forty or more hours per report. It is emphasized that no student who fails in these respects is likely to have sufficient time to attempt the course.

\* Offered in summer 1940 only.

502. Management Problems. (3-4). Credit 4.

Designed to bring into use the student's background knowledge of other professions and of general sources of information and to acquaint him with the necessity for continued study in his profession so that he may develop rapid facility in making decisions required of an engineer throughout his career.

Cases will require consideration of complex factors, of trends, and of forces at work outside the enterprise as well as the recognition of management objectives and business policy.

The course is concerned with handling problems rather than with learning principles. However, some generalizations may be drawn from the cases, and the student will be given practice in formulating general rules that may be currently useful to him. Prerequisite: Industrial Engineering 501.

503. Professional Conference. (1-0). No credit.

One group or individual conference each week with the head of the Industrial Engineering Department for the purpose of crystallizing the employment and professional objectives of the student. Open only to students whose course of study includes courses 501 and 502.

During the first semester the student is required to analyze his aptitudes, his background, and to establish an estimate of his tangible and intangible assets and possibilities.

504. Professional Conference. (1-0). No credit.

A continuation of Industrial Engineering 503 with one conference weekly.

The student is required to appraise the courses of action that are open to him, to crystallize his employment and professional aims, and to formulate a tentative plan for making progress toward the attainment of his objectives. Prerequisite: Industrial Engineering 503.

## LANDSCAPE ART

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

401, 402. Advanced Landscape Art. (3-8). Credit 6 each semester.

The development of large areas, private estates, parks, subdivisions, cemeteries, and other private and semi-private, and public properties. Major problems: landscape construction; detailed plans; professional practice. Prerequisite: Landscape Art 301, 304.

### FOR GRADUATES

605, 606. Landscape Design. (2-12). Credit 6 each semester.

Advanced landscape problems; research consultations; criticism. Professor Hensel.

## MATHEMATICS

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

405. Vector Analysis. (4-0). Credit 4.

409, 410. Advanced Calculus. (4-0). Credit 4 each semester.

### FOR GRADUATES

604. Solid Analytic Geometry. (4-0). Credit 4.

Professor Porter.

606. Theory of Probability. (4-0). Credit 4.

Professor Porter.

607, 608. Theory of Functions of a Real Variable. (4-0). Credit 4 each semester.

Professor Binney.

611. Ordinary Differential Equations. (4-0). Credit 4.

Professor Edmonson.

612. Partial Differential Equations. (4-0). Credit 4.

Professor Edmonson.

- 613, 614. Differential Geometry. (4-0). Credit 4 each semester.  
Professor Halperin.
- 615, 616. Advanced Algebra. (4-0). Credit 4 each semester.  
Professor Edmonson.
- 617, 618. Theory of Functions of a Complex Variable. (4-0). Credit 4 each semester.  
Professor Porter.
619. Elliptic Integrals. (3-0). Credit 3.  
Professor Halperin.
620. Fourier's Series and Allied Topics. (4-0). Credit 4.  
Professor Edmonson.
630. Seminar Course in Mathematics. (4-0). Credit 4.  
For advanced students. The content will be adapted to the interests of the group enrolled. Consequently, a student may receive repeated credit for the course. Assistant Professor Klipple.

## MECHANICAL ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

329. Advanced Cabinet Making. (1-6). Credit 3.  
Advanced cabinet making, design, finishing, estimating, detailing, rod making, and one research problem on one of the above subjects, or any subject that deals with cabinet making and design as applied to a school shop. Prerequisite: Teaching experience in Cabinet Making, and courses equivalent to M. E. 105 and 106.
407. Mechanical Refrigeration. (3-0). Credit 3.  
The application of the principles of thermodynamics to mechanical refrigeration. Kinds of equipment and methods of practical production or refrigeration, ice making and cold storage. Prerequisite: Mechanical Engineering 320 or 323.
410. Internal Combustion Engines. (3-0). Credit 3.  
The application of the principles of thermodynamics to the design and operation of the internal combustion engine. Prerequisite: Mechanical Engineering 320 or 323.
440. Physical Metallography. (2-3). Credit 3.  
The fundamentals of the physical metallography of iron, steels and alloys, laboratory work in polishing, etching and preparation of specimens, making and studying photomicrographs.

### FOR GRADUATES

601. Advanced Machine Design. (2-6). Credit 4.  
A detailed study of special problems in design, such as the theory and practice of lubrication, the fatigue of metals, the deflections of machine elements, the balancing of moving parts. Professor Faies.
602. Design of Machinery. (2-6). Credit 4.  
A further study of special problems in design, or the design of some complete machine (which may be a machine of the student's own choice), or the work may consist of a combination of special problems and actual design. The nature of the work can to some extent be governed by the inclination of the student. Professor Faies.
- 603, 604. Power Plants. (2-6). Credit 4 each semester.  
The design of central and isolated power plants with special attention to over-all economic operation. Prerequisite: Mechanical Engineering 418. Professor Brewer.
- 607, 608. Experimental Engineering Research. (1-8). Credit 1 to 4 each semester.  
Methods and practice in mechanical engineering research; extended problems specially chosen to meet the needs of the individual student.
613. Dynamics and Kinetics of Machinery. (4-0). Credit 4.  
Velocities and accelerations with particular emphasis upon balancing. Prerequisite: Mechanical Engineering 446. Professor Faies.

615. Advanced Engineering Thermodynamics. (4-0). Credit 4.

An extended study of the theories of thermodynamics and their application to the more involved problems in engineering practice. Prerequisite: Mechanical Engineering 320. Professor Faires.

616. Heat Transmission. (4-0). Credit 4.

The fundamental laws relating to heat flow; the application of these laws to engineering materials used in various industrial processes; a study of up-to-date developments by reference to current literature. Prerequisite: Mechanical Engineering 615. Associate Professor Wingren.

617. Mechanical Vibrations. (4-0). Credit 4.

A study of the vibrations of machinery and structures. Prerequisite: Mechanical Engineering 313, Mathematics 305. Associate Professor Wingren.

618. Advanced Air Conditioning. (4-0). Credit 4.

The thermodynamic fundamentals of vapors and heat transmission with particular emphasis on fans, duct design, air distribution, selection of machinery and equipment and practical problems in heating and air conditioning. Occasional talks from engineers in this field will be a regular part of the course. Prerequisite: Mechanical Engineering 436. Professor Long.

## MUNICIPAL AND SANITARY ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Sewerage and Sewage Disposal. (3-0). Credit 3.

Determination of the quantity of storm water and domestic sewage; design and construction of sewer systems; principles of sewage treatment; methods of treatment; operation of sewage treatment plants. Prerequisite: Civil Engineering 311.

402. Water Supply and Purification. (3-0). Credit 3.

Development of ground and surface water supplies; principles and methods of water purification; design construction and operation of water-works systems for municipalities. Prerequisite: Civil Engineering 311, or registration in that course.

403. Sanitary Design. (1-5). Credit 3.

Practical problems in the design of sewer systems and appurtenances; sewage treatment plants; water collection and distribution systems; water purification plants. Prerequisite: Municipal and Sanitary Engineering 401 or 402 or registration in either of these courses.

405. Introductory Sanitary Examination of Water and Sewage.  
(1-5). Credit 3.

Practice and interpretation of fundamental laboratory tests used for sanitary control of water and sewage. Prerequisite: Chemistry 102.

406. Sanitation and Public Health. (3-0). Credit 3.

Relation of sanitation to public health; municipal sanitary work, including garbage and refuse disposal; plumbing; control of food supplies; mosquito, fly and rodent control; sanitation of swimming pools and tourist camps; organization of health departments. Prerequisite: Junior classification.

407. Advanced Sanitary Examination of Water and Sewage.  
(1-5). Credit 3.

Theory and practice of standard laboratory and field methods used in the examination of water, domestic sewage, and industrial wastes; special emphasis on preparation of standard solutions and media and calibration of analytical apparatus. Prerequisite: Municipal and Sanitary Engineering 405 or Chemistry 206 or 218. May be taken simultaneously with Municipal and Sanitary Engineering 405.

408. Municipal Administration. (3-0). Credit 3.

City government, including the city manager plan; relation of city to state; administration of city departments; public utilities; city planning. Prerequisite: Junior classification.

412. Sanitary Laboratory. (1-5). Credit 3.

Field and laboratory work in control and operation of sewage and water treatment plants and investigation of stream pollution. Prerequisite: Municipal and Sanitary Engineering 401 or 402.

## FOR GRADUATES

### 601, 602. City Management. (4-0). Credit 4 each semester.

Development of European and American cities, form of city government, functions of the city manager; administration of municipal affairs; organization of city departments; city finances; public utilities; fire prevention and protection, police administration; parks and playgrounds, public health and welfare; housing, city planning. Assistant Professor Wright.

### 603, 604. Advanced Sanitary Engineering. (4-0). Credit 4 each semester.

Study of the problems of water supply and sewerage; recent developments in the treatment of water and sewage. Professor Steel.

### 605, 606. Research. Credit 2 to 6 each semester.

Research in sanitary engineering and municipal affairs; projects subject to the approval of head of department.

### 607, 608. Environmental Sanitation. (4-0). Credit 4 each semester.

Detailed study of environment and its relation to disease, covering malaria and its control; rodent control; sanitation of milk, shellfish, and other foods, collection and disposal of municipal refuse; sanitary aspects of air conditioning; housing sanitation, including plumbing, ratproofing, etc.; rural water supply and excreta disposal; sanitary inspection procedure. Professor Steel.

### 609. Industrial Hygiene. (2-2). Credit 3.

Occupational hazards and diseases; industrial poisons and dusts; methods of air examination; factory sanitation. Associate Professor Sorrels.

### 610. Industrial Wastes. (2-0). Credit 2.

Amount and characteristics of the commoner industrial wastes; their effects upon sewage treatment problems; methods of treatment. Prerequisite: Municipal and Sanitary Engineering 401 or its equivalent. Associate Professor Sorrels.

### 611. Public Health Administration and Epidemiology. (4-0). Credit 4.

Organization and functions of federal, state, county, city and private health organizations; significance and use of vital statistics; principles of epidemiology. Professor Steel.

### 612. Milk Plant Sanitation. (2-0). Credit 2.

Sanitation of milk plants, with special attention to sanitary safeguards in mechanical equipment; cross-connections; disposal of wastes; water supply. Associate Professor Sorrels.

## PETROLEUM ENGINEERING

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

### 402. Valuation and Management of Oil and Gas Properties. (3-0). Credit 3.

Factors which influence the value of oil and gas properties, preparation of valuation reports, cost data, operating organizations, insurance, regulation of petroleum production. Prerequisite: Petroleum Engineering 305, 306, 307, 308, 405, and 413, 415.

### 413. Natural Gas and Gasoline. (3-0). Credit 3.

Theory and practice of gas measurements, orifice meters, positive displacement meters, pitot tubes, orifice well testers, etc. The transportation of gas and the manufacture of natural gasoline. Prerequisite: Petroleum Engineering 305, 306, 307, 308, Mechanical Engineering 323, and Chemistry 342a.

### 414. Oil Measurements and Transportation. (2-0). Credit 2.

The measurement, sampling and testing of crude oil, tank strapping and preparation of tank tables, oil storage, the prevention of loss by evaporation, fire and lightning protection. A study of the principles of pipe line design and construction. Prerequisite: Petroleum Engineering 305, 306, 307, 308.

### 417, 418. Petroleum Engineering Seminar. (0-2). Credit 1 each semester.

The study and presentation of papers pertaining to recent developments in the field of petroleum engineering. Prerequisite: Petroleum Engineering 204, 305, 306, 307, 308.

## FOR GRADUATES

601, 602. Petroleum Engineering Problems. (3-3). Credit 4 each semester.

An advanced study of the problems encountered in the drilling and completing of oil and gas wells. Prerequisite: Approval of head of department.

603, 604. Advanced Petroleum Production Practices. (3-3). Credit 4 each semester.

An advanced course in petroleum production practices, with special reference to the fundamental principles of flow of reservoir fluids. Prerequisite: Approval of head of department.

619, 620. Advanced Petroleum Research. Credit 2 to 6 each semester.

Advanced work on some special problem within the field of petroleum engineering. Primarily a thesis course. Prerequisite: Approval of head of department.

## PHYSICS

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Heat. (3-3). Credit 4.

Heat transfer, kinetic theory, critical points, isothermal and adiabatic changes and the thermodynamics of the changes of state and radiation. Prerequisite: Physics 202, 204, or 208, and Mathematics 204.

302. Properties of Matter. (3-3). Credit 4.

Universal gravitation, elasticity, surface tension, diffusion, viscosity and the mechanics of fluids. Prerequisite: Physics 202, 204, or 208, and Mathematics 204.

401. Optics. (3-3). Credit 4.

Periodic motion, wave motion, the nature and propagation of light, interference, polarization and the theory of optical instruments. Prerequisite: Physics 202, 204, or 208, and Mathematics 204.

402. Electricity and Magnetism. (3-3). Credit 4.

Electric fields, potential, capacitance, current, resistance, electrolysis, primary and secondary cells, thermoelectric phenomena, magnetism, electromagnetic induction, electronics and Roentgen rays. Prerequisite: Physics 202, 204, or 208, and Mathematics 204.

407. Geophysics and Geophysical Methods. (3-0). Credit 3.

A study of the earth's gravitational, magnetic, electrical, elastic and thermal properties and the various methods of geophysical prospecting. The effects of various types of deposits upon each method are shown with the object of determining, from an analysis of structural and lithologic conditions, the type of geophysical method most suitable in any particular area. Prerequisite: Physics 202 or 204, and Mathematics 203, 204; or senior standing in Geology or Petroleum Engineering.

409. Theoretical Acoustics. (3-0). Credit 3.

A study of the fundamental theory of acoustic sound waves; theory of horns, including relations between acoustic and electrical impedance; acoustic transmission; acoustic measurements and instruments; atmospheric acoustics. Prerequisite: Mathematics 203, 204, 305.

## FOR GRADUATES

601, 602. Analytical Mechanics. (4-0). Credit 4 each semester.

A study of rectilinear motion, plane and solid motion of a point, plane and solid rotational motion, mechanisms, strains, kinetics of a particle, kinetics of a rigid body, statics, attraction and potential plane and a solid of a rigid body, hydro-static and hydro-kinetics. Professor Vezey.

603, 604. Advanced Electricity and Magnetism. (4-0). Credit 4 each semester.

A study of the underlying principles of alternating electric currents, the development of graphical methods of analysis as a basis for the solution of practical problems. The development of the equations for the propagation of an electromagnetic disturbance through a dielectric. A study of electrostatic and electromagnetic fields, the electromagnetic theory of light, thermal and electrical conduction in magnetic fields. Professor McCorkle.

605, 606. Theory of Thermodynamics and Thermal Radiation. (4-0).  
Credit 4 each semester.

An advanced course in thermodynamics and thermal radiation including Planck's thermodynamical basis of the quantum theory, the quantum theory of specific heats, Gibb's phase rule, Nernst's heat theorem, radiation, spectra, chemical equilibrium and affinity, modern theories of osmotic pressure, properties of solutions and voltaic cells. Associate Professor Sanders .

607. Kinetic Theory. (4-0). Credit 4.

A study of gas pressure, speed of gaseous molecules, Boyle's law, the law of Gay-Lussac, Graham's Law, mean free path, coefficients of diffusion and viscosity, Maxwell's distribution law. Vander Waal's equation and Brownian movements. Open to undergraduate students who have a grade of A or B in Physics 301, 302. Professor Silvey.

608. Electron Theory. (3-0). Credit 3.

A study of the conductivity of electricity through gases, mobility and diffusion of gaseous ions, measurement of the elementary electric charge, ratio of charge to mass of ions, positive ions and photo-electric action. Open to undergraduate students who have a grade of A or B in Physics 301, 302. Professor Silvey.

609. X-Rays and Crystal Physics. (3-0). Credit 3.

The generation and properties of x-rays; x-ray apparatus and high voltage equipment, ionization, absorption and calculation of absorption coefficients, polarization, scattering, reflection, refraction, x-ray spectra. X-ray analysis of the ultimate structures of materials; crystal classes, theory of scattering from crystals, experimental x-ray methods of crystal structure analyses including the powder, rotation and Laue methods, modern theories of and methods for the structure analysis of gases, liquids and amorphous materials with interpretations of their diffraction patterns. Dr. Morgan.

610. Electron Theory. (0-3). Credit 1.

This course may be taken by students who are enrolled in Physics 608 and those who have credit in this course or its equivalent. Professor McCorkle.

611, 612. Advanced Optics. (4-0). Credit 4 each semester.

The electromagnetic theory of light, spherical and chromatic aberrations, interference, diffraction, crystal optics, optical properties of metals, emission, absorption, dispersion and dispersion formulae, resonance; line and band spectra and their use in the study of the nature of atoms and molecules. Professor McCorkle.

## POULTRY HUSBANDRY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

311. Poultry Feeding. (3-2). Credit 4.

The history of poultry nutrition, a short study of the chemical composition of carbohydrates, proteins, fats, vitamins and mineral mixtures as found in poultry feeds. Composition, functions, sources and care of vitamins commonly required for efficient poultry feeding. A study of the nutritive value of the different grains, roughages, mill feeds and protein concentrates used in poultry nutrition.

Practice work in poultry feeding of laying hens, turkeys, ducks, and geese. Identification of feeds, the making of complete rations, diagnosis of lack of essentials in poultry rations.

401. Culling and Management. (3-2). Credit 4.

The underlying principles of poultry culling, study of the literature, management of large poultry flocks on commercial poultry farms, also large farm flocks, selecting the breeding stock, important qualities of a good breeding male. The practice includes a study of the relationship between physiological characteristics and egg production of the domestic fowls, the standard type, weight and qualities of standard bred domestic fowls; and culling practice, incubation, and hatchery management. Prerequisite: Poultry Husbandry 201.

402. Poultry Farming. (3-2). Credit 4.

The laying out of poultry farms, cost and management in raising a flock of one thousand or more, types of houses, incubators and brooders, raising of special types of poultry, battery brooding methods, teaching and demonstrating plans. The course includes a study of the literature relating to poultry breeding principles and practices. The practice consists of problems in organizing, financing and establishing a commercial poultry business. Prerequisite: Poultry Husbandry 201, 401, and Genetics 301.

412. Advanced Poultry Management. (3-4). Credit 4.

The underlying principles of poultry management as applied to large farm poultry flocks; the selection of breeding stock, the science and the practice of feeding large flocks; the diagnosis and treatment of the most common parasites and diseases of poultry.

## FOR GRADUATES

601, 602. Research Problems. (3-4). Credit 4 each semester.

A study of recent investigations in poultry breeding and nutrition. Research methods are given attention. Experiment station literature, scientific journals and newer publications are to be read and reported by the student. Associate Professor Parnell and Professor Reid.

603, 604. Advanced Incubation and Brooding. (3-4). Credit 4 each semester.

Factors underlying the successful hatching of eggs. A study of the effects of various chemicals and disinfectants on the hatching of hen's eggs. Peculiar requirements of hatching eggs from different species of domestic fowl,—chickens, ducks, geese, turkeys and guinea fowl. Nutritive requirements of the young of the different species of domestic fowl. Optimum percentages of proteins and other nutrients in the ration. The vitamins necessary for growth; vitamins necessary to avoid malformation and to secure good growth; minerals essential to good growth. Results of vitamin deficiency in rations. Professor Reid.

605. Embryology of the Chick. (2-6). Credit 4.

A microscopic study of the changes which take place in the egg during the period of incubation; methods of changing the rate of development of the embryo. Associate Professor Parnell.

671. Cooperative Study of Poultry Nutrition. Credit 2 to 6.

The history of the scientific study of poultry nutrition, including life, animal heat, nutrients, vitamins, etc., and the contributions of the important research workers in the field. A series of written reports, a three-hour weekly conference with the instructor and the carrying out of an Experiment Station project in animal nutrition will be required.

## RURAL SOCIOLOGY

### FOR GRADUATES AND ADVANCED UNDERGRADUATES

311. Social Psychology. (3-0). Credit 3.

The factors affecting group behavior together with methods of social control; the forces and influences which determine the mental attitude of country people; the connection between a good understanding of the social mind and successful organization effort; methods of dealing with the problems involved; the many questions related to public opinion.

312. General Sociology. (3-0). Credit 3.

The position of sociology among the social sciences. The subject matter of sociology is outlined under the following heads: population, physical environment, human motivation, social organization and social pathology. Emphasis is placed upon methods of investigation and quantitative measurement of the data of sociology.

404. Rural Organization. (3-0). Credit 3.

A study of community life in the rural districts with its natural organizing and disorganizing tendencies; a survey and evaluation of attempts at community organization, as the survey, community club plan, community council plan, the school community center, the community church, the Y.M.C.A., the Red Cross in rural districts.

407. Rural Sociology. (2-2). Credit 3.

An analysis of the conditions, forces and agencies influencing the life of the country dweller and the country community; a detailed study of a number of special problems related to the social side of the country life, such as population questions, city-ward drift; town and country relationships, rural health problems, reaction, rural leadership; community organizations and community planning. Attention is also given to the social problems connected with the home, the school, the church, the press, and other social institutions.

416. Agricultural Journalism. (2-2). Credit 3.

A continuation of course 415. Additional practice in the preparation of articles for agricultural and county newspapers; news campaigns for special objectives; the business side of conducting a paper.

## FOR GRADUATES

601, 602. Advanced Rural Sociology. (4-0). Credit 4 each semester.

An intensive study of some important aspects of the field of rural sociology. The first term is connected mainly with the evolution of rural society; the second term with an analysis of some of the principles of rural social problems of today and proposed solutions. Professor Russell.

**606. Rural Youth Leadership. (3-0). Credit 3.**

A survey and analysis of the rural youth problems and a discussion of technics of rural youth leadership. The course is meant for school teachers, Boy Scout leaders, F.F.A., 4-H Club, Y.M.C.A., Y.W.C.A., N.Y.A., and other youth leaders. The course will consist of lectures and field trips to youth projects.

**611. History of Modern Social Thought. (4-0). Credit 4.**

A study of the history, basis, and foundation of modern systems of thinking, as to authors who advance the theories, and as to different theories themselves. Special emphasis is placed on the study of the mental attitudes of the farmers on social, political, and economic questions. Assistant Professor Molyneaux.

**612. The Rural Community. (4-0). Credit 4.**

A study of the rural community as to its geographic background, population, social institutions, and occupational attitudes. Different efforts at organizing the rural community, as the county public welfare project, school and church community center projects, recreational and health projects, local, state and national agencies for rural community co-operation are studied. Professor Russell.

**671, 672. Research Methods and Problems. (2-6). Credit 4 each semester.**

Principles of research as applied to the field of Rural Sociology, analysis of rural social research projects of state and national governmental research agencies and private research agencies. A special study of research methods and techniques as applied to Rural Sociology. Staff.

### VETERINARY ANATOMY

#### FOR GRADUATES

**611, 612. Advanced Veterinary Anatomy. (2-4). Credit 3 each semester.**

Advanced work in either gross or microscopic anatomy along lines to be chosen by the individual. Prerequisite: Veterinary Anatomy 211 and 214, and approval of the Dean and Head of Department. Professor Milliff.

### VETERINARY HYGIENE

#### FOR GRADUATES

**601, 602. Advanced Food Hygiene. (3-4). Credit 4 each semester.**

The study of causes and evidence of spoilage, and detection of adulterants in fresh, canned and cured foods, and in food products such as meats, fish, vegetables and fruits. Prerequisite: Veterinary Hygiene 492. Professor Jaggi.

### VETERINARY MEDICINE AND SURGERY

#### FOR GRADUATES

**601, 602. Special Surgery. (2-4). Credit 3 each semester.**

Problems of surgical conditions, surgical pathology, surgical technique and sterility of animals. Professor Lenert.

### VETERINARY PARASITOLOGY

#### FOR GRADUATES

**601, 602. Veterinary Parasitology. Credit 1 to 4 each semester.**

Advanced Veterinary Parasitology. A detailed study of the more important helminth parasites of domestic animals, including their identification, distribution and life history. Prerequisite: Veterinary Parasitology 481 or equivalent. Professor Van Volkenberg.

**603. Diseases of Wild Game. (2-2). Credit 3.**

A study of the diseases of wild animals including mammals, birds and fish. Prerequisite: Entomology 201, Biology 206, 217, 218, 341 and 342, Fish and Game 401 and/or 402. For students in Veterinary Medicine: Fish and Game 201, Veterinary Hygiene 493 and Veterinary Parasitology 481. Professor Van Volkenberg.

**671, 672. Veterinary Parasitology. Credit 2 to 4 each semester.**

Special problems concerned with the parasites of domestic animals. Prerequisite: Veterinary Parasitology 481. Professor Van Volkenberg.

## VETERINARY PATHOLOGY AND BACTERIOLOGY

### FOR GRADUATES

641, 642. Advanced Special Veterinary Pathology. (3-4). Credit 4 each semester.

Etiology, pathogenesis, lesions and results of diseases of organs and systems of organs; pathology of infectious diseases. Prerequisite: Veterinary Pathology 342, 343, or equivalent. Professor Dunn.

643, 644. Advanced Special Veterinary Bacteriology. (3-4). Credit 4 each semester.

A study of pathogenic micro-organisms; their cultural and biological characteristics and pathogenicity. Prerequisite: Veterinary Pathology 342, 343 or equivalent. Professor Dunn.

## VETERINARY PHYSIOLOGY AND PHARMACOLOGY

### FOR GRADUATES

601, 602. Advanced Animal Physiology. (3-4). Credit 4 each semester.

Recent phases of physiology; modern experimental methods. The work is arranged to suit the needs of the student and in harmony with his previous training. Prerequisite: Veterinary Physiology 322 or its equivalent; basic courses in morphology and organic chemistry. Professor Burns.

605, 606. Advanced Poisonous Plants. (3-4). Credit 4 each semester.

Original investigations and detailed studies of poisonous plants and their effects on domestic animals. Prerequisite: Veterinary Physiology and Pharmacology 432. Professor Burns.

607, 608. Advanced Veterinary Pharmacology. (3-4). Credit 4 each semester.

Modern methods of research in pharmacology and pharmaceutical processes. Original research in studying the actions and uses of drugs. Prerequisite: Veterinary Pharmacology 333, 334. Professor Burns.

611, 612. Advanced Veterinary Physiology. (3-4). Credit 4 each semester.

A detailed study of specific phases of physiology of domestic animals. Prerequisite: Veterinary Physiology 222; Veterinary Anatomy 211, 213, 214. Professor Burns.

# INDEX

	PAGE
Administration .....	14
Application .....	15
Admission to Candidacy .....	15
Board of Directors .....	2
Character of Graduate Work .....	14
<b>COURSES of Instruction by Departments .....</b>	<b>22</b>
Accounting and Statistics .....	22
Agricultural Economics .....	24
Agricultural Education .....	25
Agricultural Engineering .....	26
Agronomy .....	28
Animal Husbandry .....	29
Architecture .....	31
Biology .....	32
Chemical Engineering .....	33
Chemistry .....	34
Civil Engineering .....	35
Cotton Marketing .....	38
Dairy Husbandry .....	38
Economics .....	39
Education .....	41
Electrical Engineering .....	42
Engineering Research .....	44
English .....	45
Entomology .....	45
Fish and Game .....	46
Genetics .....	47
Geology .....	48
History .....	49
Horticulture .....	50
Industrial Education .....	51
Industrial Engineering .....	53
Landscape Art .....	54
Mathematics .....	54
Mechanical Engineering .....	55
Municipal and Sanitary Engineering .....	56
Petroleum Engineering .....	57
Physics .....	58
Poultry Husbandry .....	59
Rural Sociology .....	60
Veterinary Anatomy .....	61
Veterinary Hygiene .....	61
Veterinary Medicine and Surgery .....	61
Veterinary Parasitology .....	61
Veterinary Pathology and Bacteriology .....	62
Veterinary Physiology and Pharmacology .....	62
Courses Offered by Experiment Station Staff .....	14
Degrees .....	14
Examinations .....	15
Expenses .....	19
Expenses of Day Students .....	20
Extension Class Work .....	15
General Statement .....	14
Graduate Committee .....	4
Graduate School Calendar .....	3
Graduation .....	15
Initiative .....	15
Leaves of Absence .....	15
Members of Staff Participating in Graduate Instruction .....	5
Officers of Administration .....	4
Professional Degrees in Engineering .....	20
Quality of Work .....	15
Registration .....	15
Regulations Governing the Award of the Degree of Doctor of Philosophy .....	18
Requirements for the Master of Science Degree .....	
Admission .....	16
Amount of Work .....	16
Course of Study .....	16
Major and Minor Subjects .....	17
Residence .....	17
Specifications as to Course .....	16
Special Committee .....	17
Thesis .....	17
Work in Summer Session .....	17
Requirements for the Master of Education Degree .....	18
Scholarships and Fellowships .....	21
Special Opportunity for the Study of Cotton .....	15