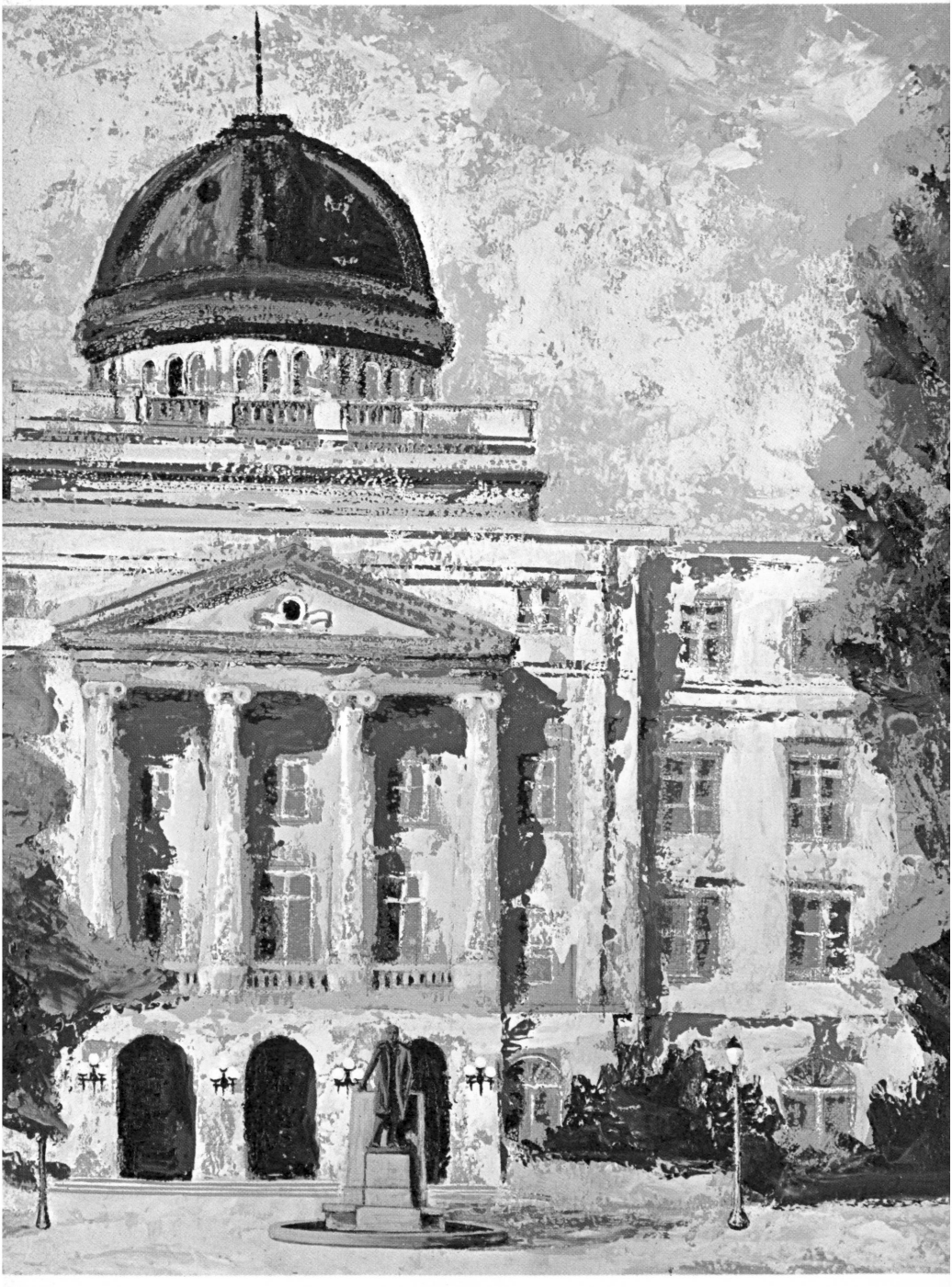
TEXAS A&M UNIVERSITY



The Graduate College ... 1964-65

BULLETIN

OF

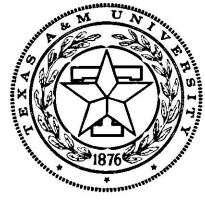
TEXAS A&M UNIVERSITY

Sixth Series, Vol. 11 June 1, 1964 No. 3

GRADUATE COLLEGE CATALOGUE

ANNOUNCEMENTS FOR THE SESSION

1964-65



COLLEGE STATION, TEXAS

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THE CALENDAR FOR 1964-65

1964

JUNE

S	M	T	W	T	F	S
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1965

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THE ACADEMIC CALENDAR FOR 1964-65

SUMMER SESSION, 1964

June 1	Monday. Registration for the first term, 7 a.m. to 12 noon.
June 2	Tuesday. Beginning of classes, 7 a.m.
June 4	Thursday. Last day for enrolling in the University for the first term and for making changes in registration.
July 9	Thursday. Beginning of first term final examinations, 7 p.m.
July 10	Friday. Last day of first term final examinations.
July 13	Monday. Registration for second term, 7 a.m. to 12 noon.
July 14	Tuesday. Beginning of classes, 7 a.m.
July 16	Thursday. Last day for enrolling in the University for the second term and for making changes in registration.
August 20	Thursday. Beginning of second term final examinations, 7 p.m.
August 21	Friday. Last day of second term final examinations.

REGULAR SESSION, 1964-65

September 5	Saturday. Registration of students in professional College of Veterinary Medicine, first trimester, 8 a.m. to 12 noon.
September 7	Monday. Beginning of classes, first trimester, for students in professional College of Veterinary Medicine, 8 a.m.
September 9	Wednesday. New freshmen who participated in the summer conferences report to campus.
September 9-10	Wednesday and Thursday. New Student Program.
September 10	Thursday. Registration of new freshmen who did not participate in the summer conferences, 8 a.m. to 12 noon.
September 10	Thursday. Registration of all other students, 1 p.m. to 5 p.m.
September 11	Friday. Continuation of registration of all other students, 8 a.m. to 5 p.m.
September 12-13	Saturday and Sunday. Organization of Cadet Corps.
September 14	Monday. Beginning of Fall Semester classes, 8 a.m.
September 19	Saturday. Last day for enrolling in the University for the Fall Semester or for adding new courses.
September 23	Wednesday. Last day in the Fall Semester for dropping courses.

November 9	Monday. Mid-semester grade reports.
November 26-29	Thursday-Sunday, inclusive. Thanksgiving holidays for all students.
December 19	Saturday, noon. Beginning of Christmas recess for all students; end of first trimester for professional College of Veterinary Medicine.
January 2, 1965	Saturday. End of Christmas recess for students in professional College of Veterinary Medicine, 8 a.m.; registration for second trimester, 8 a.m. to 12 noon.
January 4	Monday. Beginning of classes, second trimester, for students in professional College of Veterinary Medicine; end of Christmas recess for all other students, 8 a.m.
January 16	Saturday. Commencement.
January 18	Monday. First day of semester examinations.
January 23	Saturday. Last day of semester examinations.
January 27	Wednesday. New freshmen report to campus for Spring Semester.
January 29	Friday. Registration for Spring Semester, 1 p.m. to 5 p.m.
January 30	Saturday. Continuation of registration for Spring Semester, 8 a.m. to 5 p.m.
February 1	Monday. Beginning of classes, Spring Semester, 8 a.m.
February 6	Saturday. Last day for enrolling in the University for the Spring Semester or for adding new courses.
February 10	Wednesday. Last day in Spring Semester for dropping courses with no grade.
March 29	Monday. Mid-semester grade reports.
April 14	Wednesday. Beginning of Spring recess for all students, 5 p.m.; end of second trimester for students in professional College of Veterinary Medicine, 5 p.m.
April 20	Tuesday. End of Spring recess for all students except those in professional College of Veterinary Medicine, 8 a.m.
April 24	Saturday. End of Spring recess for students in professional College of Veterinary Medicine, 8 a.m.; registration for third trimester, 8 a.m. to 12 noon.
April 26	Monday. Beginning of classes, third trimester, for students in professional College of Veterinary Medicine, 8 a.m.
May 22	Saturday. Commencement and Final Review.
May 24	Monday. First day of semester examinations.
May 29	Saturday. Last day of semester examinations.
July 2-5	Friday-Monday, inclusive. Independence holiday for students in professional College of Veterinary Medicine.
August 7	Saturday. End of third trimester for students in professional College of Veterinary Medicine, 12 noon.

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THOMAS D. CHERRY, M.S.....*Director of Business Affairs*

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ROBERT W. BARZAK, *Assistant Dean*
DORIS WATSON, *Administrative Secretary*

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GRADUATE FACULTY

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

Abbott, John Paul, Distinguished Professor of English. (1926, 1956)
B.A., Vanderbilt, 1925; Ph.D., Iowa, 1939.

*Adkins, William G., Research Economist, Texas Transportation Institute. (1964)
B.S., Texas A&M, 1951; M.S., 1953; Ph.D., 1963.

Adkisson, Perry L., Professor of Entomology. (1958, 1963)
B.S., Arkansas, 1950; M.S., 1954; Ph.D., Kansas State College, 1956.

*Alexander, Robert Benjamin, Associate Professor of Chemistry. (1952, 1959)
B.A., Baylor, 1945; M.A., 1946; Ph.D., Texas A&M, 1957.

*Alter, Alan Brian, Assistant Professor of Mechanical Engineering. (1949, 1952)
B.S., Pittsburgh, 1948; M.S., Texas A&M, 1953; Reg. Prof. Engr.

Anderson, John Quincy, Professor of English and Head of Department. (1953, 1962)
A.B., Oklahoma Agricultural and Mechanical College, 1939; M.A., Louisiana State, 1948; Ph.D., North Carolina, 1952.

Angino, Ernest Edward, Assistant Professor of Oceanography. (1962)
B.S., Lehigh, 1954; M.S., Kansas, 1958; Ph.D., 1961.

Applegate, Howard George, Associate Professor of Plant Physiology and Pathology. (1963)
B.S., Colorado State, 1950; M.S., 1952; Ph.D., Michigan State, 1956.

*Ashcraft, Allan Coleman, Assistant Professor of History. (1956, 1960)
B.A., Texas A&M, 1950; M.A., Columbia, 1951; Ph.D., 1960.

Ashworth, Lee J., Jr., Assistant Professor of Plant Physiology and Pathology. (1958)
B.S., California, 1951; M.S., 1954; Ph.D., 1958.

Atkins, Irvin Milburn, Agronomist (Agricultural Research Service, USDA, cooperating.) (1939, 1954)
B.S., Kansas State College, 1928; M.S., 1936; Ph.D., Minnesota, 1945.

Atkinson, Robert Leon, Assistant Profesor of Poultry Science. (1955)
B.S., Texas A&M, 1949; M.S., 1950; Ph.D., California, 1958.

Baldauf, Richard John, Associate Professor of Wildlife Management. (1952, 1959)
B.S., Albright College, 1949; M.S., Texas A&M, 1951; Ph.D., 1956.

*Ballinger, Richard Henry, Professor of English. (1954, 1957)
B.A., Texas, 1936; M.A., 1936; Ph.D., Harvard, 1953.

Banks, William Carl, Professor of Veterinary Medicine and Surgery. (1941, 1955)
D.V.M., Texas A&M, 1941; M.S., 1952.

Barker, Donald Gene, Associate Professor of Education and Psychology. (1959, 1963)
B.A., Baylor, 1952; M.A., 1954; Ph.D., Texas, 1961.

*Barker, Palmer Winfield, Associate Professor of Physics. (1946, 1949)
B.S., Missouri, 1932; M.A., 1933.

*Associate Member

*Barzak, Robert William, Assistant Dean of Graduate Studies and Associate Professor of English. (1955, 1962)
B.A., Texas A&M, 1949; M.A., Illinois, 1951; Ph.D., 1959.

Bashaw, Elexis C., Geneticist of Agricultural Research Service, USDA. (1951, 1955)
B.S., Purdue, 1947; M.S., 1948; Ph.D., Texas A&M, 1954.

Basye, Robert Eugene, Professor of Mathematics. (1940, 1952)
B.A., Missouri, 1929; M.A., Princeton, 1931; Ph.D., Texas, 1933.

Baty, James Bernard, Professor of Civil Engineering. (1948, 1950)
B.S., Texas A&M, 1925; M.C.E., Cornell, 1950; Reg. Prof. Engr.

Beachell, Henry M., Agronomist of Texas Agricultural Experiment Station, Beaumont (Agricultural Research Service, USDA, cooperating). (1953)
B.S., Nebraska, 1930; M.S., Kansas State College, 1933.

*Bearden, Harold D., Director of Texas Engineering Extension Service. (1947, 1957)
B.S., Texas Technological College, 1931; M.A., Texas, 1936.

Beasley, Joseph Noble, Associate Professor of Veterinary Pathology. (1959)
D.V.M., Texas A&M, 1949; M.S., 1956.

*Bell, Rurel Roger, Associate Professor of Veterinary Parasitology. (1952, 1958)
D.V.M., Georgia, 1952; M.S., Texas A&M, 1955.
(On leave of absence from September 1, 1963 to August 31, 1964.)

*Bennett, Alvin Lowell, Associate Professor of English. (1954, 1957)
B.A., Texas, 1927; M.A., Washington, 1931; Ph.D., Texas, 1952.

Benson, Fred Jacob, Dean of Engineering, Administrator of the Texas Engineering Experiment Station, and Professor of Civil Engineering. (1937, 1962)
B.S., Kansas State College, 1935; M.S., Texas A&M, 1936; Reg. Prof. Engr.

Benton, Wilbourn Eugene, Professor of Government. (1957, 1962)
B.A., Texas Technological College, 1939; M.A., 1941; Ph.D., Texas, 1948.

Berry, Raymond Orvil, Professor Emeritus of Animal Husbandry. (1931, 1960)
B.S., North Texas State Teachers College, 1928; M.S., Texas A&M, 1932; Ph.D., Johns Hopkins, 1939.

Bird, Luther Smith, Associate Professor of Plant Physiology and Pathology. (1951, 1959)
B.S., Clemson College, 1948; M.S., Texas A&M, 1953; Ph.D., 1955.

*Bishop, Vernon Spilman, Assistant Professor of Nuclear Engineering. (1964)
B.S., Mississippi College, 1958; M.S., Kansas, 1960; Ph.D., Mississippi Medical Center, 1964.

Blackhurst, Homer T., Professor of Horticulture. (1947, 1950)
A.B., Glenville State Teachers College, 1935;M.S., Texas A&M, 1940; Ph.D., 1947.

Blank, Horace R., Professor of Geology. (1949, 1953)
B.S., Pennsylvania, 1919; Ph.D., 1924.

Bloodworth, Morris Elkins, Professor of Soil Physics and Head of Department of Soil and Crop Sciences. (1956, 1963)
B.S., Texas A&M, 1941; M.S., 1953; Ph.D., 1958.

*Boone, James Leroy, Jr., Assistant Professor of Industrial Education. (1952, 1955)
B.S., Texas A&M, 1947; M.Ed., 1948.

*Associate Member

Bossler, Robert Burns, Professor of Petroleum Engineering. (1956)
B.S., Pittsburgh, 1918.

Branson, Robert Earl, Professor of Agricultural Economics and Sociology. (1955, 1958)
B.S., Southern Methodist, 1941; M.P.A., Harvard, 1948; M.A., 1949; Ph.D., 1954.

Brewer, Burns W., Professor of Mathematics. (1938, 1957)
A.B., Missouri, 1935; A.M., 1936; Ph.D., 1938.

Bridges, Charles Hubert, Professor of Veterinary Pathology and Head of Department. (1955, 1960)
D.V.M., Texas A&M, 1945; M.S., 1954; Ph.D., 1957.

*Brigham, Raymond D., Agronomist. (1957)
B.S., Texas Technological College, 1950; M.S., Iowa State, 1952; Ph.D., 1957.

Brison, Fred Robert, Professor of Horticulture. (1926, 1938)
B.S., Texas A&M, 1921; M.S., Michigan State College, 1931.

Brown, Murray Allison, Associate Professor of Dairy Science. (1955, 1962)
B.S., Michigan State College, 1950; M.S., Texas A&M, 1953; Ph.D., 1956.

Brown, Meta Suche, Professor of Agronomy. (1940, 1955)
B.A., Texas, 1931; M.A., 1933; Ph.D., 1935.

Brown, Sidney Overton, Professor of Biology. (1936, 1949)
B.A., Texas, 1932; Ph.D., 1936.

*Brundidge, Kenneth Cloud, Associate Professor of Meteorology. (1955, 1962)
B.A., Chicago, 1952; M.S., 1953; Ph.D., Texas A&M, 1961.

Buchanan, Spencer Jennings, Professor of Civil Engineering. (1946)
B.S., Texas A&M, 1926; M.S., Massachusetts Institute of Technology, 1931; C.E., Texas A&M, 1948; Reg. Prof. Engr.

*Bull, Don Lee, Entomologist, Entomology Research Division, ARS, USDA. (1963)
B.S., Texas A&M, 1953; M.S., 1960; Ph.D., 1962.

Burgess, Archie Rostron, Professor of Industrial Engineering and Head of Department. (1948, 1951)
B.S., Washington, 1932; M.S., 1938; Reg. Prof. Engr.

*Burke, Horace Reagan, Assistant Professor of Entomology. (1958)
B.S., Sam Houston State Teachers College, 1953; M.S., Texas A&M, 1955; Ph.D., 1959.

Burns, Edward Eugene, Associate Professor of Horticulture. (1956, 1959)
B.S., Purdue, 1950; M.S., 1952; Ph.D., 1956.

Burns, Patton Wright, Professor of Veterinary Physiology and Pharmacology and Head of Department. (1926, 1935)
B.S., Texas A&M, 1923; D.V.M., 1926.

*Burroughs, Albert Lawrence, Serologist of Department of Veterinary Microbiology. (1954, 1957)
B.S., Wyoming, 1938; M.S., Montana State College, 1941; Ph.D., California, 1946.

Butler, Ogbourne Duke, Jr., Professor of Animal Husbandry and Head of Department. (1947, 1956)
B.S., Texas A&M, 1939; M.S., 1947; Ph.D., Michigan State College, 1953.

*Caddess, James Harvey, Associate Professor of Mechanical Engineering. (1940, 1953)
B.S., Texas A&M, 1932; M.S., 1934; Reg. Prof. Engr.

*Associate Member

Calaway, Paul Kenneth, Professor of Chemistry and Head of Department. (1957)
B.A., Arkansas College, 1931; M.S., Georgia Institute of Technology, 1933; Ph.D., Texas, 1938.

Calhoun, John C., Jr., Vice Chancellor for Programs and Professor of Petroleum Engineering. (1955, 1963)
B.S., Pennsylvania State College, 1937; M.S., 1941; Ph.D., 1946; Reg. Prof. Engr. (On leave of absence)

Calliham, Melvin Ray, Professor of Veterinary Medicine and Surgery and Head of Department. (1958)
B.S., Texas A&M, 1941; D.V.M., 1949.

Camp, Bennie Joe, Associate Professor of Biochemistry and Nutrition. (1956, 1960)
B.S., East Texas State Teachers College, 1949; M.S., Texas A&M, 1953; Ph.D., 1956.

*Carpenter, Zerle Leon, Assistant Professor of Animal Husbandry. (1962)
B.S., Oklahoma State, 1957; M.S., Wisconsin, 1960; Ph.D., 1962.

*Carter, Dilford Campbell, Assistant Professor of Wildlife Management. (1961, 1964)
B.S., Southern Methodist, 1956; M.S., 1956; Ph.D., Texas A&M, 1962.

Cartwright, Thomas Campbell, Professor of Animal Husbandry. (1958)
B.S., Clemson Agricultural College, 1948; M.S., Texas A&M, 1949; Ph.D., 1954.

Chalk, Alfred Franklin, Professor of Economics and Head of Department. (1936, 1956)
B.A., Baylor, 1934; M.S., Texas A&M, 1936; Ph.D., Texas, 1950.

*Clark, Robert Alfred, Assistant Professor of Meteorology. (1960, 1961)
B.S., Kansas State, 1948; M.S., Texas A&M, 1959; Ph.D., 1964.

Clark, William Jesse, Assistant Professor of Biology. (1957)
B.S., Utah State Agricultural College, 1950; M.S., 1956; Ph.D., 1958.

Clayton, William Howard, Associate Professor of Oceanography. (1954, 1961)
B.S., Bucknell, 1949; Ph.D., Texas A&M, 1956.

*Cleland, Samuel Miles, Professor of Engineering Graphics. (1941, 1958)
B.A., West Texas State Teachers College, 1931; M.Ed., Texas A&M, 1940.

Cleveland, Donald Edward, Associate Professor of Civil Engineering and of Industrial Engineering. (1959, 1962)
S.B., Massachusetts Institute of Technology, 1949; M.Eng., Yale, 1959; Ph.D., Texas A&M, 1962; Reg. Prof. Engr.

Cochran, Robert Glenn, Professor of Nuclear Engineering and Head of Department. (1959)
A.B., Indiana, 1948; M.S., 1950; Ph.D., Pennsylvania State, 1957.

*Cochrane, John Douglas, Associate Professor of Oceanography. (1956, 1962)
B.A., University of California at Los Angeles, 1943; M.S., Scripps Institute of Oceanography, 1948.

Coffey, Lee Clayton, Professor of Agronomy. (1950, 1957)
B.S., Texas A&M, 1940; M.S., 1950; Ph.D., Iowa State, 1954.

Collier, Jesse Wilton, Associate Agronomist. (1949, 1960)
B.S., Texas A&M, 1938; M.S., 1952; Ph.D., Rutgers, 1957.

Conway, Dwight Colbur, Associate Professor of Chemistry. (1963)
B.S., California at Berkeley, 1952; Ph.D., Chicago, 1956.

*Associate Member

*Cook, Benjamin Davy, Associate Professor of Agricultural Education and Specialist in Extension Training. (1950, 1960)
B.S., Texas A&M, 1934; M.Ed., 1950; Ph.D., Wisconsin, 1957.

*Cook, Elton D., Agronomist of Texas Agricultural Experiment Substation, Temple. (1949, 1952)
B.S., Texas Technological College, 1935; M.S., Kansas State, 1948; Ph.D., Nebraska, 1951.

Coon, Jesse Bryan, Professor of Physics. (1946, 1957)
A.B., Indiana, 1932; M.A., 1935; Ph.D., Chicago, 1949.

*Cooper, Brian Seymour, Assistant Professor of Oceanography and Meteorology. (1964)
B.Sc., Nottingham, 1953; Ph.D., 1963.

*Cooper, Rodney Jean, Associate Professor of Animal Husbandry. (1963)
B.S., Oklahoma State, 1954; M.S., Iowa State, 1958.

Couch, James Russell, Professor of Biochemistry and Nutrition and of Poultry Science. (1948, 1949)
B.S., Texas A&M, 1931; M.S., 1934; Ph.D., Wisconsin, 1948.

*CoVan, Jack Phillip, Professor of Industrial Engineering. (1946, 1956)
B.M.E., Ohio State, 1935; B.I.E., 1935; M.S., Illinois, 1942; Reg. Prof. Engr.

Crawford, Paul B., Assistant Director of the Texas Petroleum Research Committee and Professor of Petroleum Engineering. (1952, 1962)
B.S., Texas Technological College, 1943; M.S., Texas, 1946; Ph.D., 1949.

*Creger, Clarence R., Assistant Professor of Poultry Science. (1962)
B.S., Kansas State, 1955; M.S., 1956; Ph.D., Texas A&M, 1961.

Cronk, Alfred Edward, Professor of Aerospace Engineering and Head of Department. (1956)
B.S., College of St. Thomas, 1937; M.S., Minnesota, 1946; Reg. Prof. Engr.

Crookshank, Herman Robert, Animal Nutritionist for the Department of Biochemistry and Nutrition, USDA. (1959)
B.S., Northeast Missouri State College, 1938; M.S., Iowa State, 1940; Ph.D., 1942.

*Dahlberg, Frank Iver, Professor of Animal Husbandry. (1936, 1947)
B.S., Texas A&M, 1925; M.S., Wisconsin, 1930.

Danti, Alfred, Associate Professor of Chemistry. (1961)
B.S., Colorado College, 1954; Ph.D., Massachusetts Institute of Technology, 1958.

*Daron, Harlow H., Assistant Professor of Biochemistry and Nutrition. (1963)
B.S., Oklahoma, 1956; Ph.D., Illinois, 1961.

*Davis, Daniel Rowland, Associate Professor of Sociology. (1935, 1947)
B.S., Texas A&M, 1932; M.S., 1935.

Davis, Richard Bratton, Associate Professor of Wildlife Management. (1951, 1959)
B.S., Texas College of Arts and Industries, 1940; M.S., Texas A&M, 1949; Ph.D., 1952.

*Davis, Richard Harvey, Jr., Associate Professor of Veterinary Physiology and Pharmacology. (1951, 1956)
D.V.M., Texas A&M, 1941; M.S., 1956.

Davis, William B., Professor of Wildlife Management and Head of Department. (1937, 1946)
B.A., Chico State Teachers College, 1933; M.A., California, 1936; Ph.D., 1937.

*Associate Member

*Davison, Richard Read, Assistant Professor of Chemical Engineering. (1958, 1961)
B.S., Texas Technological College, 1949; M.S., Texas A&M, 1958; Ph.D., 1962.

*Dayhoff, Eldred Eugene, Assistant Professor of Statistics. (1963)
B.S., Texas A&M, 1955; M.S., 1956; Ph.D., Iowa State, 1963.

*Denison, John Scott, Associate Professor of Electrical Engineering. (1949, 1954)
B.S., New Mexico Agricultural and Mechanical College, 1948; M.S., Texas A&M, 1949; Reg. Prof. Engr.

DeWerth, Adolphe Ferdinand, Professor of Floriculture. (1946, 1949)
B.S., Ohio State, 1930; M.S., 1931.

Dieckert, Julius Walter, Associate Professor of Biochemistry and Nutrition. (1960)
B.S., Texas A&M, 1949; M.S., 1951; Ph.D., 1955.

Dillon, Lawrence Samuel, Professor of Biology. (1948, 1961)
B.S., Pittsburgh, 1933; M.S., Texas A&M, 1950; Ph.D., 1954.

*Dobson, William Jackson, Professor of Biology and Professional Counselor, Counseling and Testing Center. (1947, 1960)
B.A., Austin College, 1939; Ph.D., Texas, 1946.

Dollahite, James Walton, Associate Professor and Assistant Director for Veterinary Research. (1963)
D.V.M., Texas A&M, 1933; M.S., 1961.

Doran, Edwin Beale, Jr., Associate Professor of Geography. (1960)
B.A., Louisiana State, 1938; M.S., 1947; Ph.D., California at Berkeley, 1953.

*Dorough, Hendley Wyman, Assistant Professor of Entomology. (1963)
B.S., Auburn, 1959; M.S., 1960; Ph.D., Wisconsin, 1964.

*Dowell, William Merl, Professor of Health and Physical Education. (1942, 1950)
B.S., Sam Houston State Teachers College, 1929; M.A., George Peabody College, 1932.

*Drew, Dan D., Assistant Professor of Industrial Engineering. (1960)
B.S., North Texas State College, 1950; M.S., 1951.

*Drew, Donald Richard, Assistant Professor of Civil Engineering. (1963)
B.S., Purdue, 1952; M.S., Texas A&M, 1961; Ph.D., 1964.

*Druce, Albert John, Associate Professor of Electrical Engineering. (1946, 1956)
B.S., Texas A&M, 1943; M.S., 1950.

Duke, Frederick Robert, Distinguished Professor of Chemistry. (1963)
B.A., South Dakota, 1937; Ph.D., Illinois, 1940.

Duller, Nelson Mark, Jr., Associate Professor of Physics. (1953, 1962)
B.S., Texas A&M, 1948; M.A., Rice Institute, 1951; Ph.D., 1953.

*Dunlap, Wayne Alan, Assistant Professor of Civil Engineering. (1959)
B.S., Texas A&M, 1952; M.S., 1955.

*Durbin, Leonel Damien, Assistant Professor of Chemical Engineering. (1961)
B.S., Texas College of Arts and Industries, 1957; Ph.D., Rice, 1961.

*Earle, James Hubert, Assistant Professor of Engineering Graphics. (1957, 1960)
B.Arch, Texas A&M, 1955; M.Ed., 1962; D.Ed., 1964.

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B.S., Arkansas, 1948; M.S., Oklahoma Agricultural and Mechanical College, 1950; Ph.D., Cornell, 1956.

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Ph.D., Ohio State, 1959.

Eisner, Melvin, Professor of Physics. (1948, 1957)
B.A., Brooklyn College, 1942; M.S., North Carolina, 1947; Ph.D., 1948.

Ekfelt, Fred Emil, Professor of English. (1938, 1951)
B.A., Iowa, 1931; M.A., 1932; Ph.D., 1941.

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B.S., Texas A&M, 1933; M.S., 1935.

*Ellett, Edwin Willard, Associate Professor of Veterinary Medicine and Surgery. (1958, 1961)
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Ellis, William C., Associate Professor of Animal Husbandry. (1961, 1963)
B.S., Louisiana Polytechnic Institute, 1953; M.S., Missouri, 1955; Ph.D., 1958.

*Elmquist, Karl Erik, Associate Professor of English. (1935, 1947)
A.B., Southern Methodist, 1932; M.A., Texas, 1939.

*El-Sayed, Sayed Zakaria, Assistant Professor of Oceanography. (1961)
B.S., Alexandria, 1949; M.S., 1951; Ph.D., Washington, 1959.

*Ergle, David R., Senior Plant Physiologist of Plant Sciences Department (Agricultural Research Service, USDA, cooperating). (1944)
B.S., Clemson College, 1926; M.S., North Carolina, 1928; Ph.D., 1930.

*Eubank, Philip Toby, Assistant Professor of Chemical Engineering. (1961)
B.S., Rose Polytechnic Institute, 1958; Ph.D., Northwestern, 1961.

*Fahlquist, Davis Armstrong, Assistant Professor of Geophysics. (1963)
B.S., Brown, 1950; Ph.D., Massachusetts Institute of Technology, 1963.

Fanguy, Roy Charles, Assistant Professor of Poultry Science. (1958)
B.S., Mississippi State College, 1951; M.S., Alabama Polytechnic Institute, 1953; Ph.D., Texas A&M, 1958.

*Farris, Donald Edward, Associate Professor of Agricultural Economics and Sociology. (1963)
B.S.A., Arkansas, 1950; M.S., 1951; Ph.D., North Carolina State College, 1958.

*Ferguson, Marvin Harry, Southwestern Director and National Research Coordinator of U. S. Golf Association, Green Section (Department of Soil and Crop Sciences Cooperating). (1952, 1953)
B.S., Texas A&M, 1940; Ph.D., Maryland, 1950.

Ferguson, Thomas Morgan, Associate Professor of Poultry Science. (1946, 1956)
B.A., Southwestern, 1936; M.S., Texas A&M, 1946; Ph.D., 1954.

Flowers, Archie Ingram, Professor of Veterinary Microbiology. (1957, 1963)
B.S., Texas A&M, 1942; D.V.M., 1950; M.S., 1959.

Folweiler, A. D., Director of Texas Forest Service. (1949)
B.S., Pennsylvania State College, 1925; M.F., Yale, 1931; Ph.D., Wisconsin, 1943.

*Associate Member

Fowler, Marcus L., Associate Professor of Agricultural Economics and Sociology. (1963)
B.S.A., Arkansas, 1951; Ph.D., California, 1961.

*Franceschini, Guy Arthur, Associate Professor of Meteorology. (1952, 1961)
B.S., Massachusetts, 1950; M.S., Chicago, 1952; Ph.D., Texas A&M, 1961.

Franklin, Ted Eugene, Associate Professor of Veterinary Microbiology. (1963)
D.V.M., Texas A&M, 1941; M.S., 1952.

Freund, Rudolf J., Associate Director of the Institute of Statistics. (1962)
M.A., Chicago, 1951; Ph.D., North Carolina State College, 1955.

Furr, Howard Lee, Professor of Civil Engineering. (1962)
B.S., Mississippi State College, 1941; M.S., Texas A&M, 1948; Ph.D., Texas, 1958.

Futrell, Maurice Chilton, Assistant Professor of Plant Sciences. (1958, 1962)
B.S., Western Kentucky State College, 1947; M.S., Wisconsin, 1949; Ph.D., 1952.

Gaines, J. C., Professor of Entomology and Head of Department. (1947, 1952)
B.S., Alabama Polytechnic Institute, 1925; M.S., 1926; Ph.D., Iowa State College, 1937.

Gallaway, Bob Mitchell, Professor of Civil Engineering. (1944, 1959)
B.S., Texas A&M, 1943; M.S., 1946; M.Eng., 1956; Reg. Prof. Engr.

*Galvin, Thomas Joseph, Assistant Professor of Veterinary Parasitology. (1959, 1960)
D.V.M., Texas A&M, 1957; B.S., 1961; M.S., 1961.

Gammel, John Ledel, Professor of Physics. (1963)
B.A., Texas, 1944; M.A., 1946; Ph.D., Cornell, 1950.

Gardner, Frederick Albert, Associate Professor of Poultry Science. (1959, 1963)
B.S., Vermont, 1953; M.S., Texas A&M, 1955; Ph.D., Missouri, 1960.

*Gerard, Cleveland J., Associate Professor of Soil and Crop Sciences. (1964)
B.S., Southwestern Louisiana, 1948; M.S., Kansas State, 1950; Ph.D., Texas A&M, 1954.

German, John Paul, Professor of Electrical Engineering. (1958)
B.S., Texas, 1940; M.S., 1949; Ph.D., 1955; Reg. Prof. Engr.

*Gibbs, Leon Wilford, Professor of Veterinary Anatomy. (1949, 1963)
B.S., Texas A&M, 1939; D.V.M., 1949; M.S., 1957.

Gilruth, Robert Rowe, Visiting Professor of Aerospace Engineering. (1963)
B.S., Minnesota, 1935; M.S., 1936; D.Sc., Indiana Technical College, 1962; D.Sc., George Washington, 1962; D.Sc., Minnesota, 1962.

Gladden, James Kelly, Professor of Chemistry. (1959)
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Glazener, Everett Ruthven, Associate Professor of Industrial Education. (1962)
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Godfrey, Curtis L., Associate Professor of Agronomy. (1954)
B.S., Texas A&M, 1939; M.S., 1948; Ph.D., Iowa State College, 1951.

*Goode, Phillip Barron, Professor of Business Administration. (1946, 1949)
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Gould, Frank Walton, Associate Professor of Range and Forestry. (1949)
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A.B., James Millikin, 1933; M.A., Illinois, 1934; Ph.D., 1939.

*Griffiths, John Frederick, Assistant Professor of Meteorology. (1962)
B.S., King's College (London), 1947; M.S., Imperial College (London), 1949.

Groneman, Chris Harold, Professor of Industrial Education and Head of Department; Coordinator of Teacher Education. (1940, 1956)
B.S., Kansas State Teachers College, 1931; M.S., 1935; D.Ed., Pennsylvania State College, 1950.

Grumbles, Leland Creed, Professor of Veterinary Microbiology and Head of Department. (1949, 1957)
D.V.M., Texas A&M, 1945; M.S., 1957.

*Hacskaylo, Joseph, Lecturer in Plant Sciences. (1958, 1963)
A.B., West Virginia, 1949; M.S., 1950; Ph.D., Texas A&M, 1955.

Hale, Fred, Professor of Animal Husbandry in Charge of Swine Investigations. (1922, 1927)
B.S., Texas A&M, 1922; M.S., 1925.

Hall, Charles Franklin, Associate Professor of Veterinary Microbiology. (1959)
B.S., Kansas State College, 1949; D.V.M., 1951; M.S., Michigan State, 1959.

*Hall, Claude Hampton, Associate Professor of History. (1951, 1959)
B.A., Virginia, 1947; M.A., 1949; Ph.D., 1954.

*Hall, Dan, Associate Professor of Mathematics. (1928, 1944)
A.B., North Carolina, 1927; A.M., 1928.

Hall, Wayne C., Dean of Graduate Studies and Professor of Plant Physiology and Pathology. (1949, 1960)
B.S., Iowa, 1941; M.S., 1946; Ph.D., 1948.

*Halliwell, Robert Stanley, Assistant Professor of Plant Sciences. (1962)
B.S., Wyoming, 1956; M.S., 1959; Ph.D., Oregon State, 1962.

Hallmark, Glen Duncan, Professor of Electrical Engineering and Head of Department. (1942, 1958)
B.S., Texas A&M, 1935; M.S., 1946; Ph.D., 1953.

Ham, Joe Strother, Professor of Physics. (1956, 1963)
Ph.B., Chicago, 1948; M.S., 1951; Ph.D., 1954.

Hampton, Herbert Elwood, Professor of Agronomy. (1938, 1948)
B.S., Texas A&M, 1937; Ph.D., Missouri, 1943.

Hancock, Charles Kinney, Professor of Chemistry. (1946, 1949)
B.S., Southwest Texas State Teachers College, 1931; M.A., Texas, 1936; Ph.D., 1939.

Hanna, Ralph Lynn, Associate Professor of Entomology. (1949, 1956)
B.A., Stephen F. Austin State Teachers College, 1939; Ph.D., Texas A&M, 1951.

Hardeman, Lyman Bryce, Associate Professor of Industrial Education. (1947, 1957)
B.S., Kansas State Teachers College, 1939; M.Ed., Texas A&M, 1949.

Harrington, Edwin Lincoln, Professor of Civil Engineering. (1939, 1957)
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*Associate Member

Harrington, Marion Thomas, Chanceller of the Texas A&M University System. (1924, 1953)
B.S., Texas A&M, 1922; M.S., 1927; Ph.D., Iowa State College, 1941.

Harris, William Donald, Professor of Chemical Engineering. (1935, 1949)
B.S., Iowa State College, 1929; M.S., 1931; Ph.D., 1934; Reg. Prof. Engr.

Harrison, Arthur L., Plant Pathologist of Texas Agricultural Experiment Station, Yoakum. (1937, 1947)
B.S., Ontario Agricultural College, 1929; Ph.D., Cornell, 1935.

Hartley, Herman Otto, Professor of Statistics and Director of the Graduate Institute of Statistics. (1963)
Ph.D., Berlin, 1934; Ph.D., Cambridge, 1940; D.Sc., London, 1953.

*Hauer, Louis Frederick, Associate Professor of English. (1937, 1961)
B.A., Dubuque, 1931; M.A., Iowa, 1933.

Haupt, Lewis McDowell, Jr., Professor of Electrical Engineering. (1930, 1948)
B.S., Texas A&M, 1927; M.S., 1935; Reg. Prof. Engr.

Hawkins, Leslie Virgle, Professor of Industrial Education. (1954, 1959)
B.S., Panhandle Agricultural and Mechanical College, 1938; M.S., Oklahoma Agricultural and Mechanical College, 1946; D.Ed., Pennsylvania State, 1953.

Hays, John Q., Professor of English. (1929, 1945)
A.B., Missouri, 1929; M.A., 1932; Ph.D., California, 1942.

Hedges, Richard Marion, Associate Professor of Chemistry. (1960, 1963)
B.S., Southern Methodist, 1950; Ph.D., Iowa State, 1955.

*Henry, Walter Keith, Assistant Professor of Meteorology. (1957)
B.S., Missouri, 1941; M.S., Chicago, 1949.

Hensarling, Paul Reginald, Professor of Education and Psychology and Head of the Department. (1958, 1963)
B.S., North Texas State College, 1933; M.S., 1940; Ed.D., Houston, 1957.

*Henson, James Bond, Associate Professor of Veterinary Pathology. (1962)
B.S., Texas A&M, 1956; D.V.M., 1958; M.S., 1959.

*Hierth, Harrison Ewing, Associate Professor of English. (1946, 1957)
A.B., Illinois Wesleyan, 1935; B.Ed., Illinois State Normal, 1936; M.A., Illinois, 1942; Ph.D., Wisconsin, 1956.

Hirsch, Teddy James, Associate Professor of Civil Engineering. (1956, 1962)
B.S., Texas A&M, 1952; M.Eng., 1953; Ph.D., 1961.

Hobgood, Price, Professor of Agricultural Engineering and Head of Department. (1939, 1958)
B.S., Texas A&M, 1938; M.S., 1940; Reg. Prof. Engr.

*Hocking, Ronald Raymond, Associate Professor of Statistics. (1963)
B.S., Michigan College of Mining and Technology, 1954; M.S., Michigan, 1957; Ph.D., Iowa State, 1962.

*Holcomb, John W., Jr., Associate Professor of Agricultural Education. (1960)
B.S., Texas A&M, 1940; M.Ed., 1953.

Holcomb, Robert Marion, Professor of Civil Engineering. (1947)
B.S., Arizona, 1936; M.S., Iowa State College, 1941; Ph.D., 1956; Reg. Prof. Engr.

Holdredge, Edwin Sereno, Professor of Mechanical Engineering. (1939, 1957)
B.S., Tennessee, 1938; M.S., 1939; Reg. Prof. Engr.

*Associate Member

Holland, Charles Donald, Professor of Chemical Engineering and Head of Department. (1952, 1964)
B.S., North Carolina State College, 1943; M.S., Texas A&M, 1949; Ph.D., 1953.

Holleman, Theo Rufus, Professor of Architecture. (1946, 1957)
B.Arch., Texas A&M, 1940; M.Arch, 1951; Reg. Prof. Arch.

Holt, Ethan Cleddy, Professor of Agronomy. (1948, 1957)
B.S., Alabama Polytechnic Institute, 1943; M.S., Purdue, 1948; Ph.D., 1950.

*Holt, Oris Milton, Associate Professor of Agricultural Education. (1954, 1957)
B.S., Texas A&M, 1942; M.Ed., 1946; Ed.D., Houston, 1962.

Hood, Donald Wilbur, Professor of Chemistry and of Oceanography. (1946, 1960)
B.S., Pennsylvania State College, 1940; M.S., Oklahoma Agricultural and Mechanical College, 1942; Ph.D., Texas A&M, 1950.
(On leave of absence from September 1, 1963 to August 31, 1964.)

*Hope, Lannes Homer, Assistant Professor of Psychology. (1961)
B.S., Texas Technological College, 1949; M.Ed., 1950; Ph.D., Texas, 1960.

Hopkins, Sewell Hepburn, Professor of Biology. (1935, 1947)
B.S., William and Mary College, 1927; M.A., Illinois, 1930; Ph.D., 1933.

*Hoyle, Samuel Cooke, Jr., Professor of Business Administration. (1947, 1957)
LL.B., Texas, 1926; B.A., 1946; M.A., 1948.

Hubert, Frank William R., Dean of Arts and Sciences. (1959)
B.A., Texas, 1938; M.A., 1945; Ph.D., 1950.

*Huebner, George Lee, Jr., Senior Research Scientist, Department of Oceanography and Meteorology. (1958)
B.S., Texas A&M, 1946; M.S., 1951; Ph.D., 1953.

Hunt, Robert Lee, Professor Emeritus of Agricultural Economics. (1927, 1961)
B.S., Texas A&M, 1924; M.S., North Carolina State College, 1927; Ph.D., Wisconsin, 1934.

*Hunter, Parks Caldwell, Jr., Associate Professor of English. (1955, 1962)
B.A., Miami, 1948; B.Ed., 1949; M.A., 1950; Ph.D., Texas, 1958.

Hupp, Eugene W., Associate Professor of Biology. (1962)
B.S., Nebraska, 1954; M.S., 1957; Ph.D., Michigan State, 1959.

Hurt, John Tom, Professor of Mathematics. (1936, 1947)
B.A., Rice Institute, 1931; M.A., 1932; Ph.D., 1935.

*Huss, Donald Lee, Assistant Professor of Range and Forestry. (1955, 1958)
B.S., Texas A&M, 1949; M.S., 1954; Ph.D., 1959.

Hutchison, John Elton, Director of Texas Agricultural Extension Service. (1945, 1957)
B.S., Texas A&M, 1936; M.S., 1949; M.Ed., 1950.

Isbell, Arthur Furman, Professor of Chemistry. (1953, 1961)
B.A., Baylor, 1937; M.S., Texas, 1941; Ph.D., 1943.

Jaggi, Frederick Putnam, Jr., Professor of Veterinary Public Health and Head of Department. (1937, 1957)
B.S., Texas A&M, 1924; D.V.M., 1926.

*Jimenez, Rudolf August, Associate Professor of Civil Engineering. (1959, 1962)
B.S., Arizona, 1948; M.S., 1951; Ph.D., Texas A&M, 1962; Reg. Prof. Engr.

*Associate Member

Joham, Howard Ernest, Professor of Plant Physiology and Pathology. (1946, 1959)
B.A., Santa Barbara College, 1941; M.S., Texas A&M, 1943; Ph.D., Iowa State College, 1950.

*Jones, Jerry Lynn, Assistant Professor of Chemistry. (1962)
B.A., Oklahoma State, 1957; M.S., 1960; Ph.D., Arkansas, 1963.

*Jungerman, Paul Frank, Professor of Veterinary Microbiology. (1956, 1963)
D.V.M., Texas A&M, 1947; M.S., 1959.

Keese, Charles Joseph, Executive Officer of the Texas Transportation Institute and Professor of Civil Engineering. (1948, 1962)
B.S., Texas A&M, 1941; M.S., 1952.

*Kemler, Arden Grant, Associate Professor of Veterinary Anatomy. (1959)
D.V.M., Kansas State College, 1950; M.S., Georgia, 1959.

Kennedy, Harvey Thomas, Distinguished Professor of Petroleum Engineering. (1949)
B.S., Cornell, 1921; Ph.D., Johns Hopkins, 1928; Reg. Prof. Engr.

*Kent, Jack Thurston, Associate Professor of Mathematics. (1936, 1952)
A.B., Lambuth College, 1930; M.A., Arkansas, 1931.

Keown, Ernest Ray, Professor of Mathematics. (1952, 1960)
B.S., Texas, 1946; Ph.D., Massachusetts Institute of Technology, 1950.
(On leave of absence from September 1, 1963 to August 31, 1964)

*Kincannon, John Alvin, Associate Professor of Agricultural Economics. (1946, 1960)
B.S., Texas A&M, 1939; M.S., 1949; Ph.D., 1952.

*King, General Tye, Associate Professor of Animal Husbandry. (1953, 1960)
B.S., Kentucky, 1950; M.S., 1951; Ph.D., Texas A&M, 1958.

Kinman, Murray Luther, Agronomist of the Department of Soil and Crop Sciences. (1950)
B.S., Kansas State College, 1942; M.S., Iowa State College, 1944; Ph.D., 1950.

Klipple, Edmund Chester, Professor of Mathematics and Head of Department. (1935, 1952)
B.A., Texas, 1926; Ph.D., 1932.

Knebel, Earl H., Professor of Agricultural Education and Head of Department. (1955, 1961)
B.S., Montana State College, 1946; M.Ed., Texas A&M, 1951; D.Ed., Oklahome Agricultural and Mechanical College, 1955.

Koenig, Karl Joseph, Associate Professor of Geology. (1955, 1957)
B.S., Illinois, 1941; M.S., 1946; Ph.D., 1949.

*Kohel, Russel James, Geneticist. (1959)
B.S., Iowa State College, 1956; M.S., Purdue, 1958; Ph.D., 1959.

*Konecny, Frank Jack, Executive Assistant, Engineering Extension Service. (1955)
B.S., Texas A&M, 1927; M.Ed., 1940.

Kornicker, Louis Sampson, Professor of Oceanography. (1961, 1963)
B.S., Alabama, 1941; B.S., 1942; M.A., Columbia, 1954; Ph.D., 1957.

*Kozik, Thomas Joseph, Associate Professor of Mechanical Engineering. (1963)
B.S., Rensselaer Polytechnic Institute, 1952; M.S., Ohio State, 1957; Ph.D., 1962.

Krise, George Martin, Professor of Biology. (1959, 1963)
B.A., Texas, 1946; M.A., 1948; Ph.D., 1952.

*Associate Member

*Kroitor, Harry Peter, Associate Professor of English. (1958, 1963)
B.A., Saskatchewan, 1946; B.A., 1949; M.A., 1950; Ph.D., Maryland, 1957.

Krueger, Willie F., Professor of Poultry Science. (1953, 1959)
B.S., Texas A&M, 1943; M.S., 1949; Ph.D., Missouri, 1952.

Kunkel, Harriott Orren, Associate Director of the Agricultural Experiment Station, and Professor of Animal Husbandry and of Biochemistry and Nutrition. (1951, 1962)
B.S., Texas A&M, 1943; M.S., 1948; Ph.D., Cornell, 1950.

Kunze, George William, Professor of Agronomy. (1952, 1960)
B.S., Texas A&M, 1948; M.S., 1950; Ph.D., Pennsylvania State College, 1952.

*Kunze, Otto Robert, Associate Professor of Agricultural Engineering. (1956)
B.S., Texas A&M, 1950; M.S., Iowa State College, 1951.
(On leave of absence from September 1, 1963 to August 31, 1964)

LaMotte, Charles, Professor of Biology. (1930, 1939)
B.A., Texas, 1929; M.A., 1929; Ph.D., Illinois, 1937.

*Landiss, Carl Wilson, Professor of Health and Physical Education. (1943, 1954)
B.S., Abilene Christian College, 1935; M.Ed., Texas A&M, 1947; D.Ed., Pennsylvania State College, 1951.

Landmann, Wendell A., Professor of Animal Husbandry. (1964)
B.S., Illinois, 1941; M.S., Purdue, 1943; Ph.D., 1951.

*Lang, Herbert Howard, Associate Professor of History. (1956, 1959)
B.A., Texas, 1949; M.A., 1950; Ph.D., 1954.

Langston, Ruble George, Professor of Plant Sciences. (1961)
B.S., Oklahoma, 1947; M.S., 1951; Ph.D., Purdue, 1954.

*Larsen, John E., Horticulturist. (1962)
B.S., Purdue, 1942; M.S., 1946; Ph.D., 1957.

Laverty, Carroll Dee, Professor of English. (1939, 1955)
A.B., Colorado, 1933; A.M., 1934; Ph.D., Duke, 1951.

Leighton, Rudolph Elmo, Professor of Dairy Science. (1947, 1956)
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Leinweber, Charles Lee, Professor of Range and Forestry and Head of Department. (1960)
B.S., Texas A&M, 1952; M.S., 1953; Ph.D., 1956.

Leipper, Dale F., Professor of Oceanography and Meteorology. (1949)
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Lindsay, James Donald, Professor of Chemical Engineering. (1938, 1944)
B.S., Michigan, 1924; M.S., 1925; Ph.D., 1934; Reg. Prof. Engr.

*Lindsey, Charles Alfred, Assistant Professor of Education and Psychology. (1963)
B.S., Centenary College, 1929; M.A., North Texas State, 1949; Ed.D., Colorado State College, 1953.

*Associate Member

Linger, Irving Oscar, Professor of Economics. (1961, 1963)
A.B., Ohio, 1939; M.A., Ohio State, 1942; Ph.D., Texas, 1958.

Little, Van Allen, Professor of Entomology. (1923, 1937)
B.A., Sam Houston State Teachers College, 1922; M.S., Texas A&M, 1925; Ph.D., 1943.

*Livingston, Charles Wesley, Jr., Assistant Professor of Veterinary Microbiology. (1963)
B.S., Sul Ross State College, 1946; D.V.M., Texas A&M, 1955; M.S., 1961.

Lowy, Stanley Howard, Associate Professor of Aerospace Engineering. (1964)
B.S., Purdue, 1943; M.S., Minnesota, 1947.

Luther, Herbert Adesla, Professor of Mathematics. (1937, 1947)
B.A., Pittsburgh, 1934; M.S., Iowa, 1935; Ph.D., 1937.

Lyerly, Paul J., Research Coordinator, Substation No. 17, Texas Agricultural Experiment Station, Ysleta. (1942, 1958)
B.S., North Carolina State College, 1938; M.S., Iowa State College, 1940; Ph.D., 1942.

Lyman, Carl Morris, Professor of Biochemistry and Nutrition and Head of Department. (1940, 1949)
B.S., Oregon, 1931; A.M., Oregon State College, 1933; Ph.D., Pittsburgh, 1937.

*McAfee, Thomas Edison, Professor of Agronomy. (1939, 1957)
B.S., Oklahoma Agricultural and Mechanical College, 1939; M.S., 1940; Ph.D., Texas A&M, 1953.

*McCasland, William Richard, Associate Professor of Civil Engineering. (1956, 1962)
B.S., Texas A&M, 1955; M.S., 1957.

*McCulley, William Straight, Associate Professor of Mathematics. (1937, 1957)
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*McCully, Wayne Gunther, Associate Professor of Range and Forestry. (1948, 1960)
B.S., Colorado State, 1947; M.S., Texas A&M, 1950; Ph.D., 1958.

*McGuire, Delbert, Professor of Journalism and Head of Department. (1961)
B.J., Texas, 1947; M.Jour., 1948.

McGuire, John Gilbert, Assistant Dean of Engineering. (1935, 1963)
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McIntyre, John Armin, Professor of Physics. (1963)
B.S., Washington, 1943; M.A., Princeton, 1948; Ph.D., 1950.

*McLain, Donald Davis, Jr., Assistant Professor of Biology. (1962)
B.S., Illinois, 1952; M.S., 1956; Ph.D., 1960.

McNeely, John Gordon, Professor of Agricultural Economics. (1947, 1950)
B.S., South Dakota State College, 1933; M.S., 1934; Ph.D., Wisconsin, 1941.

Mackin, John Gilman, Professor of Biology and Head of Department. (1950, 1960)
B.S., East Central State College, Ada, Oklahoma, 1924; M.S., Illinois, 1927; Ph.D., 1933.

Magee, Aden Combs, Professor of Agricultural Economics. (1955, 1956)
B.S., Kansas State College, 1924; M.S., Texas A&M, 1926.

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*Manning, Walter Scott, Associate Professor of Business Administration. (1941, 1947)
B.B.A., Texas College of Arts and Industries, 1932; M.B.A., Texas, 1940; C.P.A., 1952.

*Martin, Lee Jackson, Professor of English. (1946, 1963)
B.S., Texas, 1941; M.A., 1948; Ph.D., Stanford, 1956.

*Maxwell, Norman Paul, Associate Horticulturist. (1946, 1955)
B.S., Delaware, 1943; M.S., Texas A&M, 1949.

Medlen, Ammon Brown, Associate Professor of Biology. (1946, 1955)
B.A., Baylor, 1930; M.A., 1932; Ph.D., Texas A&M, 1952.

Meinke, Wilmon William, Associate Professor of Chemical Engineering. (1936, 1961)
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B.S., Maharaja's College, 1949; M.S., R.R. & Agra Colleges, 1955; Ph.D., Arkansas, 1963.

*Merrill, John Calhoun, Jr., Associate Professor of Journalism. (1962)
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Meyers, Edward Arthur, Associate Professor of Chemistry. (1956, 1961)
B.S., Michigan, 1950; Ph.D., Minnesota, 1955.

*Miller, Charles Standish, Assistant Professor of Plant Physiology and Pathology. (1958)
B.S., Texas A&M, 1951; M.S., 1956; Ph.D., 1959.

*Miller, Thomas Lloyd, Associate Professor of History. (1946, 1957)
B.A., East Texas State Teachers College, 1935; M.A., 1945; Ph.D., Texas, 1956.

Milliff, John Henry, Professor of Veterinary Anatomy and Head of Department. (1936, 1941)
B.S., Texas A&M, 1931; M.S., 1934; D.V.M., 1936; Ph.D., Texas, 1958.

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B.S., Texas A&M, 1943; M.S., 1953.

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B.A., Austin College, 1952; M.A., 1954; Ph.D., Rice, 1961.

Moore, Albert Vernon, Professor of Dairy Science. (1937, 1944)
B.S., Purdue, 1927; M.S., 1933; Ph.D., Michigan State College, 1948.

Moore, Bill C., Associate Professor of Mathematics. (1937, 1948)
A.B., Kansas, 1929; A.M., 1931; A.M., Princeton, 1937.

Moore, Donald Sylvester, Associate Professor of Agricultural Economics and Sociology. (1956, 1962)
B.S., Oklahoma Agricultural and Mechanical College, 1938; M.S., 1940; Ph.D., Minnesota, 1956.

Moore, Richard Wayne, Associate Professor of Veterinary Microbiology. (1958, 1961)
D.V.M., Texas A&M, 1955; M.S., 1956.

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A.B., Emory, 1919; M.S., 1922; M.R.E., Southwestern Baptist Theological Seminary, 1927; M.S., Texas A&M, 1944; Reg. Prof. Engr.

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Olson, Edward O., Pathologist of Department of Soil and Crop Sciences, USDA, Substation No. 15. (1949)
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Rakoff, Henry, Associate Professor of Chemistry. (1953, 1957)
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B.S., California, 1955; M.S., 1956.

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B.S., Texas A&M, 1934; M.S., 1938.

Ray, Sammy Mehedy, Associate Professor of Oceanography. (1959, 1963)
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Read, Clark P., Professor of Biology and Head of Department, Rice University. (1964)
B.A., Rice, 1948; M.S., 1948; Ph.D., 1950.

Reid, Robert Osborne, Professor of Oceanography and Meteorology. (1951, 1959)
B.E., Southern California, 1946; M.S., Scripps Institute of Oceanography, 1948.

Reiser, Raymond, Professor of Biochemistry and Nutrition. (1949, 1954)
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Richardson, Luther Ray, Professor of Biochemistry and Nutrition. (1946, 1949)
B.S., Georgetown College, 1923; A.M., Missouri, 1928; Ph.D., 1932.

Richmond, Thomas Rollin, Agronomist of Department of Soil and Crop Sciences (Agricultural Research Service, USDA, cooperating). (1931, 1954)
B.S., Texas A&M, 1931; M.S., 1938; Ph.D., Minnesota, 1948.

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*Rivers, George W., Agronomist, Department of Soil and Crop Sciences. (Agricultural Research Service. USDA, cooperating). (1956)
B.S., Texas A&M, 1947; M.S., 1948; Ph.D., 1957.

Rode, Norman Frederick, Professor Emeritus of Electrical Engineering. (1922, 1962)
B.S., Clemson College, 1919; M.S., Texas A&M, 1929; E.E., Clemson College, 1939; Reg. Prof. Engr.

*Rodenberger, Charles Alvard, Associate Professor of Aerospace Engineering. (1960)
B.S., Oklahoma State, 1948; M.S., Southern Methodist, 1959; Reg. Prof. Engr.

Romieniec, Edward John, Professor of Architecture and Chairman of the School of Architecture. (1956, 1963)
B.S., Illinois, 1947; M.S., 1948; M.Arch., Harvard, 1950.

*Roots, Edmund Nelson, Jr., Assistant Professor of Electrical Engineering. (1957, 1959)
B.S., Texas A&M, 1951; M.S., 1956.

Rosberg, David William, Professor of Plant Physiology and Pathology and Head of Department of Plant Sciences. (1950, 1960) *
B.A., St. Olaf College, 1940; M.S., Ohio State, 1946; Ph.D., 1949.

*Rose, Norman Carl, Associate Professor of Chemistry. (1956, 1961)
B.S., California, 1950; Ph.D., Kansas, 1957.

*Ross, Henry, Professor of Agricultural Education. (1935)
B.S., Texas A&M, 1923; M.S., 1935.

*Rotsch, Melvin Medford, Professor of Architecture. (1950, 1955)
B.S., Texas, 1928; M.Arch., Harvard, 1930.

Runkles, Jack Ralph, Professor of Soil and Crop Sciences. (1964)
B.S., Texas A&M, 1950; M.S., 1952; Ph.D., Iowa State, 1956.

Rupel, Isaac Walker, Professor of Dairy Science and Head of Department. (1945)
B.S., Illinois, 1923; M.S., Wisconsin, 1924; Ph.D., 1932.

Russell, Daniel, Professor of Sociology. (1926)
A.B., Baylor, 1922; A.M., Chicago, 1928; LL.D., Howard Payne College, 1962.

*Russell, Leon Horace, Jr., Assistant Professor of Veterinary Public Health. (1959)
B.S., Missouri, 1956; D.V.M., 1956; M.P.H., Tulane, 1958.

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B.S., Texas College of Arts and Industries, 1938; M.S., Texas A&M, 1947; Ph.D., 1962.

Samson, Charles Harold, Jr., Professor of Aerospace Engineering, Civil Engineering, and of Structural Mechanics. (1960)
B.S., Notre Dame, 1947; M.S., 1948; Ph.D., Missouri, 1953; Reg. Prof. Engr.

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B.S., Illinois, 1949; M.S., 1950; Ph.D., Cornell, 1957.

*Schiller, Robert Edwin, Jr., Associate Professor of Civil Engineering. (1946, 1955)
B.S., Texas A&M, 1940; M.S., 1949; Reg. Prof. Engr.

Schlesselman, George Wilhelm, Associate Dean of the College of Arts and Sciences; Professor of Geography and Head of Department. (1934, 1959)
B.A., Iowa State Teachers College, 1927; M.A., Clark, 1928; Ph.D., Nebraska, 1935.

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*Schroeder, Harry William, Plant Pathologist of Department of Plant Sciences, AMS, USDA. (1957)
B.S., Minnesota, 1951; M.S., 1955; Ph.D., 1955.

Schroeder, Melvin Carroll, Professor of Geology. (1954, 1963)
B.S., State College of Washington, 1942; M.S., 1947; Ph.D., 1953.

Scrivner, Frank H., Research Engineer, Texas Transportation Institute. (1964)
B.S., United States Naval Academy, 1931.

*Seward, Clay Luzenburg, Jr., Associate Professor of Geology. (1948, 1952)
B.S., Texas A&M, 1941; M.S., 1950; Geol.E., 1953.

Shelton, James Maurice, Associate Professor of Animal Husbandry. (1950, 1963)
B.S., Tennessee, 1946; M.S., Texas A&M, 1952; Ph.D., 1957.

Sicilio, Fred, Associate Professor of Chemistry. (1961)
B.S., Centenary College, 1951; M.A., Vanderbilt, 1953; Ph.D., 1956.

Simmang, Clifford Max, Professor of Mechanical Engineering and Head of Department. (1938, 1957)
B.S., Texas A&M, 1936; M.S., 1938; Ph.D., Texas, 1952; Reg. Prof. Engr.

*Sims, Stillman Austin, Associate Professor of Mathematics. (1942, 1959)
B.S., Southwest Texas State Teachers College, 1939; M.S., Texas A&M, 1944.

*Sittler, Orvid Dayle, Assistant Professor of Physics. (1961)
B.S., Nebraska, 1948; M.A., 1950; Ph.D., Pennsylvania State, 1961.

Skrabanek, Robert Leonard, Professor of Sociology. (1949, 1957)
B.S., Texas A&M, 1942; M.S., 1947; Ph.D., Louisiana State, 1949.

Smerdon, Ernest Thomas, Professor of Agricultural Engineering. (1959, 1962)
B.S., Missouri, 1951; M.S., 1956; Ph.D., 1959.

*Smith, Fred Emmett, Professor of Geology and of Geography. (1948, 1956)
B.S., Louisiana State, 1930; M.S., 1932.

*Smith, James Clifton, Superintendent of Substation No. 3, Angleton. (1951)
B.S., Texas A&M, 1939; M.S., 1947.

Smith, James Douglas, Assistant Professor of Genetics. (1959)
B.S., Iowa State College, 1950; M.S., 1956; Ph.D., 1960.

Smith, Robert Lee, Jr., Associate Professor of Industrial Engineering. (1956, 1959)
B.S., Texas A&M, 1952.

Sorensen, Anton Marinus, Jr., Associate Professor of Animal Husbandry. (1955, 1957)
B.S., Texas A&M, 1949; M.S., Cornell, 1951; Ph.D., 1953.

Sorensen, Harold Benjamin, Associate Professor of Agricultural Economics and Sociology. (1951, 1956)
B.S., South Dakota State College, 1940; M.S., Oklahoma Agricultural and Mechanical College, 1948; Ph.D., Texas A&M, 1955.

Sorenson, Jerome Wallace, Professor of Agricultural Engineering. (1946, 1956)
B.S., Texas A&M, 1935; M.S., 1948.

Sorrels, Joseph Harrell, Professor of Civil Engineering. (1941, 1948)
A.B., Texas Christian, 1924; M.S., Vanderbilt, 1925; B.S., Texas A&M, 1946; Reg. Prof. Engr.

Sperry, John Jerome, Professor of Biology. (1941, 1951)
B.A., Nebraska, 1936; M.A., Missouri, 1938; Ph.D., Nebraska, 1942.

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Sperry, Omer Edison, Professor of Range and Forestry. (1946, 1949)
A.B., Peru, Nebraska State College, 1925; M.A., Nebraska, 1931; Ph.D., 1934.

Squire, Charles F., Associate Dean of the College of Arts and Sciences and Professor of Physics. (1962)
Ph.D., Johns Hopkins, 1937.

*Staten, Raymond Dale, Associate Professor of Agronomy. (1956, 1960)
B.S., Oklahoma Agricultural and Mechanical College, 1947; M.S., Nebraska, 1949; Ph.D., 1951.

Stelly, Randall, Associate Professor of Agricultural Economics and Sociology. (1956, 1960)
B.S., Southwestern Louisiana Institute, 1940; M.S., Texas A&M, 1947; Ph.D., Louisiana State. 1956.
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Stevenson, Robert M., Professor of Business Administration. (1947)
B.A., Duke, 1937; M.A., Pennsylvania State College, 1946; C.P.A., 1948; D.B.A., Indiana, 1955; C.L.U., 1955.

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B.A., Texas, 1943; M.A., 1948; Ph.D., 1951.

*Stokes, William Woods, Assistant Professor of Education and Psychology. (1963)
B.A., Florida, 1954; M.Ed., 1961; Ed.D., 1963.

Storey, James Benton, Associate Professor of Horticulture. (1957, 1961)
B.S., Texas A&M, 1949; M.S., 1953; Ph.D., California, 1957.

Street, William Ezra, Professor of Engineering Graphics and Head of Department. (1941)
B.S., Texas Technological College, 1930; M.A., 1933; LL.D., Harding College, 1947; Reg. Prof. Engr.

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B.Arch., Texas A&M, 1951; M.S., Iowa State, 1959.

Taber, Willard Allen, Associate Professor of Biology. (1963)
B.A., Iowa State, 1949; M.S., 1951; Ph.D., Rutgers, 1954.

*Taylor, Lloyd Chamberlain, Jr., Associate Professor of History. (1956, 1962)
B.A., Lehigh, 1949; M.A., 1951; Ph.D., 1956.

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B.S., Texas A&M, 1950; M.S., Iowa State, 1951; Ph.D., Wisconsin, 1964.

Tefertiller, Kenneth Ray, Associate Professor of Agricultural Economics. (1959, 1963)
B.S., Oklahoma State, 1952; M.S., 1957; Ph.D., Illinois, 1959.

Thames, Walter Hendrix, Jr., Associate Professor of Plant Physiology and Pathology. (1959)
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Thompson, Aylmer Henry, Associate Professor of Oceanography and Meteorology. (1960)
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B.S., Miami, 1947; M.B.A., 1949.

Thompson, John George Hatch, Professor of Mechanical Engineering. (1938, 1954)
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*Tishler, Carl Edward, Professor of Health and Physical Education and Head of Department. (1941, 1947)
B.S., Ohio State, 1926; M.A., Western Reserve, 1935.

*Tittle, Morris Edward, Associate Professor of Mathematics. (1943, 1959)
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Traxler, Ralph N., Professor of Chemistry and of Civil Engineering. (1959)
A.B., Colorado, 1920; M.A., 1922; Ph.D., Wisconsin, 1926.

Truettner, Willard Irving, Professor of Mechanical Engineering. (1930, 1943)
B.S., Michigan, 1928; M.S.E., 1930; Reg. Prof. Engr.

Turk, Richard Duncan, Professor of Veterinary Parasitology and Head of Department. (1944)
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B.S., Landbowhogeschool (Netherlands), 1952; M.S., California, 1953; Ph.D., Texas A&M, 1955.

Vanderzant, Carl, Professor of Dairy Science. (1953, 1962)
B.S., Wageningen, 1947; M.S., 1949; M.S., Iowa State College, 1950; Ph.D., 1953.

Vanderzant, Erma Schumacher, Biochemist of Department of Biochemistry and Nutrition. (1954)
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Varvel, Walter A., Professor of Psychology. (1941, 1945)
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Whealy, Roger Dale, Professor of Chemistry. (1958)
B.S., Eastern Normal, South Dakota, 1930; M.S., Colorado, 1937; M.S., Oregon, 1948; Ph.D., Colorado, 1953.

White, Robert Frederick, Professor of Architecture. (1947, 1954)
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Young, Paul A., Plant Pathologist of Texas Agricultural Experiment Station, Jacksonville. (1935)
B.S., Wabash College, 1921; M.A., Illinois, 1923; Ph.D., 1925.

Zingaro, Ralph Anthony, Associate Professor of Chemistry. (1954, 1959)
B.S., City College of New York, 1946; M.S., Kansas, 1949; Ph.D., 1950.
(On leave of absence from September 1, 1963 to August 31, 1964)

Zwolinski, Bruno John, Professor of Chemistry. (1961)
B.S., Canisius, 1941; M.S., Purdue, 1943; M.A., Princeton, 1944; Ph.D., 1947.

*Associate Member

THE GRADUATE COLLEGE

The principal objective of the Graduate College is to offer education beyond the baccalaureate level to those who aspire to become intellectual leaders in the professions and in various fields of teaching and research. It undertakes to assist graduate students in developing and pursuing individual educational programs requiring superior accomplishment through carefully directed intellectual activity.

GENERAL INFORMATION

The Graduate Faculty. The faculty of the Graduate College consists of the President, the Deans, the Directors, and selected members of the staff who are actively engaged in recognized scholarly activities, fundamental research, or professional activity.

The Dean of Graduate Studies is responsible for the academic program of all graduate students. He is the representative of the Graduate Faculty and is the medium of communication between the graduate students and the University administration.

The Graduate Council is a standing committee of the Academic Council. It is an advisory body to the Dean of Graduate Studies, who is the chief administrative officer of the Graduate Faculty. There is a Committee on Graduate Instruction in each of the several colleges. These committees are responsible for making recommendations for graduate work in the college concerned, for making recommendations regarding general policies, for reviewing thesis and dissertation proposals, and for other matters pertaining to graduate work in their colleges.

Degrees Offered. Advanced instruction is offered leading to the following degrees:

Master of Agriculture (M.Agr.)
Master of Architecture (M.Arch.)
Master of Arts (M.A.)
Master of Business Administration (M.B.A.)
Master of Computing Sciences (M.C.S.)
Master of Education (M.Ed.)
Master of Engineering (M.Eng.)
Master of Science (M.S.)
Doctor of Education (D.Ed.)
Doctor of Philosophy (Ph.D.)

The following professional degrees in engineering are offered to graduates of this university:

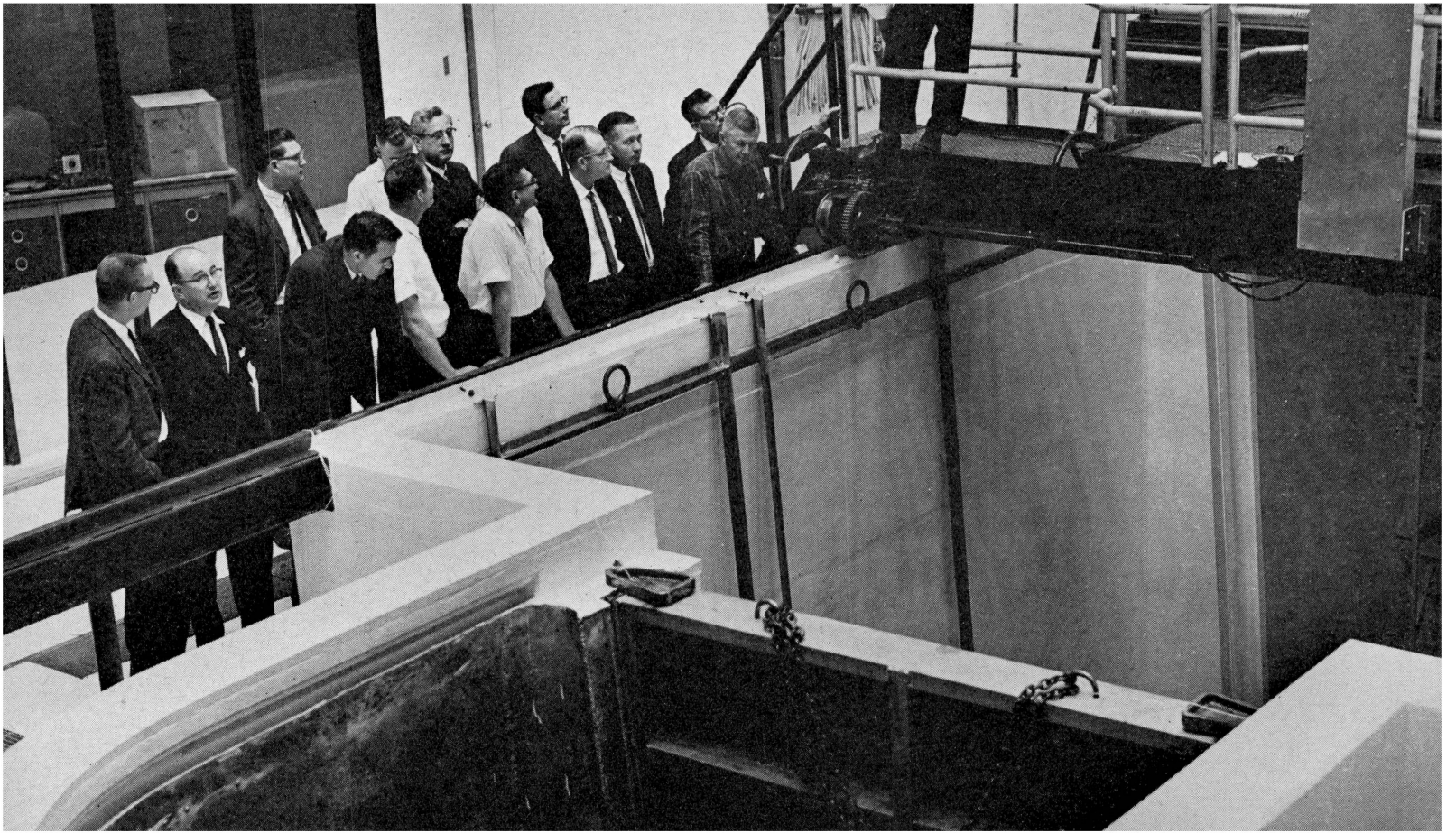
Aerospace Engineer (Aero.E.)
Agricultural Engineer (A.E.)
Architectural Engineer (Arch.E.)
Chemical Engineer (Ch.E.)
Civil Engineer (C.E.)
Electrical Engineer (E.E.)
Geological Engineer (Geol.E.)
Industrial Engineer (Ind.E.)
Mechanical Engineer (M.E.)
Nuclear Engineer (N.E.)
Petroleum Engineer (P.E.)

GRADUATE DEGREES CURRENTLY OFFERED

The following graduate degrees are currently offered:

College of Agriculture

Master of Agriculture
Master of Education, with a major in
Agricultural Education



Master of Science, with majors in

Agricultural Economics
Agricultural Education
Agricultural Engineering
Agronomy
Animal Breeding
Animal Husbandry
Animal Nutrition
Animal Parasitology
Biochemistry and Nutrition
Dairy Science
Entomology
Floriculture
Food Technology
Genetics
Horticulture
Oil Seed Technology
Physiology of Reproduction
Plant Breeding
Plant Pathology
Plant Physiology
Plant and Soil Science
Poultry Science
Range Management
Sociology
Soil Chemistry
Soil Physics
Wildlife Management

Doctor of Philosophy, with majors in

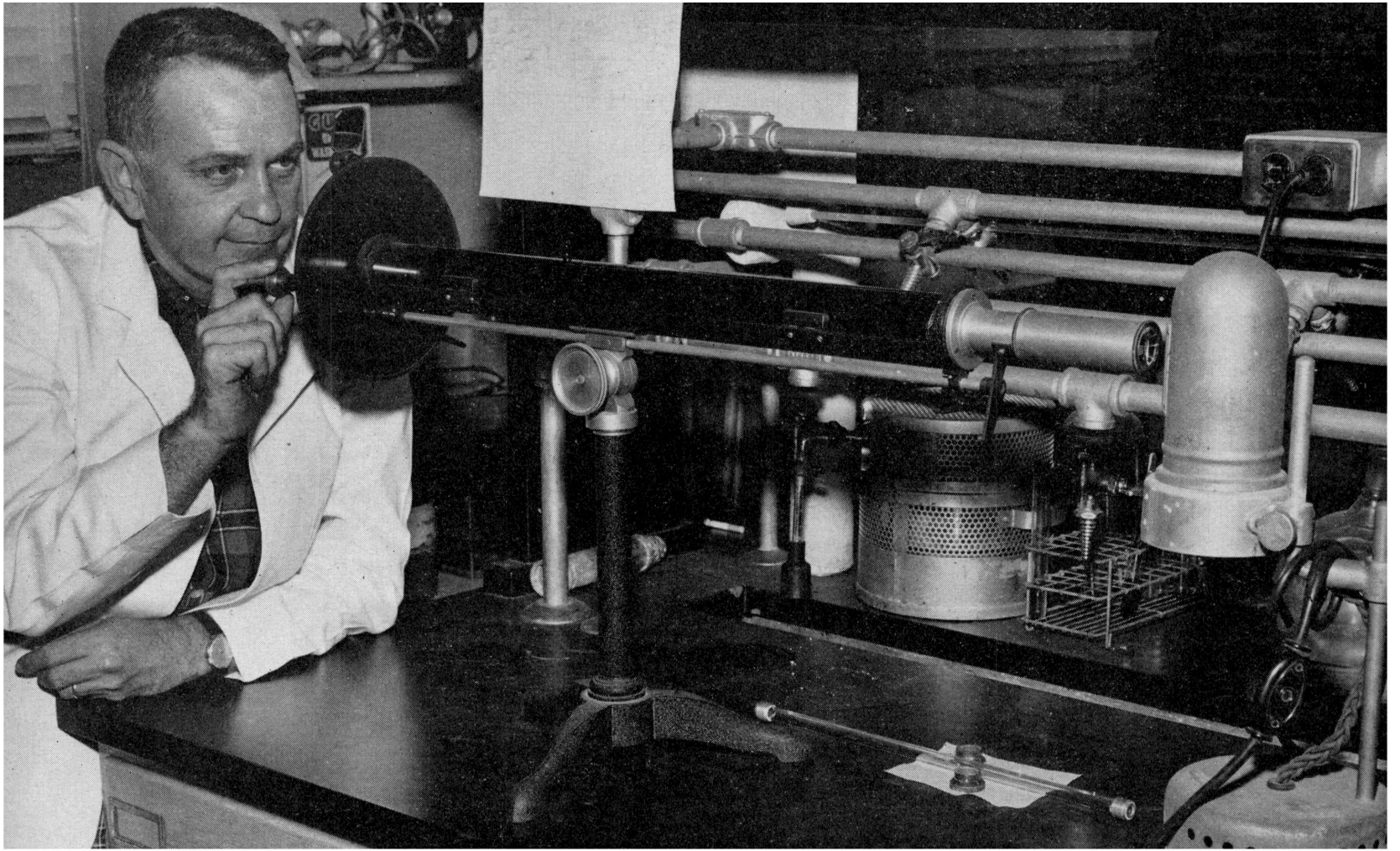
Agricultural Economics
Agricultural Engineering
Agronomy
Animal Breeding
Animal Husbandry
Animal Nutrition
Animal Parasitology
Biochemistry and Nutrition
Dairy Science
Entomology
Food Technology
Genetics
Horticulture
Oil Seed Technology
Physiology of Reproduction
Plant Breeding
Plant Pathology
Plant Physiology
Plant and Soil Science
Poultry Science
Range Management
Soil Chemistry
Soil Physics
Wildlife Management

College of Arts and Sciences

Master of Arts, with majors in

English
Government
History

Nuclear Science Center—Interior view of the primary tool of the center, the swimming pool type research reactor designed to operate at 5 megawatt capacity.



Master of Business Administration, with majors in
- Accounting
- Finance
- Management
- Marketing

Master of Education

Master of Science, with majors in
- Biology
- Botany
- Chemistry
- Economics
- Education
- Mathematics
- Meteorology
- Microbiology
- Oceanography
- Physics
- Zoology

Doctor of Philosophy, with majors in
- Biology
- Botany
- Chemistry
- Mathematics
- Meteorology
- Microbiology
- Oceanography
- Physics
- Zoology

College of Engineering

Master of Architecture

Master of Computing Sciences

Master of Education, with a major in
- Industrial Education

Master of Engineering, with majors in
- Aerospace Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Geological Engineering
- Industrial Engineering
- Mechanical Engineering
- Nuclear Engineering
- Petroleum Engineering

Master of Science, with majors in
- Aerospace Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Computer Science
- Electrical Engineering
- Geological Engineering
- Geology
- General Engineering
- Geophysics
- Industrial Education

A graduate student in chemistry measuring optical rotation of a compound with a polarimeter.

Industrial Engineering
Landscape Architecture
Mechanical Engineering
Nuclear Engineering
Petroleum Engineering

Doctor of Education, with a major in
Industrial Education

Doctor of Philosophy, with majors in
Agricultural Engineering
Chemical Engineering
Civil Engineering
Electrical Engineering
General Engineering
Geological Engineering
Geology
Geophysics
Mechanical Engineering
Nuclear Engineering
Petroleum Engineering

College of Veterinary Medicine

Master of Science, with majors in
Laboratory Animal Medicine
Veterinary Anatomy
Veterinary Medicine and Surgery
Veterinary Microbiology
Veterinary Parasitology
Veterinary Pathology
Veterinary Physiology
Veterinary Public Health

Doctor of Philosophy, with majors in
Veterinary Medicine and Surgery
Veterinary Microbiology
Veterinary Pathology
Veterinary Public Health

Graduate Institute of Statistics

Master of Science in Statistics

Doctor of Philosophy in Statistics

Graduate Courses. A graduate course is an advanced course requiring critical analysis and study. Such courses normally require frequent use of the library for reference to papers reporting original researches. Four types of graduate instruction are recognized: (1) lecture courses requiring organization by the instructor of material on an advanced level, (2) supervised laboratory courses, (3) seminars for the critical study of an organized field through reports presented by students or instructors, and (4) research by individual students under the direction of members of the Graduate Faculty.

Courses at the undergraduate level but approved for graduate credit may be used as specified later.

ADMISSION

To be admitted to the Graduate College (except under double registration) an applicant (1) must hold a baccalaureate degree from a college or university of recognized standing; (2) must show promise, as judged by his previous record of ability to satisfactorily pursue advanced study and research; (3) must have had adequate preparation to enter graduate study in the field chosen; and (4) must submit scores on the Aptitude Test and on an appropriate Advanced Test of the Graduate Record Examination.

The GRE is given at various centers, including Texas A&M University, throughout the United States on regularly established dates, usually in No-

vember, January, March, April, and July. To determine exact dates and the most convenient locations, prospective applicants should write to the Educational Testing Service, Princeton, New Jersey, or the Counseling and Testing Center, Texas A&M University.

Foreign students and other applicants who are otherwise qualified but who find it impossible to take the GRE on one of the regularly scheduled dates may be given provisional admission to the Graduate College on the condition that they take the GRE during their first semester.

Inquiries regarding admission to the Graduate College should be addressed to: The Director of Admissions, Texas A&M University, College Station, Texas. Inquiries about facilities for advanced studies, research, and requirements for graduate work in specific fields should be addressed to the department in which the principal work is offered.

A formal application is required of all persons seeking admission to the Graduate College. The application forms, which are available at the office of the Director of Admissions and Registrar, should be filed not later than four weeks prior to the opening of the semester. Admission to the Graduate College cannot be completed until all the credentials enumerated on the application form have been filed and evaluated.

In addition to the records sent to this office, the student should have in his possession a copy of his record for use in conference with members of the Graduate Faculty in planning his work.

Admission to the Graduate College may not be approved in instances where the facilities and staff available in the particular field are not adequate to take care of the needs of the student.

Scholastic Record. The normal requirement for admission to the Graduate College is a record during at least the last two years of academic training which gives evidence of ability to do successful graduate-level work.

A student whose academic record is not satisfactory for this purpose, whose scores on the GRE are not satisfactory, or who is changing fields of study may be required to take additional work to strengthen his background and preparation for graduate study in his field. Such work will be arranged in conference with the student's committee or the chairman of his major department.

Before accepting a student for graduate work, a department in which he expects to take work may require that he pass a comprehensive examination covering the basic undergraduate work in that field.

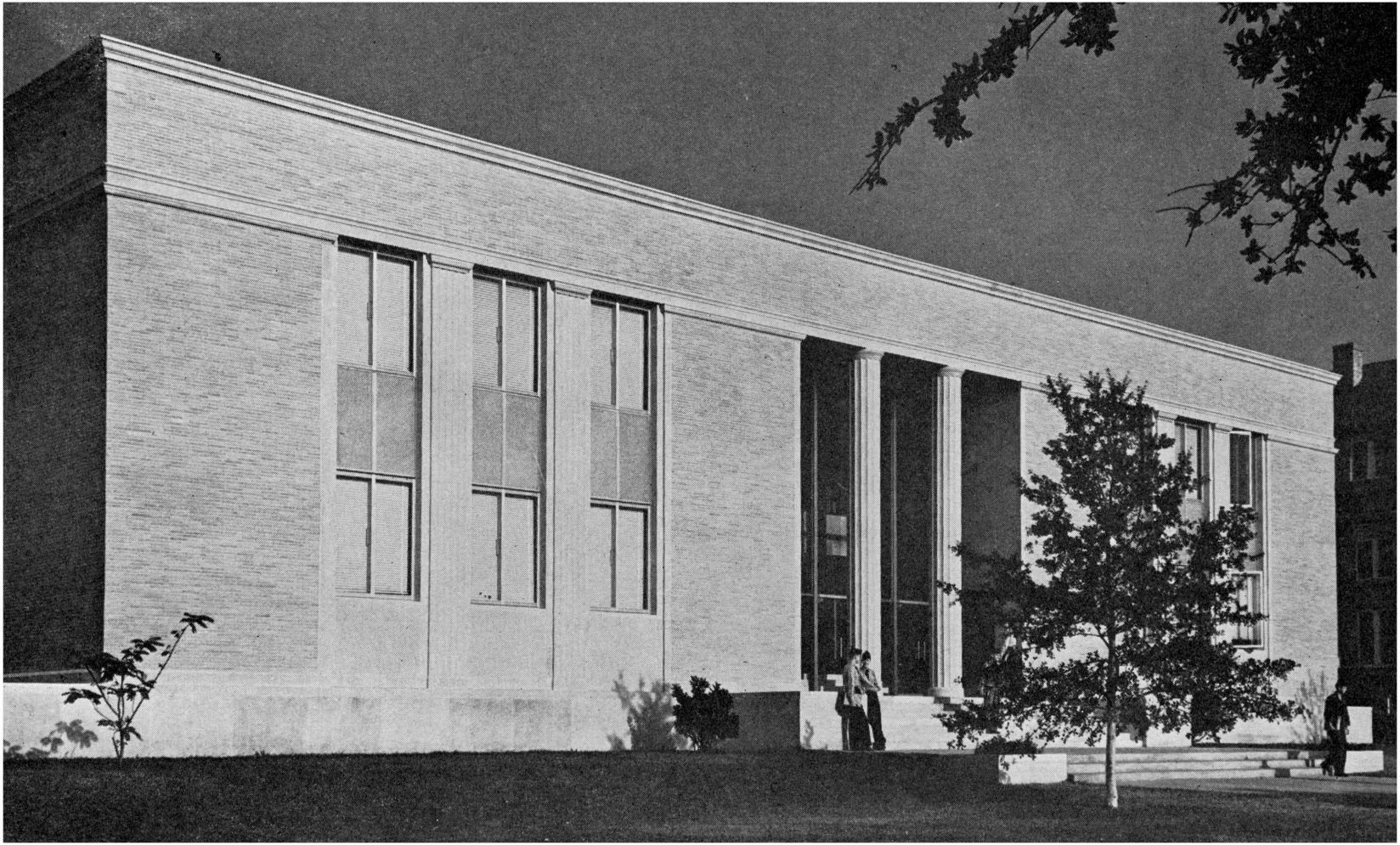
Each graduate student is responsible for familiarizing himself with the rules and regulations pertaining to graduate study and the requirements for advanced degrees.

REGISTRATION

Before his first registration the student should consult the graduate advisor representing the field of his major interest, who will assist him in planning his first registration.

The maximum load for full-time graduate students is 16 hours in a regular semester, or 6 hours in a summer term. Staff members, during full-time employment, are limited to a maximum enrollment of 4 hours of course work in a regular semester and 3 hours in a 12-week summer session. Graduate assistants on half-time employment may take up to 12 hours in a regular semester and up to 8 hours in a 12-week summer session.

Double Registration. Undergraduates at this University who at the beginning of a given semester are within 12 hours of graduation or at the beginning of a summer session are within 6 hours of graduation may be admitted to the Graduate College on a provisional basis. Such students must complete the undergraduate work and obtain the Bachelor's Degree during the first semester or summer session in the Graduate College before being eligible for full admission to the Graduate College. The maximum total credit hour



load for those double registered in the Graduate College for graduate credit is 16 hours in the regular semester or 6 hours in a summer term.

A superior undergraduate student is permitted to enroll otherwise in a graduate course for graduate credit only if he files a written petition approved by the Dean of Graduate Studies stating that he is reserving the graduate course for graduate credit and is not including it for credit on his undergraduate degree program.

Graduate Credit. Graduate credit will not be allowed for any course unless the student has been granted admission to the Graduate College and is registered therein when the course is taken.

Foreign Students. A foreign student is subject to the same requirements for admission and candidacy as students from colleges and universities in the United States. In addition, admission of foreign students requires the ability on the part of each student to speak, write, and understand the English language. Before undertaking regular study in the long session, students from other countries are required to participate in a special six-week program of English, counseling, and orientation offered during the summer of each year. The specific date for taking the special program will be announced each year by the Director of Admissions, and instructions for reporting to the University will be sent to all new foreign student applicants.

Graduate Advisors. A graduate student entering the University for the first time is required to consult with the advisor in his particular field of interest regarding courses and various programs of study. Departmental graduate advisors will be available for consultation several days prior to registration. Early in the first semester an advisor will assist each new graduate student in choosing a committee and working out a degree program for consideration by the student's full committee. This should be approved by the entire committee and submitted in advance of the second registration.

FEES

The fees of the graduate student may vary slightly from year to year. Fees for the session of 1964-65 are as follows:

			Summer Session	
	First Semester	Second Semester	First Term	Second Term
Tuition Fee for Texas residents	$ 50.00	$ 50.00	$ 25.00	$ 25.00
Tuition Fee for nonresidents	$200.00	$200.00	$100.00	$100.00
Student Services Fee	$ 18.00	$ 18.00	$ 9.00	$ 9.00
Student Activities Fee (Optional)	$ 23.80		$ ——	$ ——

In addition to expenses as outlined above, the 56th Legislature further requires the payment of laboratory fees which shall reflect the costs of materials and supplies used and which shall be not less than $2.00 nor more than $8.00 per laboratory course.

Each applicant for an advanced degree is required to pay a graduation fee of $3.00. A fee of $15.00 is required to cover the cost of binding three copies of the thesis. Each candidate for the doctorate is required to pay a dissertation abstract microfilming fee of $20.00. A copy of the Fiscal Department receipt for payment of these fees must be presented to the office of the Dean of Graduate Studies and recorded on the student's records.

Any student withdrawing officially (a) during the first week of class work in a semester or trimester will receive a refund of four-fifths of the tuition fee; (b) during the second week of class work, three-fifths; (c) during the third week of class work, two-fifths; (d) during the fourth week of class work, one-fifth; (e) after the fourth week of class work, nothing. No refunds will be made until ten days have elapsed from the time the fees were paid.

Richard Coke Building—University administrative offices, including the offices of the Dean of Graduate Studies and the Director of Admissions and Registrar, are located in this building.

The tuition fee for residents of Texas registering for less than 12 credit hours will be reduced by $4.00 for each credit hour less than 12, with a minimum tuition fee of $15.00. The tuition fee for nonresident students registering for less than 12 credit hours will be reduced by $16.00 for each credit hour less than 12. During a six-week summer term, students registering for 4 or more credit hours pay the tuition fee of $25.00 for Texas residents or $100.00 for nonresidents. Nonresident students registering for less than four credit hours for a six-week summer term pay a tuition fee of $25.00 per credit hour. Resident students registering for three hours will pay $21.00; for two hours, $17.00; and for one hour, $15.00. The absentia registration fee and the fee for "thesis only" is $15.00 for Texas residents and $17.50 for nonresidents.

UNIVERSITY HOUSING—DORMITORY AND APARTMENT

Although residence in the University dormitories is not required of graduate students, many of the unmarried men prefer to room in a dormitory, in sections set apart for their use. For married students a limited number of University-owned apartments, both furnished and unfurnished, are available. Rentals range from $40.00 to $65.00 per month, including all utilities. Application for a graduate apartment should be made directly to the Housing Office, Texas A&M University, College Station, Texas.

DEGREE PROGRAM

A graduate student's Degree Program includes all courses which are listed on his official form (except prerequisites or "other courses"). All courses on the approved Degree Program must be completed with a satisfactory grade to meet the requirements for the degree. Changes in an approved Degree Program can be made only by petition to the Dean of Graduate Studies approved by the student's full committee.

SCHOLARSHIP

A graduate student is expected to prove himself worthy of the privilege of advanced study. Graduate courses demand a substantially greater effort on the part of the student than do undergraduate courses.

A minimum grade point ratio of 2.00 (B average) is required on a graduate student's Degree Program. If this ratio is not maintained, the student may be denied further registration in the Graduate College. C is the lowest grade for which graduate credit will be given. All courses in Research (691) and Seminar (681) will receive grades of satisfactory (S) or Unsatisfactory (U), with only an S grade being acceptable toward the completion of a degree program.

Final examinations in all formal courses are required of all graduate students.

RESIDENCE REQUIREMENTS

The minimum time required to qualify for an advanced degree varies with the ability and preparation of the student. Students may find it necessary to extend their studies beyond the minimum requirements. Specific minimum residence requirements are indicated in connection with the respective degrees.

PETITIONS

Exceptions to published rules may be requested by proper petition to the Dean of Graduate Studies. If regarded as fully justifiable, on the basis of the facts presented, limited exceptions to some rules may be approved.

Any changes in membership of a student's committee, program of study, etc., must be proposed by petition to the Dean of Graduate Studies with endorsements by all members of the student's committee.

FIELDS OF SPECIALIZATION

An approved field of specialization, selected by the student, will constitute the major. The courses in the major field of specialization may be in one

department, or they may be chosen from two or more departments, provided that such courses contribute directly to the major field of specialization.

For administrative purposes the department of the chairman of the student's committee will be considered the administrative department.

The presently offered fields of specialization for both the Master of Science and Doctor of Philosophy degrees which involve courses in more than one department are animal breeding, animal nutrition, animal parasitology, food technology, physiology of reproduction, plant breeding, soil chemistry, soil physics, and the interdisciplinary program in engineering.

NUCLEAR SCIENCE AND NUCLEAR ENGINEERING

Graduates of any of the principal fields of engineering or of the basic sciences can arrange a program with either major or minor emphasis on the various fields of nuclear science or nuclear engineering. Programs for both the Master's and Doctor's degrees are available in nuclear engineering and in the nuclear sciences.

The University is a member of the Oak Ridge Institute of Nuclear Studies, through which the United States Atomic Energy Commission provides graduate fellowships in science and engineering.

The University maintains a Nuclear Science Center with a swimming-pool research reactor, designed for operation at power levels up to 5 megawatts; a Nuclear Measurements Laboratory; an AGN-201 Training Reactor; a Subcritical Laboratory; a high level Gamma Irradiation Facility; a Biological Radiation Laboratory; an Activation Analysis Laboratory, and other special facilities in nuclear technology for research and instruction in the physical and life sciences.

COMPUTER SCIENCE AND DATA PROCESSING

The University has established a Data Processing Center containing an IBM 709, IBM 650, and other digital and analog computing equipment. The IBM 709 consists of 19 units interconnected by cables to form an integrated data processing system that can read, write, and compute simultaneously. Peripheral equipment permits the preparation of magnetic tape from punch cards and the printing of magnetic tapes offline. A Master of Science degree in Computer Science is offered by the Industrial Engineering Department, and details of that degree may be found by referring to the course offerings of that department as shown in this catalogue. The Department also offers a program of studies leading to the Master of Computing Sciences degree, for which a thesis is not required.

INTERDISCIPLINARY PROGRAMS IN ENGINEERING

Texas A&M University offers Master of Science and Doctor of Philosophy degree programs in general engineering. The establishment of these general graduate programs will permit the scholarly investigation of new concepts in engineering which are either identified with no existing branch of engineering, or include several existing branches to limited extent, but with no one branch sufficiently emphasized for the concept to be clearly within its sphere of interest and competence. The programs are administered by an Interdisciplinary Program Administrative Committee appointed jointly by the Dean of Engineering and the Dean of Graduate Studies.

GRADUATE INSTITUTE OF STATISTICS

The Institute of Statistics was established in 1962, giving a student the opportunity to take either major or minor work at the Doctor of Philosophy or Master of Science level in statistics. Students interested in this field should write to the Director of the Graduate Institute of Statistics.

TYPES OF COURSES

Regular Courses are those offered in regular class schedules on the campus.

Extension Courses are for part-time students. They are offered by members of the University staff, off the campus, usually in evening or week-end classes. Registration in 685 Problems courses alone by a student not resident at the University shall be considered on the same basis as Extension Courses and shall come under the limitations applying to them.

Field Courses are full-time courses of a minimum duration of one calendar week per hour of credit offered by regular staff members at outlying units of the Texas A&M University System or at other points affording unusual laboratory or field work facilities.

Workshop Courses are courses in which the class plans the problems to be studied and carries out the work of the class through student leadership under the supervision and guidance of the instructor.

Departments offering off-campus or week-end courses are responsible to the Director of Admissions and Registrar for proper procedure and records of registration. Advance approval should be obtained from the Dean of the College concerned and from the Dean of Graduate Studies as to the course, fees, minimum enrollment, instructor, and location each time the course is offered. All students enrolling for graduate credit must have prior admission to the Graduate College.

THE DEGREE OF MASTER OF SCIENCE

Residence. The minimum residence requirement is two semesters of at least 12 credit hours of graduate work each, five six-week summer terms, or an equivalent approved by the Dean of Graduate Studies. This regulation does not apply in the case of specific programs of off-campus work which have been approved by the Academic Council. Full-time resident staff members of the University or any of its closely affiliated organizations whose headquarters are on the campus may satisfy residence requirements while employed. Specific authorization for such joint programs must be granted in advance by the employing agency.

Student's Committee. A student should consult with the departmental graduate advisor or department chairman in the field of his major interest for the selection of his graduate committee. A committee for the Master's degree will be composed of not less than three members of the Graduate Faculty. The chairman of the committee will direct the student's total graduate program.

Degree Program. The student's committee, in consultation with the student, will develop his Degree Program. This should be completed and filed with the Dean of Graduate Studies, whose approval is required, prior to the second registration.

This Degree Program must be submitted on the official form. Any prerequisite courses recommended should be included on the form. All courses listed on the form must be cleared to the satisfaction of the committee.

Thesis Proposal. The student, in consultation with members of his committee, should prepare a thesis proposal for approval by the Committee on Graduate Instruction of the College in which his major department is located. The proposal must be filed with the Dean of Graduate Studies at least 14 weeks prior to the close of the semester or summer session in which the student expects to receive his degree.

Credit Requirement. A minimum of two full semesters of approved courses and research is required for the Master of Science degree. Most of the work should be graduate courses. On recommendation of the student's committee, certain courses may be selected from those listed "For Graduates and Advanced Undergraduates." In no case may more than 12 hours of such courses be used in satisfying the requirements for any Master's degree.

Ordinarily the student will devote the major portion of his time to work in one field or two closely related fields. Other work will be in supporting fields of interest. In general, not less than one-third of the course work, exclusive of research, should be taken in one or more fields outside the major field.

Limitations on the Use of Certain Courses. If otherwise acceptable, certain courses may be used toward meeting residence and credit-hour requirements for the Master's degree under the following limitations:

1. Not more than 6 hours of extension credit, including any 685 Problems courses taken by a student not then in residence at the University.
2. Not more than 6 hours of resident week-end courses.
3. Not more than 6 hours of workshop courses.
4. Not more than 8 hours each of research, thesis, special problems or research methods, nor more than 12 hours of any combination of these.
5. Not more than 2 hours of seminar.
6. Not more than 15 hours of any combination of the above.
7. All work accepted in fulfillment of the Master's degree must have been completed within a period of six years before the degree is awarded. Permission to re-instate out-of-date courses by current written examination may be requested by proper petition to the Dean of Graduate Studies.

Transfer of Credit. Except for unusual cases, not more than 6 hours of transfer credit may be counted toward degree requirements, except that a student having earned 12 hours of graduate resident credit at Texas A&M University may, upon the advice of his committee and with the advance approval of the appropriate College Committee, be authorized to take a limited number of specified courses not available at this institution at another approved Graduate College.

Foreign Languages. There is no specific language requirement for the Master of Science degree. For other Master's degrees, departments may, at their discretion, require a reading knowledge of one or more foreign languages.

Limitations for Staff Members. Members of the resident staff of the Texas A&M University System above the rank of assistant professor, or its equivalent, will not be granted a Master's degree at this institution. They may, however, enroll for graduate work.

Thesis. An acceptable thesis is required for the degrees of Master of Arts, Master of Architecture, Master of Business Administration, and Master of Science. The thesis should embody original work on the part of the candidate. It must be grammatically correct, reflecting the ability of the candidate to express himself clearly. The general format should be consistent with that used in scholarly journals in the candidate's field. Specific instructions on form can be obtained from the office of the Dean of Graduate Studies.

The original and the first two copies of the thesis in its final form must be filed with the Dean of Graduate Studies, after approval by the student's committee, by dates announced each semester.

A thesis binding fee must be paid to the Fiscal Department and the receipt shown to the secretary of the Dean of Graduate Studies before the degree can be conferred. Instructions for typing may be obtained from the Graduate Dean's office.

Final Examination. The candidate is required to take a final examination after the thesis has been completed and filed in the office of the Graduate College and after all other requirements for the degree have been completed. Students must be registered in the University in the semester in which the examination is to be given. The examination covers the thesis and all work taken on the Degree Program. It may be written or oral, or both, at the option of the candidate's committee.

Final examinations are conducted by the candidate's committee as finally constituted. The examination is open.

THE DEGREE OF MASTER OF AGRICULTURE

The program of study leading to the degree of Master of Agriculture, for which a thesis is not required, is designed to serve those who desire addi-

tional training in agriculture and who have had one or more years of satisfactory experience in teaching, extension work, or similar fields.

Each candidate's program shall be without departmental designation and shall be approved by a committee composed of one representative from each field of study and such additional members as may be appointed by the Dean of Graduate Studies, totaling not less than five. This committee shall determine what undergraduate prerequisites, if any, will be required.

The minimum of 36 credit hours of approved courses required for this degree shall include the following:

Statistics 406, Statistical Methods, or

Business Administration 303, Statistical Method,
which shall be completed during the first half of the degree program. There shall be 8 to 12 credit hours in each of three fields of work, totaling not less than 28 credit hours. Not more than 12 credit hours in advanced undergraduate courses may be counted toward the requirements for this degree.

Each candidate will be required to prepare two written reports in addition to papers required as a part of regular course work. The reports are expected to be of the quality of the Master of Science thesis. One shall comprise a comprehensive review of the literature on a technical problem in the candidate's field of study, together with an appropriate statistical analysis of the research data. This will be supervised by the research project leader providing the data or by another person acceptable to the committee as a whole. The other report shall be a paper involving the integration and application of the candidate's course work to a community agricultural program.

These two reports, which may carry up to four hours of credit by registration in 685, Problems courses, shall be submitted to the candidate's committee for approval, and shall be available at the time of his final examination.

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

THE DEGREE OF MASTER OF ARCHITECTURE

The graduate program offered by the School of Architecture leads to the degree of Master of Architecture. The requirements for this degree are identical with those for the degree of Master of Science.

THE DEGREE OF MASTER OF ARTS

The degree of Master of Arts is designed for students majoring in English, Government, or History.

The Department of English has certain requirements for the Master's degree, in addition to the general requirements of the Graduate College:

1. Each candidate must complete a minimum of 30 credit hours; at least 15 must be in 600 courses; a maximum of 6 hours of graduate credit from another college or university will be accepted. Work toward the Master's thesis may receive up to 6 credits. The student who expects to teach should take English 461 or its equivalent.
2. In addition to the 30 hours, the candidate may be asked to make up back work, such as parts of the survey of English and American literature or a course in the English language.
3. The candidate may elect to present a minor of not more than 9 hours in a foreign language, economics, history, education, mathematics, or the sciences. These hours are to be taken in one department.
4. Each candidate must pass an oral examination on his thesis and on the courses that he has studied in his Master's program.
5. The candidate must provide evidence of his ability to read at least one foreign language, the test to be given by the Department of Modern Languages.

The Department of History and Government has certain requirements for the Master's degree, in addition to the general requirements of the Graduate College.

For the degree of Master of Arts in Government or History, the equivalent of 30 semester hours of advanced or graduate instruction is required, of which at least 15 credit hours, including thesis, shall be in courses exclusively for graduate students. On the recommendation of the student's committee, certain courses may be selected from those listed "For Graduates and Advanced Undergraduates."

Eighteen to twenty-one semester hours, including the thesis, shall constitute the major. The remaining 9 to 12 semester hours shall constitute the minor or minors and must be in related fields outside that of the major: education, English, government, history, mathematics, sciences, or other social sciences. With the consent of the departmental chairman, or advisor, and with the approval of the Dean of Graduate Studies, the candidate may take a minor outside the College of Arts and Sciences. The correlation of major and minor subjects must be approved by the Dean of Graduate Studies. If the minor work is divided, it must be in no more than two departments and include at least 6 semester hours in each field of study.

Foreign Languages: For the degree of Master of Arts a reading knowledge (usually represented by two years of college study) of at least one foreign language is required.

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

THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

The degree of Master of Business Administration is granted to students whose major programs may be in either accounting or general business.

Under general business, students may prepare for work in finance, insurance, marketing, and mangement. The requirements for this degree are identical with those for the Degree of Master of Science.

THE DEGREE OF MASTER OF COMPUTING SCIENCES

The degree of Master of Computing Sciences is a non-thesis degree, designed to complement the Master of Science degree in Computer Science.

The requirements for this degree are the completion of 36 hours of course work and a satisfactory comprehensive final examination.

THE DEGREE OF MASTER OF EDUCATION

Graduate students majoring in agricultural education, education, or industrial education may become candidates for the degree of Master of Education on recommendation of the heads of their major departments.

The requirements for this degree are the completion of 36 hours of course work and a satisfactory comprehensive final examination. A thesis is not required for this degree.

A special publication concerning the teacher education and certification programs and describing a special program leading to the degree of Master of Education for high school science teachers is available. The publication and details can be obtained on request from the Dean of Graduate Studies.

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

THE DEGREE OF MASTER OF ENGINEERING

A student holding a Bachelor of Science degree in engineering or a senior during his last semester may apply for admission to the Graduate College to work toward the non-thesis degree of Master of Engineering, majoring in his particular field of engineering. Approximately one-third of the required 36 credit hours of course work will be taken in fields outside the major field.

The work in the major field will include one or two written reports (not necessarily involving results of research conducted by the candidate) for which up to four hours credit in 685, Problems courses, is permissible.

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

PROFESSIONAL DEGREES IN ENGINEERING

The professional degrees in engineering are available to graduates of this university. These degrees are offered on the basis of acceptable professional experience, a thesis or its equivalent, and an examination. Details concerning requirements for this degree may be obtained upon application to the office of the Dean of Graduate Studies.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Work leading to the degree of Doctor of Philosophy is designed to give the candidate a thorough and comprehensive knowledge of his professional field and to train him in methods of research. The final basis for granting the degree shall be the candidate's grasp of the subject matter of a broad field of study and his demonstrated ability to do independent research. In addition, the candidate must have acquired the ability to express himself clearly and forcefully in both oral and written language. The degree is not granted solely for the completion of course work, residence, and technical requirements, although these must be met.

Residence. The minimum period of time required for the doctoral degree is six semesters of full-time graduate study, or its equivalent, beyond the Bachelor's degree. All of the work, except as noted below, must be done in resident graduate study at some approved educational institution, and at least two of the last four semesters must be spent at Texas A&M University.

Candidates for the doctoral degree will normally satisfy residence requirements by either (1) two semesters of 12 hours each, or (2) one semester of 12 hours and one summer session of 12 hours.

Full-time staff members engaged in graduate study and registered for less than 12 semester hours will receive proportionate residence credit.

Credit for Work in Absentia. Upon recommendation of his committee and approval of the Dean of Graduate Studies, a student may be permitted to carry on work in connection with his dissertation in absentia. In case credit is desired for off-campus research, the student must maintain his registration in the University.

Time Limit. All work for this degree must be completed within the seven-year period immediately preceding the final examination or within a five year period if the student enters with a Master's degree.

Student's Committee. After admission to graduate study, the student will consult the head of his major or administrative department concerning appointment of his advisory committee. This committee will consist of not less than five members of the graduate faculty representative of the student's several fields of study and research.

The committee will evaluate the student's previous training and degree objectives. They will then outline a degree program and research problem which, with the dissertation, will constitute the basic requirements for the degree. The degree program will be submitted on standard forms for the approval of the Dean of Graduate Studies. The field of study may be chiefly in one department or may be in a combination of departments. The chairman of the committee will normally have immediate supervision of the student's research and dissertation. The degree program should be submitted before the second registration after a student enters into graduate study.

Languages. All students are required to possess a competent command of English. In addition, candidates for the Ph.D. at Texas A&M University must demonstrate a reading knowledge of two foreign languages, selected

from German, Russian, and French or Spanish, subject to the approval of the student's committee, except in the following cases:

1. Another language may be substituted for one of these upon the recommendation of the student's committee and approval of the Dean of Graduate Studies, provided it is shown that there is a substantial body of knowledge in the student's field in the substitute language.
2. An alternate method of meeting the foreign language requirement will be to demonstrate a comprehensive knowledge of one of the languages in which there is a significant body of literature. A proficient ability to read, write, and speak that language is required. This alternative may be granted only upon specific prior recommendation from the student's committee and approval of the Dean of Graduate Studies.

The language requirement may be satisfied by successfully passing (1) the foreign language examinations, which are scheduled by the Department of Modern Languages four times a year, (2) a comprehensive examination in one language when such a substitution has been approved in advance by the Dean of Graduate Studies, or (3) two of the reading courses, Modern Language 402, 404, and 410.

Preliminary Examination and Admission to Candidacy. The student must be admitted to candidacy at least seven months before the time when the degree is expected to be conferred, but usually not before the completion of two full years of graduate work. A student must be registered for one hour or more in any semester in which he asks to appear for either the preliminary or the final examination.

To be admitted to candidacy, a student must have satisfied language requirements, passed a preliminary examination, and filed with the Dean of Graduate Studies his dissertation proposal approved by his graduate committee.

The preliminary examination shall be both oral and written unless otherwise recommended by the student's committee and approved by the Dean of Graduate Studies. The written part of the examination will cover each field of study included in the student's program and will be given over a period not exceeding two weeks. Credit for the preliminary examination is not transferable.

Through the preliminary examination and the dissertation proposal, the student's committee should satisfy itself that the student has demonstrated the following qualifications:

1. He has a mastery of the subject matter of all fields in his program.
2. He has an adequate knowledge of the literature in these fields and has powers of bibliographical criticism.
3. His dissertation project is feasible and adequate.

The committee which conducts the examination will report in writing the results of the examination and make recommendations regarding admission to candidacy of the student.

By permission of his committee and the Dean of Graduate Studies, a student who has failed in his preliminary examination may be given one re-examination, but only after a period of at least six months has elapsed.

Limitation for Staff Members. Members of the resident staff of the Texas A&M University System above the rank of assistant professor, or its equivalent, will not be granted the doctoral degree at this institution. They may, however, enroll for graduate work.

Dissertation. The general field of research to be used for the dissertation should be agreed on by the student and his committee at their first meeting, as a basis for selecting the proper courses to support the proposed research.

As soon thereafter as the research project can be outlined in reasonable detail, the official forms for proposing the dissertation should be completed,

approved at a meeting of the student's committee, and submitted to the Dean of Graduate Studies for final approval. This should be done before commencement of collection of data and not later than the third semester of resident work beyond the Master's level.

The ability to perform independent research must be demonstrated by the dissertation. While acceptance is based primarily on its scholarly merit, it must also exhibit creditable literary workmanship. The format of the dissertation shall be acceptable to the Graduate College. Suggestions on form may be obtained from the office of the Dean.

By dates announced each semester the candidate must submit to the office of the Dean of Graduate Studies the original and two copies of the dissertation. The dissertation must be completed with all suggestions and corrections of the student's committee incorporated, and bear the signatures of the chairman, the committee members, and the department head. These must be approved by the Dean of Graduate Studies before the final examination can be given.

In addition to the dissertation, the candidate must submit three copies of an abstract not exceeding 600 words.

All successful candidates for the doctorate are required to pay to the Fiscal Department a dissertation abstract microfilming fee of $20.00. This fund is used to film abstracts of doctoral dissertations on microfilm in cooperation with University Microfilms, Inc.

Final Examination. The candidate for the doctoral degree must pass a final examination not less than one week before the date on which the degree is to be conferred. The student's committee as finally constituted will conduct this examination. The candidate's completed dissertation will be available to this committee. While the final examination may cover the broad field of the candidate's training, it is presumed that the major portion of the time will be devoted to the dissertation and closely allied topics. The final examination will be open to all members of the Faculty. The committee will submit their recommendations to the Dean of Graduate Studies regarding acceptability of the candidate for the doctoral degree.

THE DEGREE OF DOCTOR OF EDUCATION

The Doctor of Education program is designed to offer opportunity for advanced study and research to persons who have demonstrated superior scholarship and a promise of leadership in professional education. The final basis for granting the degree shall be the candidate's grasp of the subject matter of a broad field of study and his demonstrated ability to do independent research. At present this program is available only in the field of Industrial Education.

Program of Study. Upon acceptance as an applicant for the Doctor of Education degree, the student will take a series of tests, preferably during the first session of residence. The results of this examination will be used by the student and his Advisory Committee as a partial basis in planning and developing his doctoral program.

Languages. There is no specific foreign language requirement for the Doctor of Education degree.

Statistics. A student must demonstrate competence in statistics and educational research procedures.

Educational Experience. The student must have had a period of teaching experience deemed sufficient in amount and quality in the opinion of his Advisory Committee to warrant his continuing toward a doctorate.

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

GRADUATION

Graduate degrees are conferred at the close of each regular semester or summer session. Commencement exercises, however, are held only at the close of the fall and spring semesters.

During the semester or summer session in which his degree is conferred, a student must be officially registered in the University whether or not he enrolls in course work.

Candidates for advanced degrees who expect to complete their work at the end of a given semester must give separate written notice to both the Dean of Graduate Studies and the Registrar to that effect not later than 90 days prior to the end of the semester or 30 days prior to the end of the summer term in which the student expects to have his degree conferred.

Each candidate for a degree must attend the commencement exercises in appropriate academic regalia unless his petition to be excused is approved by the Dean of Graduate Studies. The petition should be submitted at least 30 days prior to commencement.

PUBLICATION OF THESIS MATERIAL

Graduate students pursuing work leading to an advanced degree may publish in scholarly journals material that may subsequently be used as a part of the thesis or dissertation, provided the Dean of Graduate Studies is notified of this intention at the time the paper is submitted for publication. The complete title, the names of authors as they appear on the paper, and the name of the journal will be furnished the Dean of Graduate Studies. Acknowledgement should be given in the publication that the work is for partial fulfillment of graduate degree requirements.

After publication, the student will advise the Dean of Graduate Studies regarding the volume and page of the journal in which the paper was published. Students are urged to provide similar information on all scientific papers published during their graduate careers, even though the material is not intended for use as a part of the thesis or dissertation.

GRADUATE FELLOWSHIPS AND ASSISTANTSHIPS

Graduate teaching assistantships for nine months, which require one-half time service, are available to qualified students. The first-year compensation may range from $175.00 per month up, depending upon duties performed. After the successful completion of two semesters of a graduate program, teaching assistants may receive $200.00 or more per month for the nine-month period.

Graduate research assistantships are usually 12-month appointments from $175.00 per month upwards. Vacancies may be filled for shorter periods.

A maximum of 12 credit hours of academic work per semester and 4 hours per summer term is normally approved for graduate assistants.

Some adjustment in duties and in the rate of pay may be made for nonresident students to aid in meeting the nonresident fee.

A limited number of Graduate College Fellowships are available for students with outstanding records. These fellowships require no service except satisfactory academic performance. Many other assistantships and fellowships, including some post-doctoral fellowships, are available through the Agricultural and Engineering Experiment Stations or from grants-in-aid administered by individual departments. Inquiries concerning these forms of assistance may be directed either to the Dean of Graduate Studies or the head of the department in which the student plans to do his major work.

Graduate fellowships are grants permitting full-time study and research (16 hours maximum per semester and 6 hours per summer term). The amount of the stipend is variable, depending upon the nature of the grant and the qualifications of the recipient.

Applications for all assistantships and fellowships, together with letters of recommendation and other supporting information, should be filed with the Dean of Graduate Studies on or before March 1 preceding the academic year for which awards are to be made.

Forms for making application for assistantships are available in the office of the Graduate College. Information regarding research assistantships and fellowships which are administered by departments may be obtained by writing directly to the head of the department concerned.

LIBRARY FACILITIES

Cushing Memorial Library: The main University library, which serves also as the research library of the Texas Agricultural Experiment Station and of the Texas Agricultural Extension Service, is in a centrally located, air conditioned building housing a collection of over 340,000 volumes of books, periodicals, government documents, and other library materials. A total of 456,600 volumes are owned altogether by Texas A&M University. Those not in the Cushing Library are in the branches described later.

The library is a federal depository for United States government documents on a selective basis. Over 3,500 periodicals and other serials are currently received along with 51 state, national, and foreign newspapers. Special attention has been given to obtaining important foreign language periodicals in all areas. Although the library has been developed chiefly along reference and technical lines, a good general reading collection has been assembled. Generous contributions from Texas A&M Mother's Clubs throughout the State have been used to increase substantially the collection of fiction and non-technical popular material. The careful selection of new books in both technical and non-technical areas keeps the collection abreast of modern thought. A well-trained staff of librarians is on duty at all times.

The more important reference works, including indexing and abstracting services, are shelved in the General Reference Room, second floor. State and federal documents are to be found in the Documents Division, second floor. The library is a Superintendent of Documents Depository as well as a special depository for the unclassified technical reports of the U. S. Atomic Energy Commission. Microfilm and microcard machines are provided for reading materials in this form. Photocopy service is available at nominal cost.

Individual study carrels are provided in the bookstacks for the use of graduate students and faculty members and may be assigned on a semester basis. With the exception of periodicals, government documents, and certain books temporarily reserved by departments for reference or required reading. all books are loaned for home use for a period of two weeks with the privilege of renewal for the same length of time. Bound volumes of periodicals may be charged out by graduate students for over-night use only.

Normally the library is open from 8 a.m. to 12 p.m., Monday through Friday; Saturday, from 8 a.m. to 12 noon; and Sunday, from 2 p.m. to 12 p.m. On holidays and between terms, the library is open from 8 a.m. to 5 p.m. on weekdays, from 8 a.m. to 12 noon on Saturdays, and is closed on Sundays.

Texas Engineers Library: This special branch library, established in 1941 by the Texas State Board of Registration for Professional Engineers in cooperation with Texas A&M University is housed in the Gibb Gilchrist Engineering Library Building adjacent to the main University library. The collection consists of over 90,000 volumes of books, periodicals, and other library materials in all areas of engineering. The collection is well balanced but is especially strong in aeronautics, air-conditioning, highway engineering, concrete, hydrology, sanitary engineering, petroleum, and welding. Over 1,500 periodicals and other serials are currently received, including many in foreign languages and some English translations of Soviet technical journals.

The library is modern and well-lighted with stacks open to the public. It is open from 8 a.m. to 5 p.m. and from 7 p.m. to 10 p.m. on weekdays and on Saturdays from 8 a.m. to 12 noon. The library is closed on Sundays.

Veterinary Library: This branch library is located at the east end of the first floor of the Veterinary Medicine Building and is open from 8 a.m. to 10 p.m. on weekdays, and from 8 a.m. to 12 noon on Saturdays. The library is closed on Sundays. It is primarily a reference library with 11,000 volumes of books and periodicals in the fields covered by the curriculum in the College of Veterinary Medicine. The library subscribes to 435 American and foreign periodicals and receives pertinent publications from other colleges, universities, and experiment stations.

Architecture Library: This branch library, located in the new Architecture Building, furnishes reading room space and offers reference service on weekdays from 8:30 am. to 11:30 a.m.; from 1:30 p.m. to 4:30 p.m.; and from 7:30 p.m. to 9:30 p.m. On Saturdays it is open from 1:30 p.m. to 4:30 p.m., and on Sundays it is closed. The collection, numbering over 6,000 volumes of carefully selected books and periodicals, provides materials in this specialized field for both students and faculty.

Business Administration Library: Another branch of the University Library, this collection consists of 8,000 volumes of books and periodicals in the many areas of business administration, such as accounting, insurance, marketing, business law, etc. Over 170 periodicals are currently received, and a file of annual reports of corporations is carefully maintained. The library is located in the west end of the first floor of Francis Hall. It is open from 8 a.m. to 12 noon and from 1 p.m. to 5 p.m. on weekdays, and is closed Saturdays and Sundays.

Chemistry Library: This newest branch library, housed on the fourth floor of the Chemistry Building, consists of a collection numbering over 2,500 volumes carefully selected for their value as reference material for chemistry. This library is open from 8 a.m. to 12 noon and from 1 p.m. to 5 p.m. on weekdays. It is closed Saturdays and Sundays.

Other Libraries: Many departments maintain working collections of books and periodicals for use within the departments. Some of the collections are fairly large and well organized; others are small but very well chosen. Use of these libraries is restricted by the departments concerned.

VETERANS ADVISORY SERVICE

Texas A&M University provides a Veterans Advisor to assist ex-servicemen with their problems. His office is located on the ground floor of the YMCA Building.

FOREIGN STUDENT ADVISOR

The Office of the Foreign Student Advisor is located in Room 204, Counseling and Testing Center. Information relative to immigration regulations and assistance with problems peculiar to students from other lands may be obtained from this staff member.

REGISTRATION OF MOTOR VEHICLES

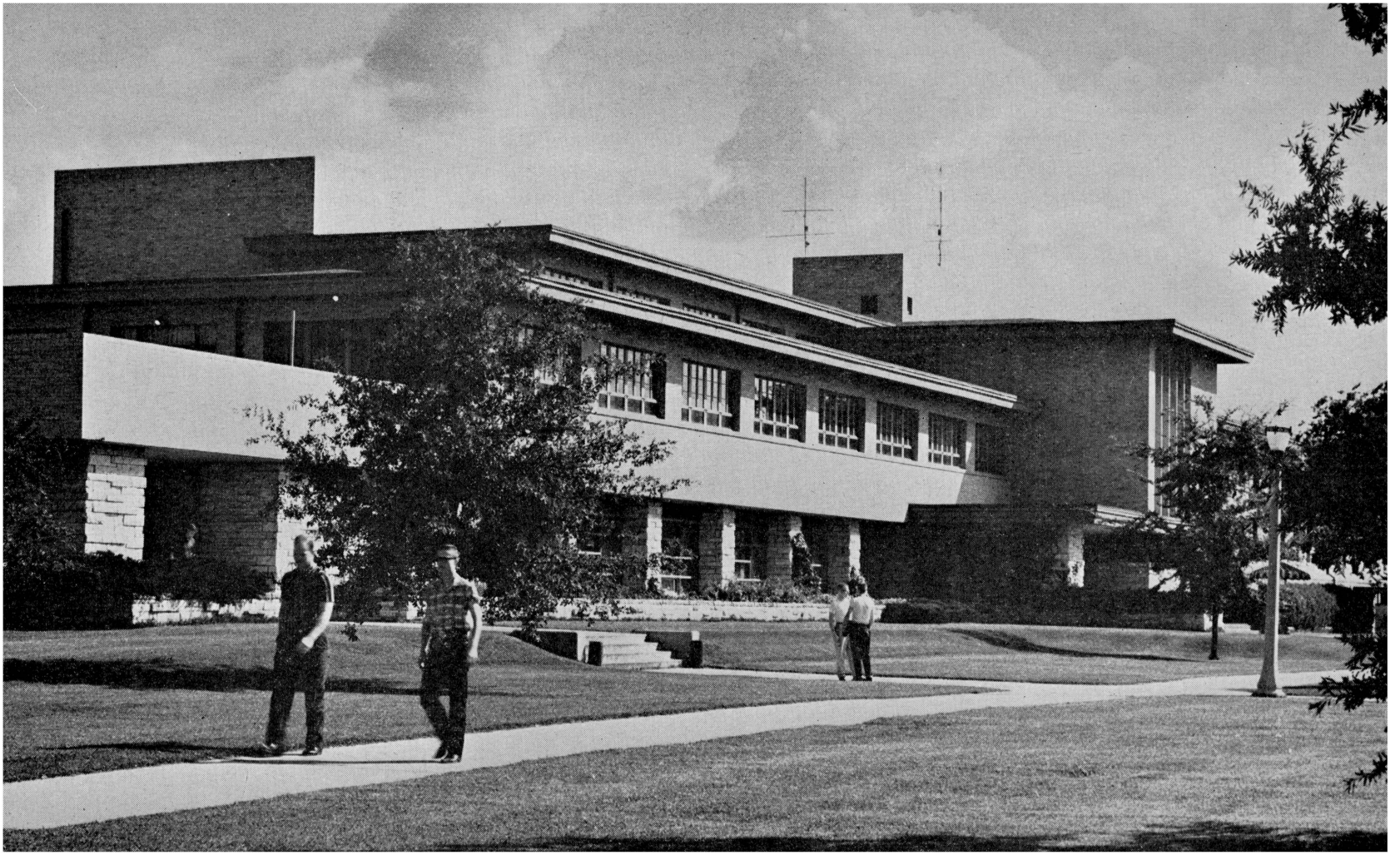
All students and employees who drive motor vehicles on the campus must have them registered in the Office of Campus Security, Ground Floor, YMCA Building, within 48 hours of the time they are brought on the campus.

Students are assigned parking areas according to their housing assignment. Cars must be parked in these designated areas during the regular classroom hours.

STUDENT HEALTH SERVICES

The University Hospital provides infirmary space for over 100 patients, as well as a modern clinic for out patient care. The facilities include a complete physiotherapy department, modern laboratory, and a new X-ray department. The medical staff includes specialists in the fields of medicine, surgery, radiology, and ear, nose, and throat.

The Clinic is open from 8 a.m. to 5 p.m. on weekdays and from 8 a.m. to 12 noon on Saturdays. The Student Services fee provides for clinic visits,



diagnostic examinations, care for acute illnesses, emergency care for accidents, and 10 days of infirmary care each semester in cases requiring hospitalization. Routine medications for acute illnesses, X-rays, laboratory tests, and local ambulance service are also furnished the student without charge. A staff of registered nurses is on duty, with a staff physician on call, to care for emergency cases at any hour.

All students are encouraged to take out the Accident Insurance Policy which is available at reasonable cost.

The water of the University is supplied through a University-owned water supply system and comes from four deep wells located nine miles northwest of the campus. As a part of the sanitary work carried on throughout the entire year, the University laboratories make bacteriological checks of this water supply and of the milk supply at regular intervals.

The University is particularly concerned with the maintenance of the health and physical development of its students. It provides the finest outdoor and indoor swimming pools in the State, as well as tennis courts, a golf course, and athletic fields. An adaptive physical education program is provided for those students needing special exercises or therapy for physical defects.

RELIGIOUS ACTIVITIES

In addition to the University Y.M.C.A. staff, there are nine churches near the campus whose primary purpose is to serve the spiritual needs of the students. The campus religious leadership is deeply conscious that the students are in perhaps the most formative period of their lives and feel keenly the responsibility for their spiritual development.

The programs of the respective churches are aimed primarily to meet the student needs. Many of the churches have distinct student departments with specialized leadership whose sole responsibility is that of ministering to the students. The pastors of the churches also give as much time as is necessary to the students for personal counseling.

The churches serving the campus have a program similar to that of the home church with an expanded young people's department and dominant emphasis upon student interests. In addition to the special student emphasis, they have the customary Sunday worship periods, church schools, and young people's organizations promoted to stimulate clear and constructive thinking in the important field of religion. The student departments are expanded to offer wholesome recreation and social life and social service.

The beautiful new All Faiths Chapel, a gift of the Former Students Association, is made of Austin limestone and glass, and is modern in design. Its landscaping adds greatly to its beauty.

In addition to encouraging individual meditation and prayer and serving as a meeting place for small religious groups, other activities include making available a library of religious books, a secluded meditation room, accommodations for small weddings, funerals, memorial services, baptisms, vesper services, and other religious rites. The Chapel is open at all hours for meditation and prayer.

THE MEMORIAL STUDENT CENTER

Dedicated to the memory of the men of Texas A&M University who gave their lives during World Wars I and II, the Memorial Student Center was erected to foster the social, cultural, and spiritual phases of student life.

General facilities of the Memorial Student Center include a dining room, cafeteria, snack bar, gift shop, telephone and telegraph center, barber shop, 66 guest rooms, travel agency, check cashing and information center, and United States Post Office. Recreational facilities include bowling lanes, billiards and table tennis area, game room, browsing library, and record playing rooms. A large number of meetings, receptions, exhibits and social affairs given by the student and staff organizations of the University are held at the Center.

Memorial Student Center—Headquarters for student activities, offering excellent air conditioned facilities for social and recreational life.

The Memorial Student Center is charged with counseling and fiscal operation of many student activities. It sponsors such activities as recreation and entertainment on the campus, including the campus movie program, music activities, social activities, clubs, student government, and other co-curricular activities.

The Memorial Student Center Building Cashier provides banking service for the numerous student organizations on the campus and in the Memorial Student Center. The Cashier's Window is also headquarters for the sale of season and individual tickets for various campus presentations, including Great Issues and Town Hall.

GRADUATE COURSES BY DEPARTMENTS

Figures in parentheses following the number of the course indicate the clock hours per week devoted to theory and practice respectively. Theory includes recitation and lectures; practice includes work done in the laboratory, shop, drawing room, or field. The unit of credit is the semester hour, which involves one hour of theory, or from two to four hours of practice per week for one semester of eighteen weeks.

Roman numerals to the right of the credit value of each course indicate the semester in which it is regularly offered. The letter "S" denotes summer offerings.

Any course may be withdrawn from the session offerings in case the number of registrations is too small to justify the offering of the course.

Department of Aerospace Engineering

A. E. CRONK* (Head), R. R. GILRUTH, S. H. LOWY, C. A. RODENBERGER, C. H. SAMSON, JR.

The Department of Aerospace Engineering offers graduate work as preparation for research careers or as more complete training in the engineering practices of the aerospace industry. Programs can be developed with emphasis on high speed aerodynamics, aerospace structures, or propulsion.

Wind tunnels provide equipment for aerodynamic research in fundamental fluid flow problems or in three-dimensional testing of complete airplane models. Investigations of structural problems are undertaken in well equipped structures laboratories.

The present trend of the aerospace industry toward more research and development rather than heavy production has stimulated interest in graduate work in aerospace engineering.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

417. Aircraft Propulsion Systems. (3-0). Credit 3. II

A study of the development, fundamentals, theories, construction, design, and performance of turbo-jet, ram jet, pulse jet, and rocket power plants for aircraft. Prerequisites: Aerospace Engineering 401, 406. Mr. Cronk

421. Dynamics of Airplanes. (3-0). Credit 3. II

Linear theory of vibrations of single and multi-degree of freedom systems; self-excited vibrations. Applications of matrix algebra. Elementary theory of flutter; landing impact, gust response, aero-elastic effects, dynamic stability. Prerequisite: Senior classification. Mr. Cronk

431. Spacecraft Technology. (3-0). Credit 3. II

Environmental conditions; detectors and sensing devices; methods of orienting spacecraft; power sources; telemetry systems; structural considerations; electronic components; integration of spacecraft components; fabrication techniques. Prerequisite: Senior classification in aerospace engineering or approval of the instructor. Mr. Cronk

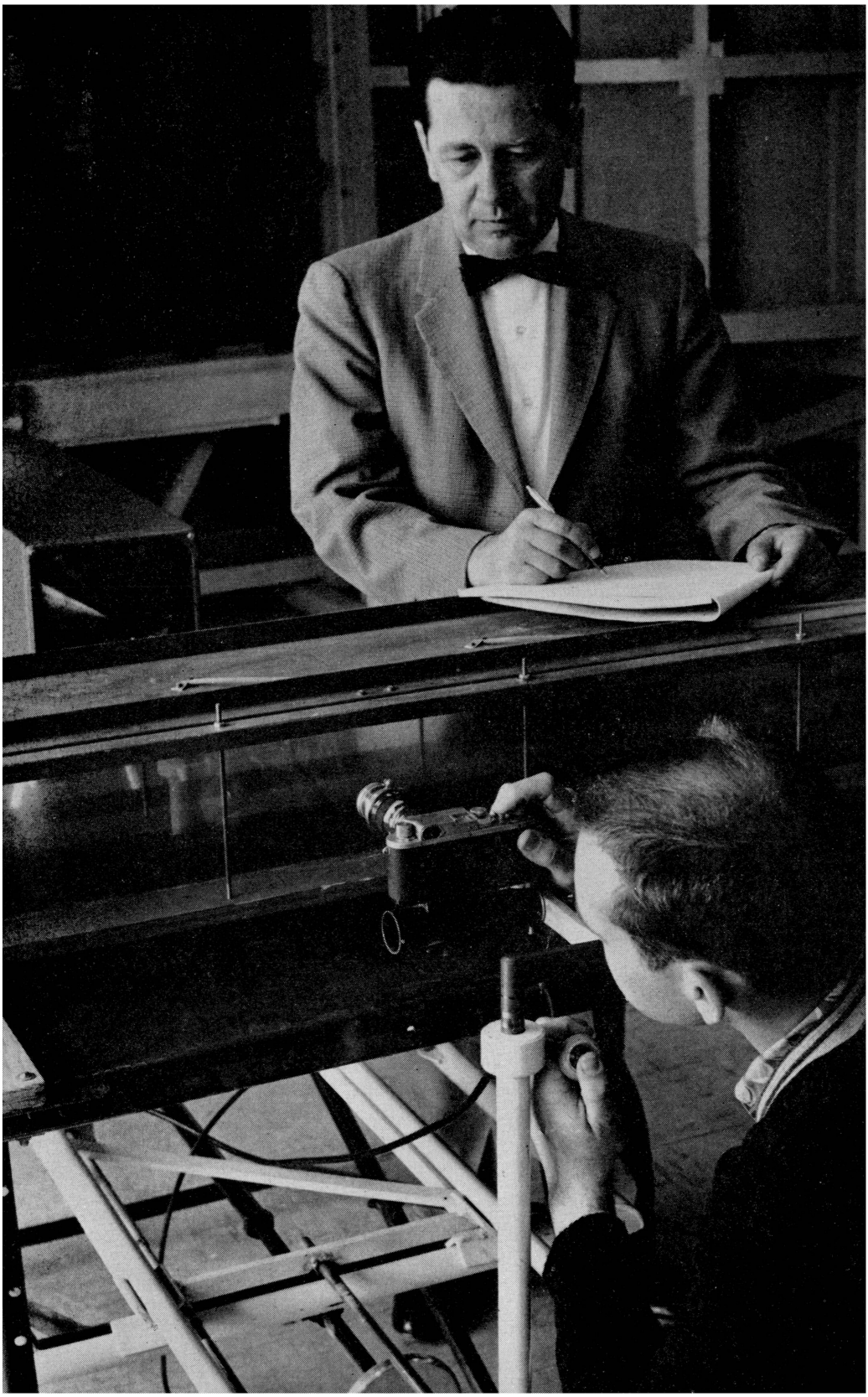
Structural Mechanics 468. Statically Indeterminate Structures. (3-0). Credit 3. I

See Structural Mechanics for a full description of this course.

Structural Mechanics 469. Analysis of Structures. (3-0). Credit 3. II

See Structural Mechanics for a full description of this course.

*Graduate Advisor



FOR GRADUATES

601. Principles of Fluid Motion. (4-0). Credit 4. I

Mathematical methods of analysis are emphasized. Perfect fluid theory development. Treatment of viscosity and boundary layer phenomena. Prerequisite: Aerospace Engineering 303. Mr. Cronk

603. Aerodynamics of the Airplane. (4-0). Credit 4. II

Application of vector analysis to two- and three-dimensional airfoil theory. Viscosity and compressibility. Drag of aircraft components. Static and dynamic stability criteria. Prerequisite: Aerospace Engineering 303. Mr. Cronk

604. Dynamics of Compressible Fluids. (4-0). Credit 4. I

Properties of compressible fluids, dynamics of one-dimensional motion, channel flows, shock waves, methods of observation, extension to two- and three-dimensional flow, effects of viscosity. Prerequisite: Aerospace Engineering 303 or approval of Head of Department. Mr. Lowy

608. Aircraft Flutter Analysis. (4-0). Credit 4. II

Theoretical development of the structural and aerodynamic equations for two- and three-dimensional flutter. Numerical solutions in practical problems to determine flutter velocities. Methods of testing to determine vibration characteristics of aircraft. Prerequisite: Aerospace Engineering 421 or Mechanical Engineering 459 or 617. Mr. Samson

632. Structural Design of Missiles and Spacecraft. (3-0). Credit 3. II

Flight loads; environment; gas properties; aerodynamic and solar heating; heat transfer through structures; thermal stresses; materials and material behavior; pressure vessels; pressure-stabilized structures; aeroelastic effects and dynamic loads; structural fatigue; heat-protection systems; reliability. Prerequisite: Graduate classification in aerospace engineering or approval of the instructor. Mr. Rodenberger

685. Problems. Credit 1 to 4 each semester. I, II, S

Investigation of special topics not within the scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification in aerospace engineering. Saff

691. Research. Credit 2 to 6 each semester. I, II, S

Technical research projects approved by the Head of the Department. Staff

Structural Mechanics 601. Theory of Elasticity. (4-0). Credit 4. I, S

See Structural Mechanics for a full description of this course.

Structural Mechanics 602. Structural Stability. (4-0). Credit 4. II

See Structural Mechanics for a full description of this course.

Structural Mechanics 603. Theory of Plates and Shells. (4-0). Credit 4. I

See Structural Mechanics for a full description of this course.

Structural Mechanics 604. Vectors and Tensors in Mechanics. (2-0). Credit 2. I, S

See Structural Mechanics for a full description of this course.

Structural Mechanics 605. Flow and Fracture of Solids. (4-0). Credit 4. II

See Structural Mechanics for a full description of this course.

Structural Mechanics 606. Theory of Thermal Stresses. (4-0). Credit 4. II

See Structural Mechanics for a full description of this course.

Structural Mechanics 607. Matrix Methods of Structural Analysis. (3-3). Credit 4. II, S

See Structural Mechanics for a full description of this course.

Photographing the high speed movement of dust particles in an aerospace graduate research endeavor.

Structural Mechanics 608. Experimental Structural Analysis. (2-3). Credit 3. II, S

See Structural Mechanics for a full description of this course.

Structural Mechanics 609. History of Structural Mechanics. (2-0). Credit 2. II, S

See Structural Mechanics for a full description of this course.

Department of Agricultural Economics and Sociology

R. E. BRANSON, D. R. DAVIS, V. W. EDMONDSON, D. E. FARRIS, M. L. FOWLER, J. A. KINCANNON, J. G. McNEELY, A. C. MAGEE, D. S. MOORE, B. H. NELSON, DANIEL RUSSELL, R. L. SKRABANEK, H. B. SORENSEN, RANDALL STELLY**, K. R. TEFERTILLER, T. R. TIMM (Head), A. B. WOOTEN*

The objective of the program in this field is the training of scientific and professional workers. Increasing attention of public agencies and private concerns to rural economic and social problems points to enlarged opportunities for qualified workers for teaching, research, public relations or administration, and private employment in these fields.

In planning a student's program, the need for broad training, rather than narrow specialization is recognized. The student, irrespective of his primary interest, is expected to take not only advanced courses covering various fields within the Department but also essential supporting courses in other departments. In all cases he is expected to acquire a knowledge of economic or social theory, its history, and its applications to contemporary agricultural problems; and the ability to employ statistical techniques and other methodology in making rural social and economic studies.

The teaching and research activities are grouped broadly as follows: in agricultural economics, under (1) farm management and production economics, (2) marketing, (3) land economics and agricultural policy, and (4) consumer economics; and in sociology under (1) social problems, (2) rural organizations, (3) social theory, and (4) social institutions. These fields are subdivided into several specific phases. The present and expanding program of research in the department affords the student wide choice and interested guidance in his research for a thesis or dissertation.

AGRICULTURAL ECONOMICS
FOR GRADUATES AND ADVANCED UNDERGRADUATES

413. Agricultural Cooperatives. (3-0). Credit 3. II

Place of cooperatives in our economic system; historical development and principles of cooperative associations. Steps in organizing an agricultural cooperative; operational aspects of cooperatives including legal considerations, financing, management, and membership relations; future role of cooperatives in American agriculture. Prerequisite: Agricultural Economics 314. Staff

416. Economics of Livestock Marketing. (2-0). Credit 2. I

An economic analysis of the livestock and meat industry; marketing practices of livestock producers; characteristics of major agencies and services; problems associated with the movement of livestock from producer to consumer. Prerequisite: Agricultural Economics 314. Mr. McNeely

429. Agricultural Policy. (3-0). Credit 3. II

An analysis of the causes, nature, and effects of government participation in agriculture. Emphasis is upon the interrelationship of American agriculture in the political and economic system, public administration and interest representation. Prerequisite: Economics 203. Mr. Timm

430. Agricultural Finance. (3-0). Credit 3. II

Analysis of the capital requirements for farming and ranching and how they are obtained; principles involved in the use of each type of credit neces-

*Graduate Advisor
**On leave of absence from February 1, 1963, to January 31, 1965.

sary to sound financial management; the risk, costs, and legal aspects of credit; the security requirements, rates, and terms of the loans available from the private and governmental lending agencies serving agriculture. Prerequisite: Economics 203. Mr. D. S. Moore

432. Farm and Ranch Appraisal and Organization. (2-2). Credit 3. II

Detailed problems involved in the appraisal, organization, and management of specific farms and ranches, covering such matters as efficiency analysis, budget preparation, layout, and improvement. Prerequisite: Agricultural Economics 325. Mr. Wooten

443. Applied Farm Management. (2-2). Credit 3. S

A special three-week summer course for Extension Service personnel and other professional agricultural workers, reviewing basic economic principles used in farm management, the use of these principles in farm business planning, consideration of some of the more common management problems confronting Texas farmers, and opportunities for and methods of using the farm management approach in educational work with farm people. Laboratory work based on actual farms and ranches. Not open for agricultural economics M.S. or Ph.D. majors. Prerequisites: Baccalaureate degree; experience in professional agricultural work. Mr. Magee

452. International Trade and Agriculture. (3-0). Credit 3. I

World production and demand, present and potential, of agricultural commodities; world trade in farm products with emphasis on causal factors; national and international policies relating to agriculture; status of agricultural resources, technological progress in agriculture, and food requirements in major areas. The course is designed particularly for those interested in foreign agricultural service with governmental agencies or in export-import work with commercial concerns. Prerequisite: Senior classification. Mr. Farris

FOR GRADUATES

602. Agricultural Market Organization and Structure. (3-0). Credit 3. S

An analysis of the framework within which farm products are marketed. Institutional and functional problems in a competitive economy. Implications of horizontal and vertical integration and governmental activities. Relative influences of producers, the food and fiber industries and consumers on market structure. Prerequisite: Agricultural Economics 314. Mr. McNeely

603. Land Economics. (3-0). Credit 3. II

A study of selected problems of the allocation and utilization of natural resources with special reference to government organizations, quasi-government bodies, and other interest groups. Prerequisite: Agricultural Economics 422. Mr. Wooten

607. Research Methodology. (3-0). Credit 3. I

A study of the scientific approach, role of theory and assumptions, bias and prejudice, attributes of problems, methods and tools of agricultural economics and sociology research. Each student is asked to critically evaluate research studies and is required to develop his thesis prospectus or its equivalent. Prerequisite: Approval of the Head of the Department. Mr. D. E. Farris

611. Production Economics. (3-0). Credit 3. II

Basic principles upon which problems in agricultural production and resource use can be analyzed. Fundamental principles of production are isolated and these principles applied to agricultural data. Emphasis is placed on the conditions under which efficiency is obtained. The problems of agricultural production and resource use are treated from the standpoint of the technical unit, the firm and society. Prerequisite: Approval of the Head of the Department. Mr. Tefertiller

613. Contemporary Thought in Agricultural Economics. (3-0). Credit 3. I

A study of contemporary contributions to the thought and analyses of aggregate relationships and problems in the agricultural economy in terms

of organizational efficiency and patterns in adjusting to economic development and economic fluctuations. Prerequisite: Approval of the Head of the Department. Mr. Branson

614. Agricultural Policy. (3-0). Credit 3. S

An analysis of public policies and programs affecting agriculture. Development of policies and programs for agriculture and their bases. Prerequisite: Agricultural Economics 429 or approval of the Head of the Department. Staff

617. Economics of Consumption. (3-0). Credit 3. I

An analysis of the consumer market for agricultural products; effects of family characteristics, such as size, age, income, and location upon consumer preferences and buying habits; motivations of consumers in buying different products; effectiveness of quality variation, packaging, and displays upon consumer purchases; the place of advertising in market creation; price policies at the retail level; and market research as a guide to marketing policies. Prerequisite: Approval of the Head of the Department. Mr. Branson

619. Farm and Ranch Business. (2-2). Credit 3. I

An analysis of the interrelationships of factors affecting profits in farming and ranching. Identification of the strong and weak points in the organization and management of actual farm and ranch businesses. Special study and analysis of the management factor affords an opportunity to relate theory and practice in farming and ranching. Prerequisite: Approval of the Head of the Department. Mr. Edmondson

620. Capital Market in Agriculture. (3-0). Credit 3. I

The role of capital in economic growth. Formation and allocation of capital in agriculture. Determinants of aggregate capital supply. Structure of the capital market for agriculture and its relationship to adjustments and technological change. Prerequisite: Agricultural Economics 430 or approval of the Head of the Department. Mr. D. S. Moore

627. Agricultural Market and Price Analysis. (3-0). Credit 3. S

The application of economic theory to an analysis of agricultural product price determination and price behavior. Consideration of various types of applied economic and statistical research for price analysis and price forecasting. The relationship of product prices to marketing costs and consumer prices. Prerequisites: Agricultural Economics 447; Business Administration 303. Staff

629. Public Administration in Agriculture. (3-0). Credit 3. S

A study of the basic theories in public administration in agriculture; techniques for accomplishing public goals; the legal basis for public agriculture programs; economic, social, and political considerations in agriculture programs; organizational structures for programs; formal and informal organizations. Prerequisite: Approval of the Head of the Department. Staff

633. Economics of Underdeveloped Agricultural Areas. (3-0). Credit 3. S

An analysis of agricultural progress in countries with variable rates of economic growth. Relation of physical potential, food needs, land tenure, cultural and institutional factors, market structure, and trade to agricultural productivity. Importance of agriculture to total economic growth. Problems and possible solutions. Prerequisites: Economics 330; approval of the Head of the Department. Mr. McNeely

641. Statistical Methods in Agricultural Economics. (2-2). Credit 3. II

Planning the statistical research project, developing forms, selecting the sample, conducting the study, tabulating, analyses, and interpreting the data. Prerequisites: Business Administration 303 or Statistics 406 or equivalent; 15 hours of social science; approval of the Head of the Department. Staff

681. Seminar. (1-0). Credit 1 each semester. I, II

A review of current literature, preparation of papers on selected topics, and discussions with visiting agricultural economists. Prerequisite: Graduate classification. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A directed individual study of a selected problem in the field of agricultural economics. Prerequisite: Approval of the Head of the Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Initiation and completion of a research project of approved scope for an advanced degree. Prerequisite: Approval of the Head of the Department. Staff

SOCIOLOGY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

306. Principles of Social Work. (3-0). Credit 3. I, II, S

The historic development and present organization of private and public welfare agencies and social services. Distinctive techniques of the social work profession in interviewing, group work, case work, and social work organization are emphasized. Students are prepared to assume intelligent leadership on committees and boards of welfare agencies and to explore the possibilities for professional employment in this 20 billion dollar enterprise. Twelve hours of independent field work must be performed if graduate credit is allowed. Prerequisite: Sociology 205 or 6 additional hours of sociology or other social science. Mr. Davis

320. Social Anthropology. (3-0). Credit 3. I, II

Cultural patterns of the principal cultures are analyzed to reveal social systems, institutions, customs, values, ethos, universal constants, and problems of cultural diffusion. Trainees in technical agriculture, engineering, business, education, public health, and the diplomatic service who anticipate domestic or overseas employment are acquainted with the methods for implementing social, cultural, and technological change. Adjustment of personnel to foreign cultures is emphasized. Prerequisite: Sociology 205 or approval of the Head of the Department. Mr. Davis

404. Community Development. (3-0). Credit 3. I

The objective of the course is to help future agricultural workers in doing a better job in their various specialties by recognizing and understanding group processes and organization in carrying on their program. The techniques of rural community development are explored as values to total agricultural and small town development. Community development problems in underdeveloped countries will be surveyed. Prerequisite: Approval of the Head of the Department. Staff

411. Social Psychology. (3-0). Credit 3. I, II, S

An analysis of why people behave the way they do, the effect of social experiences and of the groups people belong to upon the development of personality. How to influence and control the behavior of people. Social adjustment and maladjustment including analysis of causes. Public opinion. Prerequisites: Three hours of sociology or psychology; approval of the instructor. Mr. Nelson

412. Population Analysis. (3-0). Credit 3. II

Methods of demographic analysis. The influence of population numbers, birth rate, death rate, sex ratio, age composition, nativity, racial composition, and migration on social values and social structure. Theories of population growth and change and their effects on population policies. International aspects of the demographic position of the United States. Prerequisites: Twelve hours of social science; approval of instructor. Mr. Skrabanek

418. Public Opinion and Social Control. (3-0). Credit 3. I

Analysis of processes, planned or unplanned, by which individuals are taught, persuaded, or compelled to conform to usages and life values of

groups. Nature and use of public opinion and propaganda. Prerequisite: Sociology 205. Mr. Nelson

FOR GRADUATES

601. Rural Urban Relations. (3-0). Credit 3. I, S

Rise, growth, and trends of cities and their impact upon rural fringe areas. The economic, commercial, residential, and industrial structures and the function of basic urban institutions. Rural and urban demographic contrasts and urban ways of life. Problems of the city and a search for the ideal city. Designed for students in architecture, administration, education, and transportation. Prerequisite: Sociology 205 or its equivalent or 12 hours of social science*. Mr. Davis

602. Contemporary Theory in Rural Sociology. (3-0). Credit 3. II

The rise, spread, and development of the field of rural sociology in each of its three central phases—teaching, research, and extension. An objective appraisal of the scientific status of rural sociology and its interrelationships with other sciences. A review of the theories and contributions of past and present-day leading sociologists and other social scientists to the field of rural sociology. Prerequisite: Sociology 205 or its equivalent, or 12 hours of social science*. Mr. Skrabanek

606. Rural Youth Leadership. (4-0). Credit 4. I, S

To give special insight into the problems of our youth, and training techniques and programs needed to deal with these problems. To acquaint the advanced student with qualities, traits, techniques, attitudes, etc., of successful leaders in various fields. Prerequisite: Twelve hours of social science*. Staff

611. History of Social Thought. (3-0). Credit 3. I, S

The development of social thought from ancient times to the present. Chief emphasis is placed upon sociological thinkers who have made significant contributions to the field, the theories of these men, and the background from which these theories evolved. Prerequisites: Sociology 205; 12 additional hours of social science*. Mr. Nelson

612. The Rural Community. (4-0). Credit 4. II

The purpose of this course is to acquaint the advanced student with the importance, problems, processes, and techniques of community development. Each student will be given an outside reading and study program to meet his particular interest and needs in his chosen field or specialty. A major purpose is to recognize the community development self-help technique as an effective method of improving rural standards of living in agriculture, health, education, recreation, beautification, etc. Prerequisite: Twelve hours of social science*. Staff

618. Educational Sociology. (3-0). Credit 3. S

How our school system can strengthen our democratic way of life. The relationship of education to social organization, social change, and social control. Sociological analysis of the role of education in our society. Prerequisites: Sociology 205 or the equivalent; 9 additional hours of social science or a degree in education. Mr. Nelson

685. Problems. Credit 1 to 4 each semester. I, II, S

A directed individual study of a selected problem in the field of sociology. Prerequisite: Six hours of sociology or 12 hours of supporting social science. Staff

691. Research. Credit 1 or more each semester. I, II, S

Initiation and completion of a research project of approved scope for an advanced degree. Prerequisite: Approval of the instructor. Staff

*For this purpose social science is defined to include only courses in agricultural economics, anthropology, economics, political science, psychology, and sociology.

Department of Agricultural Education

B. D. COOK*, J. W. HOLCOMB, JR.*, O. M. HOLT*, E. H. KNEBEL* (Head), HENRY ROSS*, E. S. WEBB*

Advanced courses in agricultural education provide an opportunity for teachers of vocational agriculture to improve their efficiency as master teachers. Agricultural extension service workers and professional workers in agricultural departments of developing countries may also improve themselves professionally through selected courses in agricultural education. Selected courses in agricultural education are designed to meet the needs of professional agricultural workers in building programs for implementing changes. Course content and teaching procedures used in graduate courses are selected to assist in the development of skills in recognizing and analyzing professional problems and initiating plans of action for the solution of these problems.

Candidates for the advanced degrees in agricultural education should have at least one year of successful professional experience. However, evidence of maturity, purposefulness, and scholastic ability may be considered in lieu of experience upon the approval of the Agricultural Education staff and the Head of the Department.

The staff of the Department of Agricultural Education maintains close and continuous contact with teachers and agricultural extension service workers in the field by visiting departments of vocational agriculture and county offices of agricultural extension service farm agents, by attending professional meetings, by assisting with in-service training, and by conducting classes of instruction by extension. The intimate and continuous contact enables the staff to conduct its graduate programs with understanding and appreciation of the relative importance of the many complex problems and difficulties that vocational agriculture teachers, agricultural extension service workers, and professional agricultural workers encounter in their work.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

425. Course Building. (1-2). Credit 2. I

Preparing units of instruction in vocational agriculture for all-day, Young Farmer, and adult classes. Prerequisites: Agricultural Education 301; senior classification; or approval of the Head of the Department. Staff

426. Methods in Adult Agricultural Education. (2-0). Credit 2. II

Planning educational programs and activities for adult farm people in Young Farmer and adult classes. Developing skill in the use of the group process in teaching. Prerequisite: Approval of the Head of the Department. Staff

427. Methods of Developing Farming Programs. (1-2). Credit 2. II

Planning and supervising farm programs of vocational agriculture students. Prerequisite: Approval of the Head of the Department. Staff

FOR GRADUATES

601. Advanced Methods in Agricultural Education. (3-0). Credit 3. I, II, S

An advanced course in methods of teaching vocational agriculture. Prerequisite: Professional experience or approval of the Head of the Department. Staff

605. Supervised Farming. (3-0). Credit 3. I, II, S

Advanced study of supervised farming in vocational agriculture and methods of supervising students in carrying out supervised farming programs. Prerequisite: Professional experience or approval of the Head of the Department. Staff

*Graduate Advisor

607. Future Farmer and Young Farmer Activities. (3-0). Credit 3. I, II, S

Methods of conducting Future Farmer and Young Farmer activities. Prerequisite: Professional experience or approval of the Head of the Department. Staff

610. Methods in Adult and Young Farmer Education. (3-0). Credit 3. I, II, S

A study of the methods of determining educational program needs, organizing, conducting, and evaluating educational programs in agriculture for adult and Young Farmer groups. Emphasis on coordinating and utilizing groups and resources in a community in developing agricultural programs. Suitable for teachers of vocational agriculture, county agricultural extension agents, and other professional agriculture workers. Prerequisite: Professional experience or approval of Head of the Department. Staff

613. Administration and Supervision of Agricultural Education. (3-0). Credit 3. I, S

Problems of organization, administration, financing, and supervision of vocational agriculture, and extension work. Prerequisite: Professional experience or approval of the Head of the Department. Staff

615. Philosophy of Agricultural Education. (3-0). Credit 3. I, II, S

A study of the philosophy and evaluation of agricultural education. Emphasis on the development and use of evaluative criteria and tests in the field of vocational education in agriculture. Prerequisite: Professional experience or approval of the Head of the Department. Staff

616. Program Building in Agricultural Education. (3-0). Credit 3. I, II, S

Organization of programs in agricultural education and agricultural extension education on local, state, and national basis. Securing assistance of public school administrators, farmers, and county, state, and national agricultural agencies in program building. Prerequisite: Professional experience or approval of the Head of the Department. Staff

619. Workshop in Agricultural Education. Credit 1 to 3. I, II, S

A workshop offered on a one-, two-, three-, or six-week or full semester basis to study selected problems in the areas of agricultural or extension education. Committees are set up to utilize consultants in specialized areas of study. Prerequisite: Professional experience or approval of the Head of the Department. Staff

630. Guidance and Counseling for Rural Youth. (3-0). Credit 3. I, II, S

Analysis of occupational and vocational opportunities for rural youth, techniques of individual group counseling and guidance. Practicum in personality and occupational interest testing. Prerequisite: Approval of the Head of the Department. Staff

640. Methods of Technological Change. (3-0). Credit 3. I, II, S

The dynamics of cultural change as a theoretical framework for the process of planned technological change, the methods of planning and implementing technological change, the effects of technological change and how they can be predicted abroad. The land grant college as an institutional vehicle for planned technological change. Especially adapted for foreign students and American educators and technicians preparing for duty abroad. Prerequisite: Approval of the Head of the Department. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Studies related to classroom, laboratory, supervised farming, adult and Young Farmer education activities, and agricultural extension programs. Prerequisite: Approval of the Head of the Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis for Master of Science programs only. Prerequisite: Approval of the Head of the Department. Staff

Department of Agricultural Engineering

PRICE HOBGOOD* (Head), O. R. KUNZE, E. T. SMERDON*,
J. W. SORENSON, L. H. WILKES

Agricultural engineering is a relatively new subject. As the name implies, it involves both agriculture and engineering, but more specifically refers to the application of basic engineering principles and practices to agriculture and related industries. The growing need for an expanded and maximum agricultural production consistent with the greatest possible economy and efficiency has created numerous problems of an engineering nature. Some of these include the design of new mechanical devices for the cultivation, harvesting and storage of specific crops; the development of effective and efficient methods for the control of rainfall and water under various crop, soil, and climatic conditions; the creation of new applications for the utilization of electricity and other development which will provide for greater efficiency.

This expansion in the field of agricultural engineering has created an increasing need for individuals having a thorough training in the basic science subjects, in certain basic and applied agricultural and engineering subjects, and in such humanistic subjects as English, history, and economics. A four-year course of study is seldom adequate to provide this broad training for the agricultural engineer, particularly if he plans to enter certain educational, research, or scientific fields of employment. For this reason, the Agricultural Engineering Department is able to offer advanced courses in various phases of the subject, including power and machinery, farm structures, land reclamation, drainage and irrigation, and rural electrification, whereby the student may obtain a more complete and thorough knowledge and training in any specific phase of agricultural engineering. A modern building and up-to-date equipment are available for graduate study in various fields.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

410. Irrigation and Drainage Engineering. (2-3). Credit 3. II

Engineering principles of irrigation. Water sources; measurement and distribution of water; irrigation pumps; design of surface and sprinkler irrigation systems; salinity control. Drainage engineering. Design of surface and subsurface drainage systems; drainage districts and laws. Prerequisites: Agronomy 445 or registration therein; Civil Engineering 201, 311. Mr. Smerdon

413. Agricultural Structures Design. (2-3). Credit 3. II

Engineering principles of farm structures design; loads, reactions, and force systems; analysis and design of wood and steel beams, light frames and connections. Fundamentals of design of concrete beams, slabs, and columns as applied to agricultural buildings. Prerequisites: Agricultural Engineering 301; Civil Engineering 305. Staff

418. Agricultural Process Engineering. (2-3). Credit 3. I

Engineering principles in agricultural processing. Psychrometrics and thermodynamics of air, water, water vapors and pressures, vapor transmission, drying humidification, heating, refrigeration, heat transfer, conditioning of air, fluid flow, ventilation, fan laws and air conveying. Prerequisite: Mechanical Engineering 323. Mr. Sorenson

428. Soil and Water Conservation Engineering. (2-3). Credit 3. I

Engineering principles of soil and water conservation. Rainfall and runoff; soil erosion by water and wind; terrace and terrace outlet design; design of agricultural reservoirs and related structures. Prerequisites: Civil Engineering 201, 311, or registration therein. Mr. Smerdon

430. Farm Electrification Engineering. (2-3). Credit 3. II

Principles of electricity in farm electrification. Fundamentals of alternating currents and circuits with emphasis on power, energy, resistance, in-

*Graduate Advisor

ductance, capacitance and power factor. Includes the theory of magnetism and principles of transformers, generators and motors. Prerequisite: Electrical Engineering 305. Mr. Kunze

440. Farm Electrification. (3-0). Credit 3. S

This course includes the fundamentals of farm wiring, lighting and the design, construction, and operation of electric water systems, refrigeration equipment, brooders, milking machines, feed processing and handling equipment, hay and grain driers, and other electric equipment used in farm production. This is a special course for teachers and prospective teachers in vocational agriculture to be offered for a three-week period during the summer. Mr. Kunze

481. Seminar. (1-0). Credit 1. I

A review of current literature dealing with agricultural engineering problems presented by staff members and students. Prerequisite: Senior classification. Mr. Hobgood

482. Seminar. (1-0). Credit 1. II

Presentation of papers dealing with new developments and results of investigations of problems related to agricultural engineering. Prerequisite: Senior classification. Mr. Hobgood

FOR GRADUATES

601. Instrumentation and Research Methods. (3-0). Credit 3. I

Analysis of research techniques, the scientific method, and the design of experiments. Theory and use of instruments for research, particularly electrical-input transducers. Dimensional analysis, theory of similitude, design of research models, and development of prediction equations. Prerequisite: Approval of the instructor. Mr. Smerdon

602. Irrigation and Drainage. (3-0). Credit 3. II

Theory and practice in irrigation and drainage. Soil moisture, moisture flow, hydraulics of wells, erosion and sedimentation of structures, and theory of water application methods. Salinity and sodicity problems and their control. Drainage methods and theory, steady state and non-steady state problems. Prerequisite: Agricultural Engineering 410 or the equivalent. Mr. Smerdon

603. Agricultural Machinery. (3-0). Credit 3. I

The theory and practice of functional farm machinery design. Encompasses an analysis of the problem need, the functional requirements, the common materials used, the design, testing, and production of efficient operational units. Prerequisites: Agricultural Engineering 208; Mechanical Engineering 313. Mr. Wilkes

605. Agricultural Structures. (3-0). Credit 3. I

A study of the structural, environmental, and economic problems encountered in agricultural buildings with special emphasis on design considerations for structural materials. Also research methods and procedures as they apply to agricultural structures. Prerequisites: Agricultural Engineering 205, 413, 418. Mr. Kunze

606. Agricultural Process Engineering. (3-0). Credit 3. II

Basic engineering principles involved in mechanical handling, cleaning and sorting, size reduction, conditioning, and storage of agricultural products. Includes the use of refrigeration, electric energy, and radiation. Prerequisites: Agricultural Engineering 418, 430; Mechanical Engineering 323. Mr. Sorenson

609. Farm Power. (3-0). Credit 3. II

A study of the basic theory and principles of operation as applied to internal combustion engines used for agriculture. Emphasis is given to the application and functional design requirements and testing procedures. Pre-

requisites: Agricultural Engineering 324; Mechanical Engineering 313, 323. Mr. Hobgood

613. Soil and Water Conservation Engineering. (2-3). Credit 3. I

A study of soil and water conservation, with emphasis on the hydrology of agricultural watersheds, soil erosion theory, functional design of soil and water conservation structures, methods of reducing water losses, and experimental techniques. Prerequisites: Agricultural Engineering 428; Civil Engineering 463. Mr. Smerdon

685. Problems. Credit 1 to 4 each semester. I, II

Advanced laboratory or field problems not related to student's thesis. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II

Research for thesis or dissertation. Staff

Animal Breeding

A major in animal breeding may be undertaken by selecting appropriate courses in genetics and in animal husbandry, dairy science, or poultry science.

Department of Animal Husbandry

R. O. BERRY, O. D. BUTLER, JR. (Head), Z. L. CARPENTER, T. C. CARTWRIGHT, R. J. COOPER, F. I. DAHLBERG, W. C. ELLIS, FRED HALE, G. T. KING, J. K. RIGGS, J. M. SHELTON, A. M. SORENSEN, JR.

Advanced study in animal husbandry prepares the graduate for a future in teaching, research, extension, livestock production, and the meats industry. Major subjects may be selected from the following:

Animal Breeding	(M.S. and Ph.D.)
Animal Nutrition	(M.S. and Ph.D.)
Livestock Production	(M.S.)
Meats	(M.S. and Ph.D.)
Physiology of Reproduction	(M.S. and Ph.D.)

To enter graduate study in any of the subject matter fields in animal husbandry, the student should have a Bachelor of Science degree or equivalent in animal husbandry. Experience gained by working with livestock or meats is desirable.

The animal husbandry subject matter fields are strongly supported by course work in the related Departments of Agricultural Economics and Sociology, Biochemistry and Nutrition, Biology, and in the departments of the College of Veterinary Medicine.

Livestock, laboratory facilities, and special equipment are available for research in the subject matter fields. The Data Processing Center with the most modern machines is used in analysis of research data.

No foreign language is required for the Master's degree. However, foreign language is recommended for those candidates who expect to go on for the Ph.D. Each thesis is to be written in a form acceptable for publication in a journal or bulletin in addition to the regularly submitted thesis manuscript.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

306. Animal Breeding. (2-2). Credit 3. II 1965, 1966, 1967; S 1965, 1967

The description of genetic populations and techniques of quantitative genetics as a means of accomplishing genetic improvement of animals through selection and mating systems are covered under the major topics: gene frequency, heritability, genetic relationship, pedigree analysis, inbreeding, line

breeding, outbreeding, crossbreeding, heterosis, individual selection, progeny and sib testing, family selection, and selection indexes. Prerequisite: Genetics 301. Mr. Cartwright

406. Beef Cattle Production. (2-2). Credit 3. I 1965; 1966, 1967; II 1965, 1966, 1967; S 1966

Systems of production; establishing a breeding herd; mating and reprouction; performance and progeny records for selecting breeding stock; feeding and managing the breeding herd; systems of managing stockers and feeders; fattening cattle for market; farm steer beef production and commercial feedlot finishing; planning commercial and purebred cattle enterprises; fitting and showing; animal health; marketing. Prerequisite: Animal Husbandry 303. Mr. Franke

412. Swine Production. (2-2). Credit 3. I 1965, 1966; S 1967

Historical; feeding and handling the breeding herd during various seasons; culling; meat type hog selection records; the sow and the litter; growing and fattening pigs; forage crops; feeding on forage; dry lot feeding; choice and value of feeds; garbage feeding; prevention of disease; the purebred herd; fitting and showing. Prerequisite: Animal Husbandry 303. Mr. Hale

433. Reproduction in Farm Animals. (2-2). Credit 3. I 1965, 1966, 1967; II 1965, 1966, 1967; S 1966

A physiological approach to the reproductive processes in cattle, sheep, swine, and horses. Study includes hormones; estrus and estrous cycles; ovulation; mating; gestation; pregnancy tests; parturition; sperm physiology; semen evaluation; collection and storage of semen; factors affecting fertility rates and the primary causes of sterility in females and males. Prerequisite: Veterinary Anatomy 202 or approval of Head of Department. Mr. Morrow

444. Large Animal Nutrition. (3-0). Credit 3. II 1965, 1966; S 1967

A consideration of feed energy and protein, their utilization and methods of nutritive evaluation. A study of the metabolic and physiological bases for quantitative requirements of large animals for nutrients. Comparison of the nutrition of ruminant and non-ruminant mammals. Prerequisites: Animal Husbandry 303; Poultry Science 411; or approval of Head of Department. Mr. Ellis

FOR GRADUATES

600. Advanced Livestock Management. Credit 3. S

A special three-week workshop course for teachers of vocational agriculture to be offered during the summer. This course includes problems in all phases of animal production selected by the group under the supervision of the instructor. Mr. Dahlberg

605, 606. Advancements in Beef Cattle Production. (3-0). Credit 3 each semester. I 1965, 1967; S 1966; II 1965, 1967; S 1966

A comprehensive review of recent advances in research relative to the various phases of beef cattle production; the application of the basic principles of nutrition, animal breeding, and disease control to the feeding, breeding, and management of beef cattle. Prerequisites: Animal Husbandry 306, 406; or approval of the Head of the Department. Mr. Riggs

607. Meat Science and Research Techniques. (2-2). Credit 3. II 1966

This course will emphasize the biochemical, histological, anatomical, and physical factors associated with the transformation of the muscle cell into meat. The composition and decomposition of meat and those factors associated with palatability of meat will be investigated along with research techniques applicable to meats research. Prerequisite: Animal Husbandry 407 or approval of the Head of the Department. Mr. Carpenter, Mr. King

616. Animal Genetics. (3-3). Credit 4. II 1965, 1966; S 1967

The specialized study of population and quantitative genetics of animals especially as related to the improvement of herds, flocks, or other groups

within a species. Emphasis is placed on causes of change in gene frequency, methods of selection, systems of mating, heterosis, and methods of estimating genetic parameters. Prerequisites: Animal Husbandry 306; Genetics 603; Statistics 406. Mr. Cartwright

619, 620. Advancements in Sheep and Angora Goat Production. (3-0). Credit 3 each semester. I 1967; S 1965; II 1967; S 1965

A comprehensive review of recent advances in research relative to the various phases of sheep and angora goat production; the application of the basic principles of nutrition, animal breeding, and disease control to the feeding, breeding, and management of sheep and angora goats. Prerequisites: Animal Husbandry 306, 414; or approval of Head of Department. Mr. Shelton

621, 622. Advancements in Swine Production. (3-0). Credit 3 each semester. I 1965; S 1966; II 1965; S 1966

A comprehensive review of recent advances in research relating to the various phases of swine production; the application of the basic principles of nutrition, animal breeding, and disease control to the feeding, breeding, and management of hogs; fitting swine production to the whole farm enterprise; special problems relating to the planning and operation of swine production units. Prerequisites: Animal Husbandry 306, 412; or approval of the Head of the Department. Mr. Hale

628. Animal Breeding. (2-0). Credit 2. II 1965, 1967; S 1966

A course designed to acquaint the student with the current status of knowledge in the field of animal breeding through a critical survey of the literature. Emphasis is given papers dealing with problems of breeding for quantitative traits of economic importance in beef cattle, dairy cattle, poultry, sheep, and swine. Considerable attention is focused on methods which have been used or are available for use in studying animal breeding problems. Prerequisite: Animal Husbandry 616. Mr. Cartwright

631. Physiology of Reproduction. (2-2). Credit 3. II 1966, 1967; S 1965

A critique of scientific literature on reproduction. Students compile, evaluate, and summarize literature. Research project proposals are formulated and evaluated. Current topics are discussed and experimental surgery is conducted in the area of reproduction. Prerequisite: Animal Husbandry 433. Mr. Sorensen

681. Seminar. (1-0). Credit 1 each semester. I 1965, 1967; II 1965, 1966, 1967; S 1966

Important current developments in the field of animal husbandry. Review of current literature and presentation of papers on selected animal husbandry topics. Prerequisites: Graduate classification; major in animal husbandry. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Advanced studies in animal husbandry problems and procedures. Problems assigned according to the experience, interest, and needs of the individual student. Registration by approval of Head of Department. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Investigations leading to the student's thesis or dissertation in the fields of animal production, meats, wool and mohair, nutrition, inheritance of farm animals, and physiology of reproduction. Prerequisite: Graduate classification. Staff

Animal Nutrition

A major in animal nutrition may be undertaken by selecting appropriate courses in biochemistry and nutrition and in animal husbandry, dairy science, or poultry science.

Animal Parasitology

S. O. BROWN, J. C. GAINES*, R. L. HANNA, S. H. HOPKINS*,
M. A. PRICE, R. D. TURK*

A major in animal parasitology may be undertaken by selecting appropriate courses in biology, entomology, and veterinary parasitology.

Graduate instruction in parasitology is composed primarily of a detailed study of the more important parasites attacking man and domestic animals, including identification, relation to diseases, biological developments, control, and other special problems concerned with these parasites. Most of the more important ectoparasites of animals are insects and many of the endoparasites are dependent upon insects as vectors. Graduate instruction in this field is accomplished by closely correlating the graduate work offered in the respective Departments of Biology, Entomology, and Veterinary Parasitology. This arrangement makes available to the student the combined facilities of these departments. This combined course of study is intended primarily for the student working toward a Ph.D. degree.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

Biology 433. General Physiology. (3-3). Credit 4. I

Fundamental physiology of protoplasm; basic processes and functions of organs and systems. Emphasis is placed on digestion, respiration, metabolism, excretion, muscular contraction, and reproduction. Prerequisites: Biology 107 and either graduate classification, Biology 218, or the equivalent. Mr. Brown

Biology 435. Advanced Invertebrate Zoology. (3-3). Credit 4. I

Morphology, taxonomy, biology, and phylogeny of invertebrate animals. Prerequisite: Biology 107 or approval of the instructor. Mr. Hopkins

Biology 436. Animal Parasitology. (3-3). Credit 4. II

Study of parasitic worms and protozoa; laboratory methods in parasitology. Prerequisite: Biology 435 or equivalent. Mr. Hopkins

FOR GRADUATES

Biology 627. Helminthology. (3-3). Credit 4. I

A study of the parasitic worms, especially Trematoda, Cestoda, Nematoda, and Acanthocephala. Prerequisite: Biology 436. (Offered in 1964-65 and in alternate years thereafter.) Mr. Hopkins

Biology 630. Protozoology. (3-3). Credit 4. I

Morphology, taxonomy, physiology, reproduction, phylogeny, ecology, and life history of both free living and parasitic protozoa. May be taken concurrently with parasitology. Prerequisite: Biology 108. (Offered in 1965-66 and in alternate years thereafter.) Mr. Hopkins

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

A detailed study of anatomical structures of insects. Prerequisite: Entomology 305. Mr. Burke

Entomology 615. Insect Physiology. (3-3). Credit 4. I

A study of the physiology of respiration, circulation, digestion, and excretion; the mechanical and chemical senses of insects are considered. Prerequisite: Entomology 306 or equivalent. Mr. Hanna

Entomology 617, 618. Medical Entomology. (3-3). Credit 4 each semester. I, II

The taxonomy and biology of parasitic insects, ticks, mites and their role in the causation and transmission of diseases affecting man and domestic animals. Prerequisite: Entomology 208 or equivalent. Mr. Price

*Graduate Advisor

Entomology 619. Insect Toxicology. (3-3). Credit 4. II

Chemical compounds which possess toxic properties; actions of poisons on insects; evaluation of insecticides in the laboratory and field; and mathematical analysis of data. Prerequisite: Entomology 615. Mr. Hanna

Entomology 691. Research. Credit 1 or more each semester. I, II, S

Research problems on taxonomy, life histories, biological control, ecology, and physiology of insects and the toxicology of insecticides. Prerequisite: Graduate classification. Staff

Veterinary Parasitology 601. Parasitology. Credit 1 to 4 each semester. I

A detailed study of the more important helminth parasites of domestic animals, including their identification, distribution, and life history. Prerequisite: Veterinary Clinics 501 or the equivalent. Mr. Turk

Veterinary Parasitology 691. Research. Credit 1 or more each semester. I, II, S

Research for thesis. Mr. Turk

School of Architecture

T. R. HOLLEMAN, E. J. ROMIENIEC (Chairman), M. M. ROTSCH, WILLARD STRODE, R. F. WHITE

Graduate study in architecture is essentially a matter of individual effort. For this reason, the graduate program of the School is sufficiently broad in scope to encourage individual research in design, structures, history, environment (technology), landscape, and research. No sharp distinction is made between the six, the one being as important as the other in any comprehensive program. The work is so arranged as to enable the student to devote extensive units of his time to research and design and to the problems and construction and professional practice.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

433. Architectural Environment. (3-0). Credit 3. I, II

Study of environmental factors relating to architectural design in terms of natural lighting, natural ventilation and sound. Prerequisites: Physics 202; junior classification. Staff

501. Design V. (0-15). Credit 5. I

Advanced architectural and planning problems, with emphasis on analysis, programming, research, site study, concept, consideration of related design fields, client contact and promotion. Prerequisite: Architecture 402. Staff

502. Design V. (0-15). Credit 5. II

Continuation of Architecture 501; problems of a more complex nature, with emphasis on awareness of office practice. Prerequisite: Architecture 501. Staff

527. Structural Systems. (3-0). Credit 3. I

Advanced studies in the systems of architectural structures. Prerequisites: Architecture 427, 428. Staff

528. Structural Systems. (3-0). Credit 3. II

Study of structural problems as related to actual professional practice; special consideration of design factors, new materials, codes, economy, specification surveys of costs. Prerequisite: Architecture 527. Mr. Strode

554. Professional Practice. (2-0). Credit 2. I, II

To familiarize the student with the usual problems of office practice, professional relations, ethics, building law and contracts. Prerequiiste: Senior classification. Mr. Holleman

ELECTRON
MICROSCOPE

556. City Planning. (2-3). Credit 3. II

Survey of planning principles and procedures; legal aspects; physical and social development of the city; housing. Prerequisite: Senior classification. Mr. Rotsch

FOR GRADUATES

627. Contemporary and Creative Structures. (2-2). Credit 3. I

Studies and analyses of contemporary and creative structures as related to architectural design, with emphasis on esthetic considerations, structural limitations and design, functional use, construction procedures and estimates of cost. Prerequisite: Architecture 528 or the equivalent. Mr. Strode

628. Contemporary and Creative Structures. (2-2). Credit 3. II

Continuation of Architecture 627. Studies and analyses of contemporary and creative structures as related to architectural design with emphasis on esthetic considerations, structural limitations and design, functional use, construction procedures and estimates of cost. Prerequisite: Architecture 627. Mr. Strode

629, 630. History and Archaeology. (2-0). Credit 2 each semester. I, II

Individual problems of study and research in the field of American architecture and archaeology. Mr. Rotsch

681. Seminar. (1-0). Credit 1 each semester. I, II, S

Review of current work in architecture; original presentation on selected topics. Mr. Romieniec, Mr. Rotsch, Mr. Strode, Mr. White

685. Problems. Credit 1 to 4. I, II, S

Individual problems involving the application of theory and practice in the design and construction of buildings and groups of buildings. Staff

691. Research. Credit 2 to 4 each semester. I, II, S

Research for thesis. Mr. Romieniec, Mr. Rotsch, Mr. Strode, Mr. White

Department of Biochemistry and Nutrition

See also **Animal Nutrition**

B. J. CAMP, J. R. COUCH, C. R. CREGER, H. R. CROOKSHANK, H. H. DARON, J. W. DIEKERT, H. O. KUNKEL, C. M. LYMAN* (Head), J. M. PRESCOTT, RAYMOND REISER, L. R. RICHARDSON, E. S. VANDERZANT, U. G. WHITEHOUSE

Facilities and equipment are available for advanced instruction in various phases of biochemistry and nutrition. There is an adequate stock of the usual equipment necessary for metabolic, nutritional, and chemical work. The Department has adequate facilities for the use of radioactive isotopes as tracers for following specific chemical reactions in plant and animal tissues. Other special equipment includes an ultracentrifuge, automatic amino acid analyzers, gas chromatographic equipment, Tiselius electrophoresis apparatus, Barcroft-Warburg tissue respiration apparatus, Beckman spectrophotometers, high speed refrigerated centrifuges, and paper electrophoresis apparatus.

Research is in progress in the fields of vitamins, antibiotics, proteins, viruses, minerals, lipids, enzymatic systems, and microbiology. The Department cooperates with Animal Husbandry, Dairy Science, Poultry Science, and other departments in studying the nutritional requirements of various farm animals. Research in plant biochemistry includes studies on the chemical structure of the poisonous constituents of range plants, and the biochemistry and cytology underlying the storage and mobilization of metals and proteins in seeds and seedlings.

Students planning to take work in biochemistry and nutrition should have adequate preparation in chemistry, the biological sciences, physics, and mathematics.

*Graduate Advisor

The Electron Microscope—Professor instructing graduate students in the use of the electron microscope in their research problems. (This is a college-wide use facility located in the Herman Heep Building.)

A program in animal and poultry nutrition may be developed from the offerings of various departments and schools. Students desiring such a program should consult the Dean of Graduate Studies and the representatives of the appropriate departments.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Human Nutrition. (3-0). Credit 3. I

A study of the functions of food constituents in health and in physiological stress. The economic, national, and international aspects of human nutrition. Prerequisite: Junior classification. Mr. Richardson

410. Introductory Biochemistry. (3-3). Credit 4. I

The chemistry of the major constituents of living organisms. Biophysical and biochemical processes in plants and animals are stressed. The laboratory work includes the application of quantitative analytical procedures to plant and animal tissues and fluids. Prerequisites: Chemistry 223 and 231 or 228. Staff

430. Electron Microscopy. (2-3). Credit 3. II

Descriptive treatment of various aspects of electron microscopy and laboratory practice employing selected specimens. Elementary discussion of electron optics, design of electron microscopes, photographic plates, underfocusing, overfocusing, asymmetry, colloidal state, shadow casting. Biological and physical science applications in all technical departmental fields of the University given equal attention. Prerequisite: Senior or graduate classification in a physical or biological science, or approval of the instructor. Mr. Whitehouse

Animal Husbandry 444. Large Animal Nutrition. (3-0). Credit 3. II

See the Department of Animal Husbandry for a full description of this course.

Poultry Science 411. Poultry Feeding. (3-2). Credit 4. I

See the Department of Poultry Science for a full description of this course.

FOR GRADUATES

611. General Biochemistry. (3-0). Credit 3. I

Chemistry of the principal constituents of living cells, with an introduction to intermediary metabolism. Prerequisites: Chemistry 207 or 316, 228. Mr. Prescott

612. Laboratory Procedures in Biochemistry. (0-6). Credit 2. I

A laboratory course designed to familiarize the student with the application of chemical and biological methods to the solution of fundamental biochemical problems. Prerequisite: Biochemistry and Nutrition 611 or registration therein. Mr. Prescott

613. Vitamins. (3-0). Credit 3. II

The role of vitamins in animal nutrition and metabolism. Occurrence in plant and animal tissues. The specific functions of vitamins in enzyme systems. Prerequisite: Chemistry 228. Mr. Couch

614. The Determination of Vitamins and Minerals. (0-3). Credit 1. II

A laboratory course designed to familiarize the student with methods for the determination of vitamins and minerals in biological materials. Prerequisite: Biochemistry and Nutrition 613 or registration therein. Mr. Couch

615. Experimental Animal Procedures. (0-3). Credit 1. II

A laboratory course involving the management, preparation of purified rations, and the production and cure of nutritional diseases. Prerequisites: Biochemistry and Nutrition 613, 614 or registration therein. Staff

618. Chemistry and Metabolism of Lipids. (2-0). Credit 2. II

An advanced course in lipid chemistry and metabolism. Prerequisite: Biochemistry and Nutrition 611. Mr. Reiser

619. Proteins. (2-0). Credit 2. I

Advanced studies on the chemical, physical, and biological properties of proteins. Particular emphasis will be placed on the biological synthesis and metabolism of proteins. Prerequisite: Biochemistry and Nutrition 611. Mr. Dieckert

620. Advanced Biochemical Techniques. (0-6). Credit 2. S

A laboratory course involving practice in the use of special techniques and instruments employed in biochemical research and the isolation, identification, and analysis of biological compounds. Preparation of representative enzymes and laboratory work on factors affecting their action. Prerequisites: Biochemistry and Nutrition 612, 624. Staff

624. Enzymes. (2-0). Credit 2. II

General principles of enzyme chemistry. The physical chemistry of enzyme action. Types of enzymes and coenzymes. Enzymes in the patterns of metabolism. Prerequisites: Biochemistry and Nutrition 611; Chemistry 324 or 342; or approval of instructor. Mr. Daron

626. Radioisotopes Techniques. (2-3). Credit 3. I

A general course on the nature and utilization of isotopes in chemical and biochemical studies. History, general properties of nuclei, nuclear reactions, radiations; health physics and instrumentation will be included. Prerequisites: Chemistry 316, 317; Physics 201, 202. Mr. Dieckert

627. Mineral Nutrition and Metabolism. (2-0). Credit 2. II

A study of the role of minerals in animal nutrition with emphasis on physiological function, biochemical interrelationships with other minerals and other nutrients, deficiency symptoms and nutritional significance. Prerequisite: Biochemistry and Nutrition 410 or 611. Mr. Creger

630. Metabolism. (3-0). Credit 3. II

A descriptive consideration of the various chemical pathways of metabolism. Prerequisites: Biochemistry and Nutrition 611, 613. Staff

632. Radioactive Tracer Techniques in Metabolism. (1-3). Credit 2. II

The use of isotopes in measuring the metabolic pool, precursor-product relationships, isotopic competition, cycles and intermediates, isotopic dilution and double dilution, permeability, adsorption and absorption and assay of common elements. Prerequisites: Biochemistry and Nutrition 611, 612, 626, or approval of instructor. Mr. Dieckert

634. Techniques in Lipid Chemistry. (0-6). Credit 2. II

This course is designed to acquaint the student with recently developed techniques in chemical and biochemical investigations. Prerequisites: Biochemistry and Nutrition 612, and 618 or registration therein. Mr. Reiser

640. Clinical Chemistry. (2-6). Credit 4. II

A study of the quantitative distribution of body constituents and their physiological interpretations. Prerequisites: Biochemistry and Nutrition 312 or 410 or 611, or Biology 433, or Veterinary Physiology and Pharmacology 427. Mr. Crookshank

681. Seminar. (1-0). Credit 1 each semester. I, II

The study and discussion of original articles in biochemistry and nutrition and related fields designed to broaden the understanding of problems in the field and to stimulate research. Staff

685. Problems. Credit 1 or more each semester. I, II

An advanced course in biochemical laboratory procedures including preparations and instrumentation. Problems assigned according to the experience, interests, and needs of the individual student. Staff

691. Research. Credit 1 or more each semester. I, II

Research for thesis or dissertation. Laboratory facilities are available for original investigations in various phases of biochemistry and nutrition. Prerequisite: Approval of major advisor. Staff

Genetics 631. Biochemical Genetics. (2-0). Credit 2. I

See Genetics Section in the Department of Plant Sciences for a full description of this course.

Department of Biology

See also **Animal Parasitology** and **Physiology of Reproduction**

S. O. BROWN, W. J. CLARK, L. S. DILLON, W. J. DOBSON, H. L. GRAVETT, S. H. HOPKINS*, E. W. HUPP, G. M. KRISE. CHARLES LaMOTTE, D. D. McLAIN, JR., J. G. MACKIN (Head), A. B. MEDLEN, J. J. SPERRY*, W. A. TABER

The graduate courses and research in biology include the three major fields of bacteriology, botany, and zoology, and the minor fields of aquatic biology, microtechnique, cytology, and physiology. Biology has its main applications in medicine, veterinary medicine, and the various agricultural fields including fisheries and wildlife management. The objective of the graduate courses in biology is to train for research and teaching.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

343. Histology. (2-3). Credit 3. I

Normal tissues of vertebrates including histogenesis of some. Histogenesis and organography of mammalian tissues reviewed. Prerequisite: Biology 217. Mr. Medlen

344. Embryology. (2-3). Credit 3. II

Introduction to general and comparative vertebrate embryology; emphasis on early development of frog, chick, and pig. Prerequisite: Biology 217. Mr. Gravett

353. Mycology. (2-3). Credit 3. II

An introduction to the study of fungi, including structure, reproduction, ecological relationships, and taxonomic aspects. Prerequisites: Biology 101, 206, or approval of instructor. (Offered in 1964-65 and in alternate years thereafter.) Mr. McLain

422. Microtechnique. (1-6). Credit 3. II

Standard methods in the preparation of permanent microscopic slides of plant and animal tissues. Prerequisite: Twelve hours of biological science, including Biology 343. Mr. Medlen

433. General Physiology. (3-3). Credit 4. I

Fundamental physiology of protoplasm; basic processes and functions of organs and systems. Emphasis is placed on digestion, respiration, metabolism, excretion, muscular contraction, and reproduction. Prerequisites: Biology 107 and either graduate classification, Biology 218, or the equivalent. Mr. Brown

434. Circulatory and Nerve Physiology. (2-3). Credit 3. II

Comparative functions of the circulatory, nervous system, and of the organs of special sense. Prerequisites: Biology 218; or Biology 107 and senior or graduate classification in an animal science. Mr. Brown

435. Advanced Invertebrate Zoology. (3-3). Credit 4. I

Morphology, taxonomy, biology, and phylogeny of invertebrate animals. Prerequisite: Biology 107 or approval of the instructor. Mr. Hopkins

*Graduate Advisor

436. Animal Parasitology. (3-3). Credit 4. II

Study of parasitic worms and protozoa; laboratory methods in parasitology. Prerequisite: Biology 435 or equivalent. Mr. Hopkins

438. Bacterial Physiology. (2-6). Credit 4. I

A detailed study of the physiological activities of bacteria. Prerequisite: Biology 206. (Offered in 1964-65 and in alternate years thereafter.) Mr. Taber

453. Plant Anatomy. (2-3). Credit 3. I

Fundamental anatomy of the vegetative and reproductive organs of the plant with emphasis on development of tissue types. Technique of staining and mounting of plant tissues. Prerequisite: Six hours of plant sciences including Biology 101 or the equivalent. Mr. LaMotte

457. Bacterial Ecology. (2-6). Credit 4. II

Relation of bacteria to their environment, especially to other microorganisms. Methods of isolation, identification, and differentiation. Prerequisite: Biology 206. (Offered in 1963-64 and in alternate years thereafter.) Mr. Taber

481. Seminar in Biology. (1-0). Credit 1. I

Recent advances. For graduates and advanced undergraduate majors in either microbiology, botany, or zoology. May be repeated once for credit not to exceed two hours. Staff

482. Seminar in Biology. (1-0). Credit 1. II

Integration of the branches of biological science. May be repeated once for credit not to exceed two hours. Staff

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

See the Department of Dairy Science for a full description of this course.

Dairy Science 326. Food Bacteriology. (3-3). Credit 4. II

See the Department of Dairy Science for a full description of this course.

FOR GRADUATES

600. Teaching of High School Biology. (2-3). Credit 3. S

A study of the problems and techniques of teaching biology in the secondary school, along with appropriate subject matter. The laboratory work emphasizes those exercises, projects, and materials which are most useful in the high school biology laboratory and in stimulating interest in the subject. Prerequisite: Approval of the Heads of the Biology and Education and Psychology Departments. Mr. LaMotte

603. Advanced Vertebrate Zoology. (1-5). Credit 3. II

Phylogeny of vertebrates based on comparative anatomy, histology, embryology, and distribution. Prerequisites: Biology 218, 343, 344, or the equivalent. Mr. Dobson

604. Advanced Embryology. (1-5). Credit 3. I

Comparative and experimental studies of the mechanics of embryonic development. Prerequisites: Biology 218, 343, 344, or the equivalent. (Offered in 1964-65 and in alternate years thereafter.) Mr. Gravett

608. Ecology and Taxonomy of the Algae. (2-6). Credit 4. I

A study of the form, structure, reproduction, and ecology of the algae, with detailed work on selected locally available forms, both marine and fresh water. Prerequisite: Biology 327 or 353 or approval of the instructor. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Clark

615. Cytology. (2-6). Credit 4. I

An intensive study of the organization and activities of the cell, with emphasis on topics related to cytogenetics and cytotaxonomy. Prerequisites: Genetics 301; approval of the instructor. Mr. LaMotte

619. Systematic Botany. (2-6). Credit 4. I

Principles of taxonomy. Phylogenetic considerations and criteria used in schemes of classification. History of classification. Nomenclature and identification. Field and herbarium techniques. Prerequisites: Biology 102, 327, or approval of the instructor. Mr. Sperry

620. Systematic Botany. (2-6). Credit 4. II

Survey of Angiosperms with emphasis on relationships. Biosystematics and modern taxonomy. Procedures in monograph preparation. Monographers. Field and herbarium techniques with problems designed for individual needs and interests. Prerequisite: Biology 619 or approval of the instructor. Mr. Sperry

623. Plant Morphology. (2-6). Credit 4. II

A study of the anatomical, reproductive, and organogenetic features of representative vascular plants; emphasis on economic forms. Prerequisite: Biology 327 or the equivalent. Mr. LaMotte

627. Helminthology. (3-3). Credit 4. I

A study of the parasitic worms, especially Trematoda, Cestoda, Nematoda, and Acanthocephala. Prerequisite: Biology 436. (Offered in 1964-65 and in alternate years thereafter.) Mr. Hopkins

630. Protozoology. (3-3). Credit 4. I

Morphology, taxonomy, physiology, reproduction, phylogeny, ecology, and life history of both free living and parasitic protozoa. May be taken concurrently with parasitology. Prerequisite: Biology 108. (Offered in 1963-64 and in alternate years thereafter.) Mr. Hopkins

632. Methods in General Physiology. (2-6). Credit 4. II

Methods for the quantitative study of metabolism, respiration, circulation, excretion, movement, and other basic physiological phenomena. Recent advances in physiological methods to be presented on a seminar basis. Prerequisite: Biology 433 or the equivalent. Mr. Brown

635. Physiology of Microorganisms. (2-6). Credit 4. I

An advanced consideration of the physiological activities of bacteria with special emphasis on metabolism. Prerequisites: Biochemistry and Nutrition 312 or 410; Biology 206. (Offered in 1964-65 and in alternate years thereafter.) Mr. Taber

647. Industrial Microbiology. (2-6). Credit 4. II

Microorganisms as the basis of industrial processes. Practice includes antibiotic assay; analysis of products of metabolism, and fermentation balances. Prerequisites: Biochemistry and Nutrition 312 or 410; Biology 206. (Offered in 1963-64 and in alternate years thereafter.) Mr. Taber

649. Biology of the Endocrine Glands. (3-3). Credit 4. I

A study of the structure, development, comparative anatomy, and physiology of the endocrine glands of the different animal groups. Prerequisites: Three hours of either anatomy or anatomy and physiology. Mr. Brown

651. Mycology. (2-6). Credit 4. II

Detailed studies of the fungi, with emphasis on life cycles of representative forms; genetics and cytology; principles of taxonomy; ecology and geographical distribution. Prerequisite: Biology 353 or approval of the instructor. (Offered in 1963-64 and in alternate years thereafter.) Mr. McLain

653. Zoogeography. (3-0). Credit 3. II

A study of the distribution of animals during geologic and present times; emphasis on the role of ecology and the effects of geography upon terrestrial and marine distribution. Prerequisite: Twelve hours of biological sciences, including at least 3 hours of advanced courses. Mr. Dillon

654. Radiation Biology. (3-0). Credit 3. I

Lecture and demonstration reviewing the physical theory of radiations important to living organisms with especial emphasis on ionizing radiation: X-ray, gamma, alpha, beta, and neutron. Survey of the effects of ionizing radiations on biological systems. Prerequisite: Graduate classification in biological or agricultural science. Mr. Krise

655. Mammalian Radiation Biology. (3-0). Credit 3. II

Lecture and demonstration on effects of X-ray, gamma, alpha, beta, and neutron radiation on mammalian organisms. Effects of dose rate and method of delivery will be covered. Both early and delayed effects will be emphasized. Use of radioactive materials in mammalian biology will be introduced. Prerequisites: Biology 433, 434, 654. Mr. Hupp, Mr. Krise

656. Analytical Histology. (2-6). Credit 4. II

Designed to acquaint the student with certain quantitative histochemical techniques in plant and animal science as applied to nucleoproteins, carbohydrates, lipids, and enzymes. Presentation of cytological evidences which aid in localizing the activities of nucleoproteins in cell metabolism. Prerequisites: Biology 343 or 453 or the equivalent; Chemistry 227. Staff

660. Aquatic Ecology. (2-3). Credit 3. II

A study of fresh water as an environment; its physical and chemical characteristics; the plant and animal communities which inhabit it; and the mechanisms by which the physical and chemical characteristics and the interactions of the biological populations affect the distribution, population dynamics, and productivity of the aquatic organisms. Prerequisites: Biology 327 and 435 or the equivalent; graduate classification or approval of the instructor. Mr. Clark, Mr. Mackin

661. Cellular Physiology. (2-3). Credit 3. II

A consideration of the physiochemical nature of the cell and its relationship to the environment with emphasis on conversion of energy and matter as required by the cell as a living unit. Prerequisites: Graduate classification in biology or animal or plant science; approval of the instructor. Mr. Krise

662. Biology of the Mollusca. (3-3). Credit 4. I, II, S

Conferences and laboratory work on classification, life, history, morphology, physiology, ecology, diseases, parasites, predators, and competitors of molluscs, with special reference to oysters. Some attention will be given to the economic aspects of molluscs. Emphasis will be placed on studies of original literature. Prerequisite: B.S. degree in biology or related fields, or approval of the instructor. Staff

681. Seminar. (1-0). Credit 1. I, II

Detailed reports on specific topics in the field chosen. Prerequisites: Graduate classification in the appropriate field. Staff

685. Problems. Credit 1 to 4 each semester. I, II

Limited investigations in fields other than those chosen for thesis or dissertation. Staff

691. Research. Credit 1 or more each semester. I, II

Research for thesis or dissertation. Prerequisite: Approval of ranking professor in the field chosen. Staff

Plant Physiology and Pathology 607. Physiology of the Fungi. (3-0). Credit 3. II

See Plant Physiology and Pathology Section of the Department of Plant Sciences for a full description of this course.

Plant Physiology and Pathology 618. Bacterial Plant Diseases. (2-3). Credit 3. II

See Plant Physiology and Pathology Section of the Department of Plant Sciences for a full description of this course.

Plant Physiology and Pathology 620. Plant Viruses. (2-0). Credit 2. II

See Plant Physiology and Pathology Section of the Department of Plant Sciences for a full description of this course.

School of Business Administration

R. L. ELKINS, P. B. GOODE, S. C. HOYLE, JR., T. D. LETBETTER, W. S. MANNING, E. S. PACKENHAM, J. E. PEARSON (Head), R. M. STEVENSON, H. G. THOMPSON, JR.

The graduate work in business administration is designed to train students for research or for careers in business and government where the student desires a more advanced course than is offered at the undergraduate level. Students preparing to enter the teaching profession may take a combination of business and education courses. Graduate students may specialize in accounting and management.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

330. Advanced Accounting. (3-0). Credit 3. I, S

Special phases of partnership accounting; joint ventures; consignments; installment sales, accounting for insurance costs; statement of affairs and accounting for insolvent concerns; compound interest; home office and branch accounting. Prerequisite: Business Administration 328 or registration therein. Staff

341. Corporation Finance. (3-0). Credit 3. I, II, S

A survey of the principles underlying the financial practices and financial management of the modern business corporation. A study will be made of advantages and disadvantages of the corporation, sources of long-term and short-term credit, working capital, surplus and dividend policy, expansion and combination problems, and failure and reorganization. Prerequisite: Economics 203 or the equivalent. Staff

403. Income Tax. (3-0). Credit 3. I, II

Income tax legislation; the present income tax law and regulations; treasury decisions, court decisions, and departmental rulings; income tax problems and returns. Prerequisite: Business Administration 327. Staff

406. Managerial Accounting. (3-0). Credit 3. II

A study of the uses of accounting information by management. Emphasis is placed on accounting procedures and reports essential to management. Cost analysis, cost control, budgeting and controllership. Prerequisite: Business Administration 329. Mr. Letbetter

407. Auditing. (3-0). Credit 3. I

Auditing procedures used by internal auditors and independent public accountants; preparation of working papers. Prerequisites: Business Administration 328, 329. Mr. Manning

408. Auditing. (3-0). Credit 3. II

A continuation of Business Administration 407. Work on an audit practice case with preparation of working papers and audit report, case studies involving auditing problems in special situations. (Required of students who plan to enter public accounting.) Prerequisite: Business Administration 407. Mr. Manning

409. Survey of Accounting Principles. (3-0). Credit 3. I, II, S

A survey of accounting designed for students majoring in engineering and architecture. The course provides for a survey of accounting procedures, basic elements of cost accounting, and the preparation and interpretation of financial statements. The course is not as comprehensive as Business Administration 227, 228, is not open to students in business administration, agricultural administration, or liberal arts. Prerequisite: Junior classification. Staff

419. Legal Principles Relating to Accounting. (3-0). Credit 3. I, S

An intensive study of legal principles emphasizing those which arise in the practice of accounting. Prerequisite: Senior classification. Mr. Goode

420. Principles of Investment. (3-0). Credit 3. I, II, S

An analysis of the character of various investment risks, comparison of investment media, and a study of the securities market. Theories and financial tools vital to decision making concerning the structure of the security portfolio and changes in that structure to adapt most advantageously to changing economic conditions and particular needs are investigated. Prerequisite: Business Administration 341. Staff

428. Real Estate Titles and Conveyances. (3-0). Credit 3. I, II, S

The ownership and transfer of titles to real property, including deeds, easements, urban and rural property with special attention to zoning, building codes, private restrictions and conditions. The law of fixtures, timber and crops, mortgages and liens, building contracts, plans and specifications, performance bonds, mines and minerals, contracts of sale, escrow and earnest money agreements, real estate brokers, sufficiency of property description, and other matters related to real property. Prerequisite: Business Administration 211. Mr. Hoyle

430. Cost Accounting Survey. (3-0). Credit 3. II, S

An introductory cost accounting course following Business Administration 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: Business Administration 409. Staff

432. Security Analysis. (3-0). Credit 3. II

Methods of analyzing individual security issues, establishment of principles of selection and protection of security holdings, setting up sound and workable tests of safe investments including financial statement analysis, understanding rights and interests of investors in senior securities and owners of common stock. Prerequisite: Business Administration 420. Staff

436. Sales Management. (3-0). Credit 3. II, S

A consideration of the problems confronting the modern sales executive; organization of sales departments; product research, selection and recruiting; compensation plans, routing, supervision, and costs connected with sales administration. Prerequisite: Business Administration 435 or 448. Mr. Thompson

445. Marketing Research. (3-0). Credit 3. I

A study of the nature and uses of marketing research in business. Emphasis is on methods of collecting and interpreting marketing information and specific application to problems in marketing. Prerequisites: Business Administration 303, 321. Mr. Thompson

446. Marketing Industrial Products. (2-0). Credit 2. II

Management aspects and economic factors affecting marketing policies are considered. Special emphasis is given to marketing research, marketing policies, channels of distribution, brand policy, pricing and control of marketing operations as they affect industrial products. A term project involving a report on the marketing of a specific industrial product is required of each student. Prerequisites: Business Administration 321, and Business Administration 303 or Mathematics 116. Staff

448. Marketing Problems. (3-0). Credit 3. II

A study of the problems involved in the marketing of industrial and consumer goods; the problems connected with customer relations, channels of distribution, brands, sales promotion, pricing, and legislation. Prerequisites: Business Administration 321; Economics 203, 204. Mr. Thompson

454. Law of Private Corporations. (3-0). Credit 3. I, II

Powers and limitations of the corporate form of business organization as distinguished from other forms of business enterprise. Legal problems encountered in formation, management, financing, and dissolution of corporations. Rights of corporate stockholders and creditors. Legislative control under state and federal statutes. Prerequisite: Business Administration 212. Mr. Sandstedt

459. Management Problems. (3-0). Credit 3. I, S

A case study approach to the solution of management problems dealing with effective use of personnel, materials, facilities, finances, methods, time, markets, and research. Prerequisite: Business Administration 363 or approval of the instructor. Staff

466. Management Policy. (3-0). Credit 3. II, S

Policy problems of the business organization. Designed to develop official thinking and provide training in writing and presenting oral solutions to problems requiring business decision making. Integrates the fields of marketing, finance, accounting, economics, law, and insurance into managerial concept of business decision making. Prerequisites: Senior classification; Business Administration 363 or approval of the instructor. Staff

FOR GRADUATES

601. Statement Analysis. (3-0). Credit 3. II, S

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: Business Administration 330. Mr. Letbetter

602. Consolidated Statements. (2-0). Credit 2. II

Consolidated balance sheets, consolidated income and surplus statements, holding companies, mergers. Prerequisite: Business Administration 330. Mr. Packenham

603. Price Analysis. (3-2). Credit 4. I, S

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 a commodity. Prerequisites: Business Administration 303; Economics 203, 204. Staff

604. Statistics. (3-2). Credit 4. II, S

Curve fitting and empirical formulas. Multiple correlation, mathematical and graphic. Sampling and measures of unreliability. Chi-square test. Analysis of variance and covariance. Prerequisites: Business Administration 303; Mathematics 102. Mathematics 110 is recommended. Staff

605. Accounting Problems. (3-0). Credit 3. I

A study of advanced accounting theory and problems dealing primarily with corporation accounting, assets and liabilities, analysis of statements, and cost accounting. The problems considered will be of the type currently stressed in accounting examinations. Prerequisite: Approval of instructor. Mr. Packenham

606. Accounting Problems. (3-0). Credit 3. II

A continuation of Business Administration 605. The topics will deal primarily with partnerships, fiduciaries, home office and branch, insurance, and auditing. Prerequisite: Approval of instructor. Mr. Packenham

607. Market Analysis. (3-0). Credit 3. I

A critical analysis of selected problems in the field of marketing. Each member of the class will be required to present a term report on some specific problem in the field of distribution. Prerequisites: Business Administration 303, 321. Mr. Thompson

609. Management Seminar. (3-0). Credit 3. I, S

A case study course covering the interrelated functions of production, distribution, and finance. Problems and situations confronting top and middle management are critically examined. Quantitative tools and techniques of accounting, statistics, and mathematics are employed to provide a framework for analysis and decision making. Prerequisite: Approval of instructor. Staff

612. Advanced Taxes. (2-0). Credit 2. II

A study of special income tax problems of taxpayers; Federal estate and gift taxes; Texas inheritance tax; Texas franchise tax on corporations; claims for refund of taxes; preparation of protests to deficiency assessments; planning for tax savings. Prerequisite: Business Administration 403. Mr. Manning

616. Governmental and Institutional Accounting. (3-0). Credit 3. I, S

A study of the accounting principles and procedures peculiar to governmental units and institutions. Prerequisite: Business Administration 328. Economics 412 is recommended. Mr. Letbetter

620. Law and Business. (3-0). Credit 3. I

Students write a paper on a topic of law in which they are interested, approved by instructor. Also, the following topics are covered: law and business, their relation to each other; present sources of law in Texas today; community property laws of Texas; collection of judgments in Texas; ad valorem taxes; automobile accidents and other topics relating to business. Staff

622. Trade Regulations. (3-0). Credit 3. II, S

Delineation of governmental control intended to promote free competition and curb its abuses. A study of the Federal anti-trust acts and their application by the courts; the Federal Trade Commission and its method of dealing with unauthorized business practices such as unfair competition, misleading advertising, price discrimination, and retail price maintenance. Prerequisite: Business Administration 211. Staff

630. Problems of Corporation Finance. (3-0). Credit 3. I

The financial problems of the profit-seeking corporation are discussed from the viewpoint of the corporate financial officer. Consideration is given to such matters as current financing, financial aspects of promotion, refunding operations, dividend policies, and corporate reorganization. The course is designed to exercise the principles of corporation finance. Prerequisite: Business Administration 341. Mr. Stevenson

631. Business Investigation and Analysis. (3-0). Credit 3. II

The problems arising in the quantitative and qualitative analysis of railroad, public utility, and industrial securities are presented so as to train the advanced student of investments in the use of the tools of security analysis. The text material is supplemented by the consistent use of representative sources of investment information. Prerequisite: Business Administration 341. Staff

634. Statistical Method Applied to Business Problems. (3-0). Credit 3. II

The use of statistical methods applied to sales control, cost studies, personnel management, forecasting sales and production of an individual concern, and forecasting general business activity. Readings, reports, and problems. Prerequisites: Business Administration 303, 604. Staff

681. Seminar. (1-0). Credit 1 each semester. I, II

A critical examination of the subject matter presented in current periodicals, recent monographs and bulletins. Separate seminars will be conducted as required in fields such as accounting, finance, marketing, management, and statistics. Staff

685. Problems. Credit 1 to 3 each semester. I, II, S

Directed study on selected problems not covered in the thesis research or in other courses. Prerequisites: Graduate classification; approval of instructor. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis. Staff

Department of Chemical Engineering

R. R. DAVISON, L. D. DURBIN, P. T. EUBANK, W. D. HARRIS, C. D. HOLLAND, J. D. LINDSAY* (Head), W. W. MEINKE

The graduate program in chemical engineering is designed to give the student a well-rounded training in the fundamentals of chemical engineering and in research methods. The courses given cover various unit operations and chemical engineering thermodynamics, economics, and applications to petroleum refining. The applications courses utilize mainly petroleum and other hydrocarbon process data to develop examples of methods which are of general applicability. Courses devoted to specialized industrial technologies are given, but the major emphasis is on fundamentals.

Research is an integral part of the work leading to an advanced degree. The department specializes particularly in research on chemical engineering kinetics, absorption and extraction, and multicomponent distillation. Applied thermodynamics and other subjects also are covered. The extraction work is related mainly to the recovery and purification of cottonseed oil. The chemical engineering kinetics studies are concerned with catalytic alkylation, catalytic oxidation, methods of commercial reactor design, and comparison of laboratory with plant reactor performance. The distillation work is both experimental and theoretical.

The research facilities include, in addition to standard laboratory equipment, several precision analytical distillation columns (Oldershaw and Podbielniak), a precision gas analyzer, and a recording infra-red spectrometer. A mass spectrometer is also on the campus and is available for use by the department. These tools facilitate the prosecution of any research involving chemical analysis.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

304. Unit Operations. (3-0). Credit 3. I, II

A study of fluid and heat flow, evaporation and drying. Prerequisite: Chemical Engineering 204. Mr. Durbin

314. Unit Operations Laboratory. (0-3). Credit 1. II

Laboratory work based on Chemical Engineering 304. Prerequisite: Chemical Engineering 304. Staff

409. Oil and Gas Technology. (3-0). Credit 3. I

Application of the principles of chemical engineering to the treatment and processing of petroleum and its products. Emphasis is on unit operations. Prerequisite: Chemical Engineering 423. Mr. Davison

423. Unit Operations. (3-0). Credit 3. II, S

A continuation of Chemical Engineering 304 covering distillation, gas absorption, filtration, size reduction, separation, and mixing. Prerequisite: Chemical Engineering 304. Mr. Eubank

*Graduate Advisor

426. Plant Design. (2-6). Credit 4. II

The solution of problems involved in the design and development of chemical engineering plants. These problems cover such factors as the capacity, selection, and location of equipment, reaction rates, economic balances, specifications, drawings, cost estimates, and plant location. Prerequisite: Chemical Engineering 424. Mr. Davison, Mr. Eubank

429. Oil and Gas Technology Laboratory. (0-3). Credit 1. I

Laboratory work to accompany Chemical Engineering 409. Mr. Harris

433. Unit Operations Laboratory. (0-3). Credit 1. I

Laboratory work based on Chemical Engineering 423. Prerequisite: Chemical Engineering 314. Staff

454. Chemical Engineering Thermodynamics. (3-0). Credit 3. I

A study of the applications of thermodynamics to chemical engineering processes and operations. Prerequisites: Chemical Engineering 423; Chemistry 324. Mr. Holland

461. Process Control and Instrumentation. (2-0). Credit 2. I

A study of the fundamental principles and methods used in the measurement and control of the process variables such as pressure, temperature, and flow rate. Prerequisite: Chemical Engineering 423. Mr. Durbin

464. Chemical Engineering Kinetics. (3-0). Credit 3. II

An introduction to the kinetics of reactions and the application of fundamental principles to the design and operation of commercial reactors. Prerequisites: Chemical Engineering 424, 454. Mr. Holland

FOR GRADUATES

605. Chemical Engineering Economics. (3-0). Credit 3. I

Advanced calculations involving process design and process control as limited by least cost or maximum profit. Problems are based on the various unit operations and unit processes. Prerequisite: Chemical Engineering 423. Mr. Harris

606. Unit Operations. (3-0). Credit 3. II

Applications of chemical engineering fundamentals in the manufacture of chemicals, refining petroleum, and other allied industries. Prerequisite: Chemical Engineering 423. Mr. Holland

608. Heat Transmission. (3-0). Credit 3. I

Process and process design calculations on equipment involving the transfer of heat by conduction, convection, and radiation. Prerequisite: Chemical Engineering 423. Mr. Eubank

612. Distillation. (3-0). Credit 3. I

Process and process design calculations involving distillation of multicomponent and complex systems. Extractive and azeotropic distillation are covered. Prerequisite: Chemical Engineering 423. Mr. Holland

619. Corrosion and Materials of Construction. (3-0). Credit 3. I

The uses of materials of construction to preclude high corrosion rates in process equipment. Prerequisite: Chemical Engineering. 423. Mr. Lindsay

623. Applications of Thermodynamics to Chemical Engineering. (3-0). Credit 3. II

A study of the applications of thermodynamics to chemical engineering operations and processes. Prerequisite: Chemical Engineering 454. Mr. Holland

624. Chemical Engineering Kinetics I. (3-0). Credit 3. I

A study of rates and mechanisms of chemical reactions. Thermal and catalytic reactions both homogeneous and heterogeneous are considered. Prerequisite: Chemical Engineering 423. Mr. Holland

625. Chemical Engineering Kinetics II. (3-0). Credit 3. II

A study of the physical factors affecting chemical reaction rates and of methods for design of reaction equipment. Prerequisite: Chemical Engineering 624. Mr. Holland

626. Oil and Fat Technology. (3-0). Credit 3. I

A study of the composition and properties of oils and fats, methods of extraction and purification, and their industrial utilization. Prerequisites: Chemical Engineering 423; Chemistry 228. Mr. Harris

627. Oil Mill Operation. (2-6). Credit 4. I

A study of the theoretical and practical operating characteristics of the various units used in vegetable oil production. The economic factors of each unit and their over-all effect on plant operation will be covered. Prerequisite: Chemical Engineering 626 or registration therein. Mr. Harris

629. Transport Phenomena. (3-0). Credit 3. I

The principles of transfer of momentum, energy, and mass will be studied by application to advanced chemical engineering problems. The theoretical analogy of these three modes of transfer will be emphasized. Prerequisites: Chemical Engineering 423, 454. Mr. Eubank

631. Process Dynamics I. (3-0). Credit 3. I

A study of the dynamics, simulation, and control of linear models of fluid, thermal, and mass transfer processes for the chemical and allied industries by means of transient and frequency response analysis and design methods. The course will illustrate the application of electronic and pneumatic analog computer simulation. Prerequisites: Chemical Engineering 461; Mathematics 601; or registration therein. Mr. Durbin

632. Process Dynamics II. (3-0). Credit 3. II

This is a continuation of Chemical Engineering 631 and will cover the theory and application of discrete, nonlinear, and stochastic dynamic analysis and optimal design policies to processes in the chemical and allied fields. Prerequisite: Chemical Engineering 631. Mr. Durbin

681. Seminar. (1-0). No credit. I, II

Graduate students will be required to attend one hour per week to discuss problems of current importance in connection with their research. Staff

685. Problems. Credit 1 to 6. I, II, S

Special work to suit individual or small group requirements. The work may cover the numerous particular problems in chemical engineering processes and operations. It may be laboratory work or conference and discussion. Prerequisite: Approval of Head of Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Problems of unit operations and unit processes. For maximum credit comprehensive thesis must be prepared which is of sufficiently high calibre to permit a publication in the scientific and technical journals. Prerequisite: Approval of Head of Department. Staff

Department of Chemistry

R. B. ALEXANDER, P. K. CALAWAY*, D. C. CONWAY, ALFRED DANTI, F. R. DUKE, J. K. GLADDEN, C. K. HANCOCK, R. M. HEDGES, D. W. HOOD**, A. F. ISBELL, J. L. JONES, E. A. MEYERS, J. O. PAGE, HENRY RAKOFF, N. C. ROSE, FRED SICILIO, R. N. TRAXLER, R. D. WHEALY, R. A. ZINGARO***, B. J. ZWOLINSKI

Graduate work in chemistry is offered at both the Master's and Doctorate levels. The program leading to the Master's degree is designed to provide the student with a strong fundamental knowledge and understanding in the

*Graduate Advisor
**On leave of absence from September 1, 1963, to August 31, 1964.
***On leave of absence from October 16, 1963, to August 31, 1964.

major areas of chemistry. In addition, a thesis is required which affords the student an opportunity to actively participate in experimental or theoretical research.

The program leading to the Ph.D. degree is designed so that the student has the opportunity to spend more of his time in research. The dissertation which results from this research must satisfactorily demonstrate that the student is capable of (1) independent and creative research in a specialized area of chemistry and (2) that the student has a superior knowledge and understanding of this area in which his research activities were performed. In addition, the student must demonstrate that he has a broad and commanding knowledge of the subject matter in the general field of chemistry.

Opportunities for research are available to the graduate student in a variety of specialized areas. Those areas in which research activities currently are available include organic phosphorus compounds, halogenated dienes, natural products, compounds of pharmacological activity, relationship of physical and chemical properties of organic compounds to their structure, and studies of organic reagents for use in inorganic analysis. Other opportunities are found in the areas of kinetics, passivity of aluminum, molecular ultra violet spectroscopy and molecular quantum mechanics, and X-ray diffraction studies of crystal and molecular structure. There are also research opportunities in the areas of gas chromatography, oxidation-reduction potentials, solubility studies in non-aqueous solvents, phase studies, and inorganic compounds. Too, research is being done in the chemical deposition of semi-conducting surface films, positive halogen ions, chemical reactions in liquid hydrogen telluride, and inorganic charge-transfer complexes. Other areas of study are found in excess thermodynamic properties of binary liquid solutions; and the entropy, enthalpy, and free energy of transfer of simple salts from non-aqueous to aqueous solutions. In addition one might work with the analytical determination of ferrous metals in ores and the chemistry of metal complexes and development of analytical methods via complexation.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

317. Quantitative Analysis. (2-6). Credit 4. II

An introduction to the theory and practice of gravimetric, optical, and electrical methods of analysis. Prerequisite: Chemistry 316. Mr. Jones

323. Physical Chemistry. (3-3). Credit 4. I, II

Explanation and mathematical development of the theories and principles of chemistry. Topics discussed are atomic structure, gas laws, thermodynamics, thermochemistry, liquids, solutions, osmotic pressure, and colloids. Experiments in the laboratory substantiate the theories and principles developed in the classroom. Prerequisites: Chemistry 207 or 316; Mathematics 122 or 210. Staff

324. Physical Chemistry. (3-3). Credit 4. II, S

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

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

Explanation of basic chemical theories and principles with reference to their relationship to transformations in living matter. Special emphasis on such topics as atomic structure, diffusion and osmotic pressure, colloids, chemical equilibrium, catalysis, reaction velocity, hydrogen-ion concentration and its importance in biological processes. Prerequisites: Chemistry 207 or 316, and 227. Staff

447. Qualitative Organic Analysis. (2-6). Credit 4. I

The identification of the principal classes of organic compounds. Prerequisite: Chemistry 228. Mr. Isbell

461. Physical Chemistry. (3-0). Credit 3. I

This course covers those topics in undergraduate physical chemistry which are not covered in Chemistry 323 and 324. The course content includes surface phenomena, colloids, atomic structure, molecular structure and properties. Prerequisite: Chemistry 324. Mr. Meyers

462. Inorganic Chemistry. (3-0). Credit 3. I

The periodic relationship of the elements, their compounds, principles of their bonding and applications. Prerequisite: Chemistry 324. Staff

463. Inorganic Chemistry. (2-3). Credit 3. II

A continuation of Chemistry 462. Laboratory work consists of preparation and analysis of inorganic compounds designed to introduce the student to basic preparative techniques. Prerequisite: Chemistry 462 or approval of instructor. Staff

464. Nuclear and Radiochemistry. (2-3). Credit 3. II

Chemical aspects associated with the production and application of nuclear energy; principles of separations and utilization of radioactivity and radiation. Less extensive than Chemistry 661. Prerequisites: Chemistry 317, 324 or approval of the instructor. Mr. Sicilio

FOR GRADUATES

600. Survey of Chemistry. (2-3). Credit 3. I

A survey course in chemistry designed for teachers of high school chemistry. Prerequisites: Graduate classification; approval of Heads of Departments of Chemistry and of Education and Psychology. Mr. Rakoff

607. Organic Techniques and Preparations. (1-6). Credit 3. II

A study of laboratory operations theory and a description and comparison of equipment used in advanced work. Application of techniques of organic chemistry is made in the laboratory. Prerequisite: Chemistry 646 or registration therein. Mr. Rose

608. Qualitative Organic Analysis. (1-6). Credit 3. I

Analysis of organic compounds. Prerequisite: Chemistry 228. Mr. Isbell

609. Theory of Organic Chemistry. (3-0). Credit 3. II

The development and application of chemical theories to organic compounds. Prerequisite: Chemistry 646. Mr. Rose

611. Principles of Physical Chemistry. (3-0). Credit 3. I

A study of the general principles of chemistry from the quantitative standpoint. The course will include a discussion of gases, liquids, and solutions. Prerequisite: Graduate classification. Mr. Gladden

620. Principles of Chemical Analysis. (3-0). Credit 3. II

An advanced survey of the principles of chemical analysis with special emphasis on the newer developments in the field of analytical chemistry. Prerequisite: Chemistry 317. Mr. Whealy

621. Chemical Kinetics. (3-0). Credit 3. I

Study of some of the present theories about chemical reaction rates and mechanisms. Prerequisite: Chemistry 324. Mr. Zwolinski

624. Physico-Organic Chemistry. (3-0). Credit 3. II

Mathematical and quantitative investigation of organic chemical phenomena. Prerequisite: Chemistry 609 or approval of instructor. Mr. Hancock

625. Petroleum Chemistry. (3-0). Credit 3. II

Practical and theoretical consideration of chemical reactions of petroleum hydrocarbons. Prerequisites: Chemistry 228, 324. (Offered in 1963-64 and in alternate years thereafter.) Mr. Hancock

626. Thermodynamics. (3-0). Credit 3. I

Theory and applications of classical thermodynamic functions. Prerequisite: Chemistry 324. Mr. Gladden

628. The Non-Metallic Elements. (3-0). Credit 3. I

Study of the non-metals and their compounds. Recent developments. Knowledge of German or French desirable. Prerequisite: Chemistry 324. Staff

630. The Metallic Elements. (3-0). Credit 3. I

Study of the metals and their compounds. Recent developments. Knowledge of German or French desirable. Prerequisite: Chemistry 324. Staff

631. Statistical Thermodynamics. (3-0). Credit 3. II

An introduction to the methods of statistical mechanics based primarily on Boltzmann statistics. The approach to thermodynamics through the partition function. The statistical concept of entropy. Prerequisite: Chemistry 626. Mr. Gladden

635. Heterocyclic Compounds. (3-0). Credit 3. I

Structure, preparation, and properties of heterocyclic compounds with special emphasis on those with biological activity. Prerequisite: Chemistry 228. (Offered in 1964-65 and in alternate years thereafter.) Staff

636. Electrochemistry. (3-0). Credit 3. I

Advanced treatment of conductivity, electrochemical thermodynamics, galvanic cells, electrodeposition, and corrosion. Prerequisite: Chemistry 324. Mr. Jones

639. Instrumental Methods of Analysis. (2-3). Credit 3. I

A study of the theory and practice of modern techniques of chemical analysis and research. The laboratory work will illustrate the use of these instruments for routine analytical work and also their use as research tools. Prerequisite: Chemistry 317. Mr. Jones

641. Structural Inorganic Chemistry. (3-0). Credit 3. I

Study of nuclear and extranuclear structure, isotopes, valency of the elements, and stereochemistry of inorganic compounds. Prerequisites: Chemistry 324, 462. Mr. Zingaro

642. Methods of Structural Chemistry. (3-0). Credit 3. II

A study of theory, methods, and application of structural determination (arrangement and bonding) of chemical species. Prerequisite: Chemistry 641 or approval of the instructor. (Offered in 1963-64 and in alternate years thereafter.) Mr. Zingaro

643. Inorganic Complex Compounds. (3-0). Credit 3. II

History, theories, and methods of investigations of inorganic complex compounds. Prerequisites: Chemistry 324, 462. (Offered in 1964-65 and in alternate years thereafter.) Mr. Zingaro

644. Quantitative Organic Analysis. (1-6). Credit 3. I

Determinations: Macro Dumas, sulfur, Carius halogen, Micro residue, fractionation, Micro Dumas, catalytic hydrogenation, carbon and hydrogen, Micro Kjeldahl, Rast molecular weight, molar refraction, active hydrogen, alkaxyl, semi-micro saponification number. Prerequisites: Chemistry 228; reading knowledge of German. Mr. Isbell

646. Organic Chemistry. (3-0). Credit 3. I

A systematic and thorough presentation of organic chemistry on an advanced level. Prerequisite: Chemistry 228. Mr. Rakoff

648. Principles of Quantum Mechanics. (3-0). Credit 3. I

A brief review of classical mechanics and the development of wave mechanics. The application of wave mechanics to some special chemical problems. Prerequisite: Approval of the instructor. Mr. Hedges

649. Molecular Quantum Mechanics. (3-0). Credit 3. II

The course will be a continuation of Chemistry 648 and will include an introduction to group theoretical methods and applications in molecular quantum mechanics and elements of ligand field theory. Prerequisite: Chemistry 648. Mr. Hedges

650. Molecular Spectra and Structure. (3-0). Credit 3. II

A comprehensive introduction to molecular spectroscopy and its relations to structure, theoretical treatments, quantum and wave mechanics, vibrations and normal coordinates, rotational and magnetic resonance spectra, molecular symmetry, and group theory. Particular emphasis will be placed on the following types of spectroscopy: Infrared, far infrared, Raman, microwave, and nuclear magnetic resonance. Prerequisite: First year graduate students qualifying in chemistry and physics, or approval of the instructor. Mr. Danti

661. Radiochemistry. (2-3). Credit 3. II

A general course dealing with radioactive materials; their radiations; their preparation, purification, detection, identification, and their practical applications. Material on nuclear structures, nuclear transmutations, and radioactivity. Prerequisite: Chemistry 324. Mr. Sicilio

685. Problems. Credit 1 to 6. I, II, S

This is a course in special topics to suit small group requirements. The work will deal with the more recent problems and results in the various branches of chemistry. It may be laboratory work or conference and discussion. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis or dissertation. Staff

Department of Civil Engineering

J. B. BATY, F. J. BENSON, S. J. BUCHANAN*, D. E. CLEVELAND, W. A. DUNLAP, H. L. FURR, B. M. GALLAWAY, E. L. HARRINGTON, T. J. HIRSCH, R. M. HOLCOMB, R. A. JIMENEZ, C. J. KEESE, W. R. McCASLAND, J. A. ORR, CHARLES PINNELL, C. H. SAMSON, JR., R. E. SCHILLER, JR., J. H. SORRELS, R. N. TRAXLER, S. R. WRIGHT (Head)

Sufficient graduate courses are offered in civil engineering to permit a student to specialize in a particular branch of civil engineering. These courses are designed to acquaint the student with the new developments in a particular field and to permit the student to study some of the more advanced problems not covered in the undergraduate curriculum. The Department is especially well equipped to teach courses in soil mechanics and foundations, highway engineering, structural engineering, hydraulic engineering, municipal engineering, and sanitary engineering.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Water and Sewage Treatment. (2-2). Credit 3. I, II, S

Principles and methods of water purification and sewage treatment and disposal; laboratory demonstrations of control tests and correlation of results with treatment plant operation; interpretation of reports; inspections of local plants. Prerequisites: Chemistry 102 or 104; Civil Engineering 311. Mr. Sorrels

402. Water Supply and Sewerage Practice. (2-2). Credit 3. I, II

Development of sources of water supply; determination of the quantity of storm water and domestic sewage; short problems relating to water supply distribution systems, sewer systems, and the general features of water purification and sewage treatment plants; appurtenances and treatment plant equipment; local inspections of water supply and sewerage systems. Prerequisites: Civil Engineering 338, 401. Mr. Baty

*Graduate Advisor

403. Sanitary Design. (2-3). Credit 3. II

Practical problems in the design of sewer systems and appurtenances; sewage treatment plants; water collection and distribution systems; water purification plants. Prerequisite: Civil Engineering 402 or registration therein. Mr. Baty

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

Relation of sanitation to public health; residential water supply and excreta disposal methods; municipal sanitary work, including refuse disposal; plumbing; control of food supplies; mosquito, fly, and rodent control; sanitation of swimming pools; industrial hygiene; organization of health departments. Prerequisite: Junior classification. Mr. Baty, Mr. Sorrels

407. Highway Engineering. (3-0). Credit 3. I, II, S

An introduction to problems in location, design, drainage, construction, and maintenance of highways, streets and pavements. Road laws, finances, highway organizations and supervision briefly considered. The text is supplemented by lectures, the use of bulletins, models, and samples of materials. Prerequisites: Civil Engineering 300, 338, 465 or registration therein. Mr. Keese, Mr. Pinnell, Mr. Rowan

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

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

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

Origin, production, specifications, and tests of bituminous materials and mixtures used in the construction and maintenance of roads and pavements. Prerequisites: Senior classification in engineering and Civil Engineering 407 or registration therein. Mr. Gallaway

435. Soil Engineering. (2-3). Credit 3. I

Problems encountered in the design and construction of earth dams and coffer dams; design of footings, drilled piers, and pile substructures; design and construction of embankments and subgrades for roads and airfields; seepage through earth masses. Prerequisites: Civil Engineering 465; senior classification. Mr. Dunlap

443. Materials of Construction. (1-3).* Credit 2.* I, II

Laboratory tests, supplemented with theory of portland cement, coarse and fine aggregates, concrete mixture design, air entrained and lightweight aggregate concrete. Prerequisite: Senior classification. Mr. Gallaway, Mr. Jimenez

448. Engineering Economy. (2-0). Credit 2. I, II

Analysis of operating costs of engineering projects including interest, depreciation, fixed costs, overhead. Comparison of first cost economy versus ultimate economy. Prerequisite: Junior classification in engineering. Mr. Baty, Mr. Sorrels

456. Highway Design. (2-3). Credit 3. II

Theory and practice in highway design. Highway classification and design criteria, location studies, design of vertical and horizontal alignment, cross section, pavement, intersections and highway drainage elements. Prerequisite: Civil Engineering 407. Mr. Rowan

457. Traffic Engineering. (3-0). Credit 3. I

A study of vehicle operating characteristics, traffic flow, geometric design of roads, streets, and intersections, and methods of traffic control. Prerequisites: Civil Engineering 201, 407 or registration therein; Physics 219. Mr. Drew, Mr. Pinnell

*Becomes (2-3), credit 3, effective September 1, 1965.

RECORDER
ON
OFF
HEATER
ON
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458. Hydraulic Engineering. (3-0). Credit 3. II

Flow in pipes and complex pipe systems; non-uniform flow in open channels; pumping machinery; elementary hydraulic model theory. Prerequisite: Civil Engineering 338. Mr. Harrington, Mr. Schiller

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

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

465. Soil Mechanics and Foundations. (2-2). Credit 3. I, II, S

An elementary introduction to soil mechanics and its application to the usual problems encountered in civil and architectural engineering. The origin, formation processes, and types of soils are reviewed. Methods of exploration and soil testing required for the design of various types of foundations, retaining walls, bridge abutments, coffer dams, earth dams, and other engineering structures. Prerequisites: Civil Engineering 305; Geology 320 or 422. Mr. Buchanan, Mr. Dunlap, Mr. Schiller

470. Aerial Photogrammetry. (2-3). Credit 3. II

A study of photogrammetric optics, characteristics of aerial photographs, aerial cameras, map projections, ground control, radial plots mosaics, interpretation of aerial photographs, stereoscopic plotting instruments, and mapping from oblique photographs. Prerequisite: Civil Engineering 201. Mr. Orr

473. Cost Estimating. (3-0). Credit 3. I, II, S

Approximate and detailed estimates of the cost of construction projects including earthwork, foundations, concrete, masonry, steel, and miscellaneous items. Costs are developed to include materials, equipment, labor, overhead, and profit. Prerequisite: Senior classification. Mr. Smith

478. Construction Plant and Methods. (3-0). Credit 3. I, II

Plant and equipment selection for earthwork, foundations, concrete and structural steel, based on performance and economy. Construction schedules, progress reports, and performance records. Prerequisite: Senior classification in engineering or architecture. Mr. Smith

481. Seminar. (1-0). Credit 1. I, II

A study of the methods of job procurement subsequent to graduation including letters of application and job interviews; responsibilities and obligations of the young civil engineer; professional ethics; membership in professional societies, professional registration; lectures by staff and practicing engineers. Prerequisite: Senior classification. Mr. Buchanan

483. Analysis and Design of Structures. (2-3). Credit 3. I, II

The over-all procedure of analysis and design, including functions, loads, layouts of force systems, analysis, design drafting, specifications, cost comparisons, and maintenance as applied to typical simple bridge and building structures, design of plate girders, trusses, and reinforced concrete buildings. Prerequisites: Civil Engineering 344, 346, 465. Mr. Holcomb

486. Design of Prestressed Concrete Structures. (2-3). Credit 3. II

Basic theory. Properties of materials used. Stress losses. Prestressing systems. Design of determinate beams for flexure, shear, bond, and bearing. Deflections. Design of slabs and of continuous beams. Circular prestressing. Tension and compression members. Connections. Current specifications and economics of design. Prerequisite: Civil Engineering 483. Mr. Furr

Structural Mechanics 468. Statically Indeterminate Structures. (3-0). Credit 3. I

See Structural Mechanics for a full description of this course.

Structural Mechanics 469. Analysis of Structures. (3-0). Credit 3. II

See Structural Mechanics for a full description of this course.

Graduate student and graduate faculty supervisor conducting research with the mechanized gyratory compactor for hot-mix asphaltic concrete paving materials in Civil Engineering.

FOR GRADUATES

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

Development of European and American cities; forms 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. Mr. Orr

603. Sewage Treatment and Stream Sanitation. (4-0). Credit 4. I

Advanced studies of the theories of the various processes of sewage treatment, with special attention given to the details of the individual methods and units employed to effect these processes; and the requirements regarding the quality of sewage treatment plant effluents in relation to the sanitary protection of the receiving waters. Prerequisite: Civil Engineering 402. Mr. Baty

604. Water Quality and Treatment. (4-0). Credit 4. II

Advanced studies of the characteristics of available sources of water, standards of quality of public water supplies, and the theories of treatment and purification processes, with special attention given to the details of the methods and units employed to effect these processes. Prerequisite: Civil Engineering 402. Mr. Baty

607, 608. Environmental Sanitation. (4-0). Credit 4 each semester. I, II

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 and ratproofing; rural water supply and excreta disposal; sanitary inspection procedure. Mr. Sorrels

610. Industrial Wastes. (4-0). Credit 4. II

Amount and characteristics of the common industrial wastes; their effects upon sewage treatment; methods of treatment. Prerequisite: Civil Engineering 401 or the equivalent. Mr. Sorrels

612. Transportation in City Planning. (2-0). Credit 2. I, S

The importance and place of transportation in urban development and planning. The role of the engineer in planning. The relationship of transportation to planning studies, land use, zoning, planning legislation, and administration. Prerequisite: Graduate classification in the College of Engineering. Mr. Cleveland

615. Structural Design of Flexible Pavements. (2-0). Credit 2. I

Characteristics of pavement loads, stress analysis in flexible pavements, design practices, construction and maintenance. Prerequisite: Civil Engineering 407. Mr. Jimenez

617. Traffic Engineering: Characteristics. (2-3). Credit 3. I

Advanced theory and practice of engineering studies of traffic characteristics. Methods of traffic administration. Prerequisite: Civil Engineering 457. Mr. Pinnell

618. Traffic Engineering: Operations. (2-3). Credit 3. II

Advanced theory and application of traffic control and design of traffic facilities. Traffic regulations. Prerequisites: Civil Engineering 457, 617. Mr. McCasland, Mr. Pinnell

619. Highway Problems Analysis. (2-3). Credit 3. II

The theory and application of advanced techniques in statistics, aerial photogrammetry, and data processing in the solution of problems in highway and traffic design and research. Student should have knowledge of computer programming and basic statistics. Prerequisites: Civil Engineering 617; Industrial Engineering 414. Mr. Pinnell

620. Structural Design of Rigid Pavements. (2-0). Credit 2. II

Theory of rigid pavement design, design practices, maintenance, and construction. Prerequisite: Civil Engineering 407. Mr. Jimenez

621. Advanced Reinforced Concrete Design. (3-3). Credit 4. I

Flat slabs, continuous building frames, torsion, deep beams, bulk storage structures, creep and temperature change effects. Prerequisite: Civil Engineering 344. Mr. Furr

622. Hydraulics of Drainage Structures. (2-3). Credit 3. II

Hydraulics of open channels, bridge openings, culverts, head walls, surface street drainage, storm sewers, gutters, drop inlets and spillways. Theory of model studies as applied to drainage of highways, streets, and freeways. Prerequisite: Civil Engineering 338 or the equivalent. Mr. Harrington, Mr. Schiller

625. Geometric Design of Highways. (2-3). Credit 3. I

The advanced theory and practice in highway design. Design controls and criteria, elements of design, design of alignment, cross-section, intersections and interchanges, multilane expressways, and drainage structures. Prerequisites: Civil Engineering 407, 465. Mr. McCasland

627. Hydrology. (3-3). Credit 4. I

A study of precipitation, steam gaging methods, evaporation and transpiration, groundwater, hydrograph analysis, flood hydrographs from rainfall and snow, snow melt. Stream flow routing, frequency and duration. Studies of sedimentation, storage reservoir design, graphical correlation, and airfield drainage. Mr. Harrington, Mr. Schiller

628. Hydraulic Engineering. (3-3). Credit 4. II

A study of boundary layer theory, fluid flow in pipes, complex pipe networks, dimensional analysis, similitude and models, gradually and rapidly varied flow in open channels, backwater curves in natural streams, stilling basin design problems. Mr. Harrington, Mr. Schiller

629. Hydraulics of Open Channels. (3-3). Credit 4. I

Advanced problems in uniform and non-uniform flow in open channels; the hydraulic jump; control section; backwater profiles. Mr. Harrington

632. Advanced Design in Metals. (2-3). Credit 3. II

Properties of high-strength and other special materials. Stress concentrations and fatigue. Ultimate strength. Reconsideration of selected specification rules in the light of theory, tests and new developments. Characteristics of thin gauge structures. Design of complex members and connections such as curved columns, fixed bases, and rigid-frame knees. Prerequisites: Civil Engineering 483; Structural Mechanics 468. Mr. Holcomb

633. Advanced Mechanics of Materials. (4-0). Credit 4. II, S

Review of stresses and strains at a point, torsion of non-circular cross sections, beams with combined axial and lateral loads, built-up columns, lateral buckling of beams, torsional buckling of centrally loaded columns, bending of thin plates and shells. This course is intended for students who do not intend doing further work in structural mechanics. Prerequisites; Aerospace Engineering 306 or Civil Engineering 306; Mathematics 308. Mr. Holcomb

634. Airfield Planning and Design. (2-0). Credit 2. II

Study of regional planning, air traffic routing, landing requirements, methods for development of master plans for site selection, airfield design requirements involving layouts, pavement selection, and design. Review and application of criteria of design of drainage for all types of fields. Mr. Buchanan

636. City Street Design. (2-0). Credit 2. S

Street classification and function. Design of city streets, intersections, access drives, and pavements. Street drainage. Financing city street improvements. Prerequisite: Civil Engineering 407. Mr. McCasland

640. Freeway Design and Operation. (2-0). Credit 2. S

Characteristics of traffic flow on controlled access facilities. Advanced theory and practice in operation on freeways and related street systems. Freeway traffic control. Material based on advanced research of the Texas Transportation Institute. Prerequisite: Civil Engineering 618. Mr. Keese, Mr. McCasland, Mr. Pinnell

643. Plastic Analysis and Design in Steel. (2-3). Credit 3. I, S

Principles and methods that are the basis for plastic analysis and design of steel frames. Static and mechanism methods of analysis of structures for ultimate load. Influence of shear and axial forces on plastic design. Effect of lateral buckling. Design of connections to provide plastic action. Design guides and specifications. Prerequisite: Graduate classification in civil engineering or approval of the instructor. Mr. Hirsch

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

A study of foundation materials as they exist and of the various types of soils, their physical properties, testing procedure, and principles of classification. For advanced undergraduates and for graduate electives. Prerequisites: Civil Engineering 465; Geology 320. Mr. Buchanan

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

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. Prerequisite: Civil Engineering 649. Mr. Buchanan

651. Advanced Theory and Application of Soil Mechanics. (3-3). Credit 4. I

Special lectures, discussions and applications of theory to solution of major problems encountered in practice of soil engineering, embracing the fields of seepage, earth work design, foundation design, port structures, and special problems. Prerequisite: Civil Engineering 650. Mr. Buchanan

653. Flexible Materials of Construction. (2-3). Credit 3. I

Theory supplemented with laboratory tests of bitumen, tars, and plastics. Stabilization of base and subgrade materials. Advanced mix design and evaluation of test methods; rheology and chemistry of asphalt. Prerequisite: Civil Engineering 417. Mr. Gallaway

654. Rigid Materials of Construction. (2-3). Credit 3. II

A study of physical and chemical properties of rigid materials of construction; laboratory tests of different kinds of concrete, tests of metals and laminates; theory of corrosion of ferrous metal; corrosion mitigation; shrinkage and plastic flow of stressed concrete; design of concrete mixtures for resistance to alkali reactive aggregates, blasts from jet planes, salt water, and cavitation in hydraulic works. Prerequisite: Civil Engineering 443. Mr. Gallaway

656. Concrete Structures Testing Laboratory. (1-3). Credit 2. II

Methods and equipment used in testing reinforced concrete structures and elements of structures. Planning of tests, and testing of various beams and columns. Observations of behavior in compression, flexure, shear, torsion, and combinations thereof. Correlations with theory, both elastic and plastic. Prerequisite: Civil Engineering 621. Mr. Furr

657. Dynamic Loads and Structural Behavior. (3-3). Credit 4. I

The forces resulting from wind, other moving fluids, earthquakes, blasts, impact, moving loads, and machinery. The dynamic behavior of various structures and structural elements under the action of such loads. Self-induced vibration. Design to minimize and resist such forces. Prerequisites: Civil Engineering 483; Mechanical Engineering 459; Structural Mechanics 468. Mr. Hirsch

659. Structural Design. (3-3). Credit 4. II

General theory and design procedures for thin-shell and folded-plate structures. Characteristics, use, construction, problems, and economic factors. Membrane theory for shells. Edge effects and effects of unsymmetrical loading. Design procedure for long, shallow, folded-plate structures. Approximate procedure for short, deep, folded-plate structures. Other special design problems. Prerequisite: Structural Mechanics 469 or the equivalent. Mr. Furr

664. Water Resources Development. (3-0). Credit 3. II

Conservation and utilization of water resources with emphasis on the legal, social, and economic phases of watershed planning and multi-purpose projects. Prerequisites: Graduate classification; approval of the Head of the Department. Staff

666. Foundation Structures. (2-3). Credit 3. II

The structural analysis and design of foundations. Spread footings, combined footings, and raft foundations. Retaining walls, piles, and pile foundations. Sheet-pile structures, cofferdams, wharves, and piers. Bridge piers and abutments. Prerequisites: Civil Engineering 465 or the equivalent; graduate classification in civil engineering. Mr. Hirsch

667. Highway Structures. (3-3). Credit 4. I

The structural analysis and design of bridges, grade separation structures, retaining walls, and culverts. Review of functional and aesthetic requirements. Loads, materials, comparisons of different types, and economic proportions. Current standard, new developments, and current cost information. Prerequisites: Civil Engineering 483, 625. Mr. Holcomb

669. Bituminous Technology. (2-0). Credit 2. I, II

A review will be made of the methods and techniques used in evaluating the chemical, physical, colloidal and rheological properties of asphaltic materials. The available data will be discussed and a study made of the methods for evaluating durability of asphalt. The original literature will be used for assigned reading. Prerequisite: Civil Engineering 417. Mr. Traxler

670. Bituminous Technology. (2-0). Credit 2. I, II

A study will be made of procedures used in selecting and processing crude oil for the manufacture of asphalt. The fundamental properties of asphaltic cutbacks, asphalt emulsions and mineral filled bitumens will be reviewed. The requirements of asphalts for use in roads, roofing and special applications will be studied. Original source material will be used. Prerequisites: Civil Engineering 417, 669. Mr. Traxler

671. Urban Transportation Planning. (2-0). Credit 2. S

The urban transportation problem. Techniques of estimating demand for traffic facilities. Special studies required in transportation planning. Prerequisite: Civil Engineering 617. Mr. Cleveland

672. Urban Transportation Planning. (2-0). Credit 2. S

Problems of mass transportation. Study of the central business district, suburban shopping centers and terminal planning. Street and subdivision transportation system planning. Urban transportation economics, financing, and administration. Prerequisite: Civil Engineering 671. Mr. Cleveland

681. Seminar. (0-2). Credit 1. I, II, S
Reports and discussion of current research and of selected published technical articles. May not be taken for credit more than once in a Master's degree program and twice in a Ph.D. program. Prerequisite: Graduate classification. Staff

685. Problems. Credit 1 to 6 each semester. I, II, S
A course offered to enable majors in civil engineering to undertake and complete with credit in their particular fields of specialization limited investigations which do not fall within their thesis research and which are not covered by other courses in the established curriculum. Credit for this course normally will be limited to four credits per semester, but in exceptional circumstances, the Head of the Department may approve a maximum of six credits in one semester or summer term. Staff

691. Research. Credit 1 or more each semester. I, II, S
Research for thesis or dissertation. Staff

Structural Mechanics 601. Theory of Elasticity. (4-0). Credit 4. I, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 602. Structural Stability. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 603. Theory of Plates and Shells. (4-0). Credit 4. I
See Structural Mechanics for a full description of this course.

Structural Mechanics 604. Vectors and Tensors in Mechanics. (2-0). Credit 2. I, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 605. Flow and Fracture of Solids. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 606. Theory of Thermal Stresses. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 607. Matrix Methods of Structural Analysis. (3-3). Credit 4. II, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 608. Experimental Structural Analysis. (2-3). Credit 3. II, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 609. History of Structural Mechanics. (2-0). Credit 2. II, S
See Structural Mechanics for a full description of this course.

Department of Dairy Science

See also **Animal Breeding** and **Animal Nutrition**

M. A. BROWN, R. E. LEIGHTON, A. V. MOORE, I. I. PETERS, I. W. RUPEL (Head), CARL VANDERZANT

Graduate work leading to the M.S. and Ph.D. degrees is offered in dairy production and dairy manufacturing. The dairy herds, numbering some 400 head, afford opportunities to study various problems in nutrition, breeding, artificial insemination, and management.

The various processing operations and the procedures in bacteriological and technical control provide opportunities for graduate research study. Experiment Station projects are under way in both production and manufactur-

ing. Such projects offer an opportunity for the graduate student to study these and allied problems.

Minors or joint majors, or both, in such areas as Biochemistry and Nutrition, Genetics, and others, according to the field of interest of the candidate, readily may be arranged.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

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

Nutritional value of milk; milk and public health; organization of city milk supplies; processing, distribution, and inspection of market milk. Prerequisites: Biology 206; Dairy Science 202. Mr. Vanderzant

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

Methods of analysis of milk and milk products, and their use in controlling the composition and quality of dairy products. Prerequisites: Chemistry 223, 231; Dairy Science 301. Mr. Vanderzant

316. Butter and Cheese Manufacture. (3-4). Credit 4. II

Processing procedures in the commercial manufacture of domestic and foreign cheeses; creamery butter manufacture. Prerequisites: Dairy Science 301, 320. Mr. Peters

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

Relation of microorganisms to quality in milk and milk products; starter and fermented milk culture management; sanitary control on farms and in commercial dairies; standard analytical procedures according to the American Public Health Association. Prerequisite: Biology 206. Mr. Moore

326. Food Bacteriology. (3-3). Credit 4. II

The microbiology of human foods and accessory substances. A study of raw and processed foods, emphasizing the physical, chemical, and biological phases of spoilage. Standard industry techniques of inspection and control. Prerequisite: Biology 206. Mr. Moore

407. Ice Cream Manufacturing. (2-3). Credit 3. II

The manufacture of ice cream, sherbets, and ices, and the physical and chemical principles involved; ice cream plant equipment; flavoring materials; merchandising. Prerequisites: Agricultural Engineering 213; Dairy Science 202. Mr. Vanderzant

410. Dairy Plant Management. (1-2). Credit 2. I

Dairy plant operating efficiency. Special economy problems related to the handling of fluid milk, butter, cheese, and concentrated dairy products. Prerequisite: Senior classification in dairy science or approval of the instructor. Mr. Moore

415. Condensed and Powdered Milk. (2-2). Credit 3. II

The manufacture and distribution of condensed and evaporated milk, milk powder, milk sugar, casein, and other milk products. Prerequisites: Chemistry 231 or equivalent; Dairy Science 301; one semester of physics. Mr. Moore, Mr. Peters

416. Milk Secretion and Milking. (1-2). Credit 2. I

The physiology of lactation and the relationship between mechanical milking and the health and function of the bovine mammary gland. Prerequisites: Animal Husbandry 303 or Biochemistry and Nutrition 410; Biology 206. Mr. Leighton

417. History and Development of Dairy Cattle. (2-2). Credit 3. I

The breeding and development of a dairy herd, including artificial breeding, selection of breeding animals, production testing and type classification, breeding programs, herd analysis, and a review of the development of the breeds. Prerequisites: Dairy Science 202; Genetics 301. Mr. Brown

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

The feeding, care, and management of the dairy herd; calf raising, developing the dairy heifer, care of dry and fresh cows, feeding for milk production, disease control, silage, buildings, and related topics. Prerequisites: Animal Husbandry 303 or Biochemistry and Nutrition 401; Dairy Science 202. Mr. Leighton

481. Seminar. (1-0). Credit 1. I, II

A review of current dairy literature and presentation of papers on selected dairy topics. May be elected a second time for one additional credit. Prerequisite: Senior classification. Mr. Rupel, Mr. Vanderzant

485. Special Problems. Credit 1 to 4. I, II

Special problems in dairy production or dairy manufactures. May be repeated for additional credit when less than four credits have been earned. Prerequisites: Senior classification; approval of Head of Department. Staff

FOR GRADUATES

601, 602. Dairy Production. (2-6). Credit 4 each semester. I, II

An advanced study of dairy production, feeding, breeding, and management. Prerequisite: Dairy Science 418. Mr. Leighton, Mr. Rupel

603, 604. Dairy Manufactures. (2-6). Credit 4 each semester. I, II

An advanced study of dairy manufactures. Prerequisites: Dairy Science 316, 407, 415. Mr. Moore, Mr. Peters, Mr. Vanderzant

685. Problems. Credit 1 to 4 each semester. I, II, S

A study of research methods and a review of scientific literature dealing with individually selected problems in production or manufactures and not pertaining to thesis or dissertation. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research leading to thesis or dissertation in the respective fields of dairy production and dairy manufactures. Prerequisite: Graduate classification. Staff

Department of Economics

A. F. CHALK* (Head), I. O. LINGER

Graduate study in economics is offered leading to the degree of Master of Science. Curricular offerings are designed to equip the student with a specialized knowledge for careers in teaching, government, and business, and to give a sound preparation for continuing graduate study toward the doctorate elsewhere.

Prerequisites: To major in economics, the student should present undergraduate credits of 30 semester hours in economics, business administration, and the social sciences, of which 21 should be in economics. To minor in economics, the student should submit a minimum of 12 semester hours of undergraduate credit in economics. Up to 6 semester hours of prerequisites in economics for majors and minors may be granted for undergraduate courses in statistics, corporation finance, business cycles, and other closely related work in business administration or agricultural economics.

Those students who major in economics are expected to enroll in Courses 601, 602 and to have a good knowledge of economic theory. The thesis may be written in any of several fields, including economic theory, labor, international economics, public finance, and fiscal policy.

*Graduate Advisor

FOR GRADUATES AND ADVANCED UNDERGRADUATES

321. International Trade and Finance. (3-0). Credit 3. I

A study of international economics, including the theory of international trade, foreign exchange, and the balance of payments; tariffs, exchange controls, and other barriers to trade; international investment; and contemporary problems of international disequilibrium. Prerequisite: Economics 203. Mr. Linger

323. Economic Analysis. (3-0). Credit 3. I

The importance of prices in directing production and distributing income under both competitive and monopolistic market situations is considered, along with a survey of the effects of governmental policies on the pricing system. Prerequisites: Economics 203, 204. Staff

410. Theory of Income and Employment. (3-0). Credit 3. I

Primary emphasis is given to the following topics: (1) conceptual problems of measuring national income; (2) organization of the national income accounts of the United States; and (3) determinants of the aggregate levels of income, employment, and prices. Prerequisite: Economics 311. Staff

412. Public Finance. (3-0). Credit 3. II

A survey of financial practices at the federal, state, and local levels of government. Current public problems and the theory of public finance are analyzed with the objective of determining appropriate changes in expenditure, tax, debt, and budget policies. Prerequisites: Economics 203, 204. Staff

443. Contemporary Economic Problems. (3-0). Credit 3. II

A study of current economic problems which lie within the following major areas of economic policy: economic stability, control of monopoly power, distribution of income, and international economic relations. Prerequisites: Economics 203, 204. Mr. Chalk

481. Seminar. (1-0). Credit 1. II

Primarily for students majoring or minoring in economics. A study of methodology, scope and philosophy of economic science, followed by individual investigation of some current economic problems. Prerequisite: Approval of the Head of the Department. Staff

FOR GRADUATES

601. History of Economic Thought. (4-0). Credit 4. I

Primary emphasis is given to the classical period of 1776-1848, although a brief survey of pre-classical economic thought is made at the beginning of the course. Students are expected to read extensively in original sources, and special attention is devoted to the works of Smith, Malthus, West, Ricardo, and Mill. Prerequisite: Approval of the Head of the Department. Mr. Chalk

602. History of Economic Thought. (4-0). Credit 4. II

Following a general survey of the wage-fund controversy, an intensive study is made of marginal utility theory as developed by Menger, Jevons, Boehm-Bawerk, etc., followed by the neoclassical period. The final portion of the course is devoted to the synthesis of classical and marginal utility theory found in Marshall's system. Prerequisite: Approval of the Head of the Department. Mr. Chalk

606. Economics of Labor. (4-0). Credit 4. II

A survey of theories of the labor movement is followed by analysis of wage and employment theories, the effect of union policies and practices upon wages and employment, and the role of unionism in economic stability. Prerequisite: Economics 318. Staff

607. Contemporary Economic Theory. (4-0). Credit 4. II

This is a survey of the more important contributions to economic thought which have been made during the last generation. The current writings of important contemporary economists are read and evaluated. Prerequisite: Economics 323. Staff

611. National Income Analysis. (4-0). Credit 4. I

This course develops modern static national income analysis from a general equilibrium system. A survey is made of elementary dynamic national income analysis. The roles of fiscal and monetary policy in promoting economic stability are examined. Prerequisite: Economics 410 or approval of the Head of the Department. Staff

613. International Economic Policies. (3-0). Credit 3. II

A critical examination of governmental policies toward international trade both at home and abroad; includes study of the role of the individual and the state in foreign trade; examines export and import controls, exchange control and exchange stabilization funds; considers tariff and rehabilitation policies of the government and their relation to foreign trade. Prerequisite: Economics 321. Mr. Linger

685. Problems. Credit 1 to 3 each semester. I, II, S

Individual problems not related to a thesis or dissertation. Prerequisites: Graduate classification with major or minor in economics; approval of the Head of the Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Thesis research. Staff

Department of Education and Psychology

D. G. BARKER, P. R. HENSARLING (Head), L. H. HOPE, C. A. LINDSEY, G. P. PARKER, D. F. PARRY, W. W. STOKES, W. A. VARVEL

Graduate courses in education and psychology are designed to advance knowledge and competency related to the teaching profession. Planned programs lead to the Master of Education or Master of Science degrees, and professional certificates for the superintendent, principal, supervisor, counselor, and specialized teacher of mathematics, biology, physics, chemistry, general science, English, and history. Professional programs for these certificates are subject to the requirements of the Texas Education Agency (state accrediting agency). Course work is designed to assist practicing school personnel to improve their professional efficiency and to serve students majoring in other departments as they minor in education or work toward additional certificates. Members of the faculty have had successful teaching, supervisory, counseling, and administrative experiences in the fields related to the courses they are assigned to teach. Emphasis is given to counseling the graduate student and to supervising his program of study.

EDUCATION

FOR GRADUATES AND ADVANCED UNDERGRADUATES

421. History and Philosophy of Education. (3-0). Credit 3. I, S

An evaluation of the educational achievements of the various nations and people of the western world; the development of the social, religious, political, and cultural beliefs and attitudes that underlie American education today. Mr. Barker

426. Tests and Measurements. (3-0). Credit 3. II, S

The development of scientific measurement. The fundamental principles of sound measurement and an intensive study of the methods of appraising achievements of instructional objectives. Primary emphasis upon methods of constructing teacher-made objective tests and techniques for improving other types of written examinations. Mr. Barker

427. Principles of Guidance. (3-0). Credit 3. I, S

Introduction to the field of guidance and student personnel work. Treatment of principles underlying the aims, methods, and instruments employed in counseling and guidance. Attention to relationship of instruction and guidance. Prerequisite: Psychology 301 or a course in general psychology. Mr. Barker

436. Organization and Administration of the Elementary School. (3-0). Credit 3. S

The functional study of the participation in, and the organization and administration of the elementary school. Designed to meet the needs of elementary school principals, supervisors, teachers, and school superintendents. Prerequisite: Twelve hours of education. Mr. Lindsey

439. Educational Statistics. (3-0). Credit 3. II, S

Statistical techniques for classroom teachers, principals, students of psychology and education, and educational research workers. Problems originating in classrooms, offices of principals, laboratories of educational investigators will be used for illustrative materials and exercises. Not open to students who have received credit for any other course in statistics. Mr. Barker.

443. Elementary School Curriculum. (3-0). Credit 3. II, S

Curriculum problems as they relate to the growth, development, and adjustment of the child in the elementary school. Emphasis given to the study of curriculum materials and to the resource unit approach within the modified elementary curriculum structure. Mr. Lindsey

444. Secondary School Curriculum. (3-0). Credit 3. I, II, S

Inquiry into current curriculum practices and their backgrounds, basis for curriculum reorganization, emphasis upon the resource unit approach within the modified curriculum structure. Mr. Parker, Mr. Stokes

451. Physical Science for Elementary School Teacher. (3-0). Credit 3. I, II, S

A study of the physical science concepts applicable to the elementary school science program. Special emphasis will be given to subject matter program planning, demonstrations, projects, and observations. Prerequisites: Senior classification; approval of the Head of the Department. Mr. Loyd, Mr. Parker

FOR GRADUATES

601. College Teaching. (3-0). Credit 3. I, S

Conceptions of higher education underlying typical programs including general education, the learning process, and effective use of techniques and instrumentalities of classroom instruction. Mr. Parry

606. Secondary School Administration and Supervision. (3-0). Credit 3. I, S

The functional study of the participation in, and the organization and administration of, the secondary school. Administration and supervision of personnel. Pupil accounting. Observation and field studies. Designed to meet the needs of secondary school principals, supervisors, teachers, and school superintendents. Prerequisite: Twelve hours of education. Mr. Hensarling, Mr. Lindsey

607. Programs and Procedures in Supervision. (3-0). Credit 3. II, S

Designed for teachers, supervisors, and administrators. Deals with the philosophy, organization, and administration of supervision of both the elementary school and the secondary school. It is suggested that Education 639 precede this course. Mr. Stokes

608. School Finance and Business Management. (3-0). Credit 3. S

A study of school funds on the local, state, and federal level; budgeting systems of accounting and reporting. Supply management as related to school efficiency. Administration of special services, maintenance of buildings, grounds, and equipment. Mr. Parker

609. Public School Laws. (3-0). Credit 3. S

A review of the constitutional provisions, statute laws, court decisions, and regulations governing the public schools, with special reference to Texas. Mr. Parker

613. The School Plant. (3-0). Credit 3. S

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. Mr. Lindsey

615. Structural Organization and Administration. (3-0). Credit 3. II, S

A study of educational administration in the United States through an analysis of the nature of the educational function, consideration of the implications of democracy, and the legal relations of formal education to the democratic state. Emphasis will be given to the structural organization and administration of state and local school systems. Mr. Lindsey, Mr. Parker

616. Administration of Staff Personnel. (3-0). Credit 3. I, S

A study of selection, salary schedules, tenure, and promotion of teachers, including in-service training; efficiency records and ratings. Mr. Parker

623. Standardized Tests and Measurements. (3-0). Credit 3. I, S

Use of standardized tests in instruction and guidance. Study of various tests of achievement, aptitude, interest and personality. Methods of construction, experimental trial, and standardization of published tests. Interpretation of test results. Mr. Barker

624. Individual Testing. (2-3). Credit 3. II, S

Practicum in administration and interpretation of Stanford-Binet and Wechsler-Bellevue intelligence tests. Introduction to individual tests of personality. Prerequisite: Education 623 or registration therein. Mr. Barker, Mr. Varvel

629. Practicum in Counseling and Guidance. (2-3). Credit 3. II

Supervised practice in individual counseling and group guidance. Cases assigned in Counseling and Testing Center and in local public schools. Prerequisites: Education 624, 631 or registration therein. Mr. Barker, Mr. Varvel

631. Techniques of Counseling. (3-0). Credit 3. I, S

Methods of gathering, analyzing, and interpreting case data in counseling. Analysis of dynamics of counselor-counselee relationship. Interviewing techniques. Use of test results in counseling. Prerequisites: Education 427 or 635; 623; Psychology 634; or registration therein. Mr. Hope

632. Educational and Occupational Information. (3-0). Credit 3. I, S

Sources, classification, and analysis of educational and occupational information. Occupational trends, local occupational surveys. The use of occupational information by the classroom teacher and the guidance specialist. Mr. Barker, Mr. Varvel

633. Methods of Group Guidance. (3-0). Credit 3. II, S

Methods and practices in group guidance. The homeroom, classroom, and school clubs as opportunities for guidance. Prerequisite: Education 427 or 635. Mr. Stokes

635. Organization and Administration of Pupil Personnel Services. (3-0). Credit 3. II, S

A course for administrators, counselors, supervisors, and teachers designed to help them develop an understanding of the role of pupil personnel services; responsibility for the techniques of evaluating the program of pupil personnel services. Mr. Hensarling

637. Advanced Elementary School Methods. (3-0). Credit 3. S

A study of teaching methods, devices, and techniques of learning-teaching situations on the elementary school level. Prerequisite: Twelve hours in elementary education or an elementary school certificate. Mr. Lindsey

638. Trends in Curriculum and Instruction. (3-0). Credit 3. I, II, S

Recent research and development in theories and practices of curriculum and instruction. Special attention is given to programmed subject content and new instructional media. Prerequisite: Approval of the Head of the Department. Mr. Parker

639. Processes in Educational Leadership. (3-0). Credit 3. I, S

An analysis of the skills and techniques of the administrator in the modern school, with emphasis on democratic leadership, teacher-administrator relationships, group processes, and evaluation of the administrative programs. Mr. Stokes

640. School-Community Relationships. (3-0). Credit 3. S

Considers the total educational and social patterns of living which exist in any community. The home, the school, the church, clubs, recreation centers, and all agencies of the community are conceived collectively as dominating educational influences in the life of the child. Prerequisites: Twelve hours of advanced education; graduate classification. Mr. Hensarling, Mr. Parker

646. Internship for the School Principal. (0-9). Credit 3. I, II

Designed to give the prospective school principal on-the-job training under the guidance of a successful, experienced, practicing public school administrator and supervision of a member of the University staff. A certification requirement for the principalship unless waived by the Head of the Department. Prerequisites: Master's degree; approval of the Head of the Department. Mr. Hensarling

647. Internship for the School Superintendent. (0-9). Credit 3. I, II

Designed to give the prospective school superintendent on-the-job training under the guidance of a successful, experienced, practicing public school superintendent and supervision of a member of the University staff. A certification requirement for the superintendency unless waived by the Head of the Department. Prerequisites: Master's degree; approval of the Head of the Department. Mr. Hensarling

648. Internship for the School Business Administrator. (0-9). Credit 3. I, II

The internship is designed to give the prospective school business administrator on-the-job training under the guidance of a successful, experienced, practicing public school administrator and the supervision of members of the University staff. May apply to certification requirements for the school business administrator. Prerequisites: Eighteen semester hours of graduate credit; approval of the Head of the Department. Mr. Hensarling, Mr. Parker

651. Orientation in Business Principles and Procedures. (3-0). Credit 3. I, S

Interdisciplinary survey course which utilizes various fields in business to broaden the knowledge of the school superintendent and the school business official; contemporary economic theory, business cycles, business operation, insurance, tax structures, modern accounting systems, real estate, finance, price analysis and statistical methods applied to business problems. Case studies. Field studies. Prerequisite: Master's degree or approval of the Head of the Department. Mr. Hensarling, Mr. Parker

652. Educational-Governmental Relationships. (3-0). Credit 3. II, S

Interdisciplinary survey course which utilizes various fields in political science, comparative government, American and state history. A current analysis of the inter-relationships of educational administration to local, county, state, national, and international political organizations. Prerequisites: Master's degree; approval of the Head of the Department. Mr. Barker, Mr. Stokes

653. The Nature and Problems of Administrative Behavior. (3-0). Credit 3. I, S

Interdisciplinary survey course which utilizes the case study method. Designed to enhance understanding and improve techniques in decision making, communication and personnel relations. Emphasis is placed upon use of resource persons in the social sciences and upon field studies, problems, and experiences. Prerequisites: Master's degree; approval of the Head of the Department. Mr. Varvel

681. Seminar. (1-0). Credit 1. I, S

Problems pertinent to the superintendent, principal, counselor, supervisor, and visiting teacher are selected. Recent developments and research in the different areas will be presented. Prerequisites: Eighteen hours of advanced education; approval of the Head of the Department. Mr. Hensarling

685. Problems. Credit 1 to 4 each semester. I, II, S

A directed individual study of a selected problem in the field of education. Prerequisite: Graduate classification in education. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis. Staff

PSYCHOLOGY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

403. Dynamics of Human Behavior. (3-0). Credit 3. II

The motivation of behavior and the mechanisms of adjustment to conflict. Types of maladjustment and their causation. The development and integration of the personality. Theories of personality. Prerequisites: Psychology 207 or 301 or 303, and 305 or graduate classification in education or sociology. Mr. Varvel

436. Techniques of Research. (3-0). Credit 3. I, S

Fundamental concepts and tools of research applied to psychological and educational problems. Rationale of research, analysis of problems, library skills, sampling, appraisal instruments, statistical description and inference, writing the research report, and representative research designs. Prerequisite: An elementary course in statistics or its equivalent. Mr. Barker

FOR GRADUATES

634. Principles of Human Development. (3-0). Credit 3. I, S

Biological, psychological, and cultural interrelationships in human development. Emphasis upon principles and methods as illustrated in research and theoretical contributions. Experiences in procedures of child study. Prerequisite: Graduate classification. Mr. Varvel

Department of Electrical Engineering

J. S. DENISON, A. J. DRUCE, J. P. GERMAN*, G. D. HALLMARK (Head), L. M. HAUPT, JR.*, M. G. REKOFF, JR.*, N. F. RODE, E. N. ROOTS, JR.

The graduate program in electrical engineering provides suitable course offerings for students whose major interest is in either the electronics or the power field. Opportunity is afforded for independent laboratory investigations in either field. The facilities include a large modern AC network calculator provided with two control desks which make it possible to have two separate studies in progress at the same time. An electronic analog computer has been built in the department and is available for investigations in all fields. The machinery laboratories are amply provided with all the standard and many special machines. The department is well equipped as regards instrumentation in all of the various laboratories.

*Graduate Advisor

FOR GRADUATES AND ADVANCED UNDERGRADUATES

331. Theory and Application of Electron Devices. (3-3). Credit 4. I, S

For students other than electrical engineering majors. A study of theory of operation and characteristics of electronic devices and circuits with emphasis on instrumentation and control. Prerequisite: Electrical Engineering 305 or 307. Staff

401. Electrical Machinery. (3-0). Credit 3. I, II

A graphical and mathematical study of electrical machines, including transformers. Prerequisites: Electrical Engineering 324, 330, registration in 403. Mr. Denison, Mr. Haupt, Mr. Rekoff

402. Electromechanical Energy Conversion. (3-0). Credit 3. II

An advanced study of electromechanical energy conversion phenomena. The topics covered fall in the general area of generalized machine theory, electromechanical transducers, and advanced analysis of specialized machines. Prerequisites: Electrical Engineering 401, 403. Mr. Haupt, Mr. Rekoff

404. Electrical Laboratory. (0-6). Credit 2. II, S

This laboratory course is devoted to individual design projects based on material covered in the prerequisite courses. Prerequisites: Electrical Engineering 401, 403, 439, registration in 420. Mr. Denison, Mr. Haupt, Mr. Rekoff

415. Transmission Networks. (2-2). Credit 3. I

An analytical study of the theory of transmission lines and impedance matching devices. Hyperbolic-function treatment is generalized to apply to power, electronic, and communication circuits. The laboratory will consist of group problems and demonstrations. Prerequisite: Electrical Engineering 324. Mr. Hallmark

420. Servomechanisms and Control Devices. (3-0). Credit 3. II, S

A general study of closed-loop control devices, including electrical, hydraulic, and mechanical systems. Prerequisites: Electrical Engineering 307 or 323; Mathematics 308. Staff

428. Communication Circuits. (2-3). Credit 3. I

A study of the engineering principles used in wire line communications, including telephone and telegraph systems, transmission theory, inductive interference, networks, filters, loading, repeater and carrier systems. Laboratory investigations include transmission measurements on artificial lines involving the use of vacuum tube measuring devices and impedance bridges. Prerequisite: Electrical Engineering 439 or registration therein. Mr. Hallmark

451. Applied Electromagnetic Theory. (3-0). Credit 3. I

Static boundary value problems; conformal transformation; the Schwarz transformation; rectangular harmonics; cylindrical harmonics; Bessel functions; mathematics of Bessel functions; spherical harmonics; Legendre polynomials; applications of Maxwell's equations to plane waves in dielectrics and conductors; Maxwell's equations applied to antennas; radiation; fields and power calculations; antenna impedances. Prerequisites: Electrical Engineering 322; Mathematics 308. Mr. German

452. Ultra High Frequency Techniques. (2-3). Credit 3. II

An introduction to the theory and practice of ultra high frequency radio wave generation, transmission and radiation. Development of Maxwell's equations and their application to transmission of electrical energy in wave guides. Prerequisites: Electrical Engineering 322, 326. Mr. German

454. Advanced Electronic Circuits. (3-0). Credit 3. II

A study of the electronic circuits used for pulsing, counting, computing, and regulating and as wide band amplifiers. Transistor and tube elements will be considered. The laboratory will consist of measurements on typical devices. Prerequisite: Electrical Engineering 439 or registration therein. Staff

IBM

456. Communication Theory. (3-0). Credit 3. II

Introduction to the processing and transmission of information with emphasis on the mathematics and block diagrams of systems. Includes elements of information theory, effects of signal-noise ratio, methods of modulation and demodulation. Prerequisite: Electrical Engineering 439. Staff

457. Principles of Electronic Computers. (3-3). Credit 4. I, II

Organization and internal operation of analog and digital computers; function integration, addition, multiplication, and generation; analog system simulation; switching networks; Boolean algebra applied to digital computer components; analysis and synthesis of sequential devices, digital computer memories, input and output devices; the arithmetic unit. Prerequisite: Electrical Engineering 439 or registration therein. Mr. Roots

FOR GRADUATES

601.* Linear Network Analysis. (3-4). Credit 4. I, S

Fourier and Laplace transform methods of analysis applied to linear networks having periodic, transient, or random excitation. Mr. Hallmark

602.* Nonlinear Network Analysis. (3-4). Credit 4. II

Analysis and application of nonlinear electrical and electronic systems. Introduction to stability and phase plane analysis. Mr. Hallmark

605.* Linear Servomechanisms. (3-3). Credit 4. I

A continuation of Electrical Engineering 420 to include advanced topics which will extend the study of analytic methods as applied to linear systems and introduce concepts related to linear systems synthesis. Prerequisite: Electrical Engineering 420. Mr. Rekoff

606. Nonlinear Servomechanisms. (3-0). Credit 3. II

A study of techniques available to analyze nonlinear systems, and discontinuous systems, and a study of associated synthesis procedures. Prerequisites: Electrical Engineering 605; Mathematics 617. Mr. Rekoff

607. Alternating Current Circuits and Machines. (3-4). Credit 4. I

The study of transient conditions in electrical machines. Mr. Rekoff

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

The solution of unbalanced electrical circuits by means of symmetrical components; the study and measurement of machine constants by means of the oscillograph. Mr. Denison, Mr. Haupt

624. Electronic Circuits for Instrumentation and Computation. (3-3). Credit 4. II

Theory, analysis, and design of the electronic circuits used in instrumentation and computation. AC amplifiers, operational amplifiers, "and" circuits, "or" circuits, and "gate" circuits are included. Problems of drift compensation in DC amplifiers and closed-loop stability in multi-stage amplifiers are treated in detail. Prerequisites: Electrical Engineering 326, 457. Mr. Roots

628.* Design of Active Networks. (4-0). Credit 4. II

A study of regeneration and feedback theory with emphasis on circuit design methods suitable for treatment of these topics. Prerequisites: Electrical Engineering 601; Mathematics 601 or the equivalent. Mr. Hallmark

636. Network Synthesis. (4-0). Credit 4. I

Synthesis of electrical networks having arbitrarily specified terminal characteristics. Studies include realizability conditions, realization of general two-terminal and four-terminal networks and approximation of network specifications. Prerequisites: Electrical Engineering 601; Mathematics 601. Mr. Hallmark

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

Data Processing Center—Contains an IBM 709, an IBM 650 and other digital and analog computing equipment and facilities.

637. Wave Guides and Cavities. (3-0). Credit 3. I

Application of Maxwell's equations to the solution of guided electromagnetic fields. Course includes studies in skin effect, parallel plane wave guides, rectangular wave guides, circular wave guides, cavities, and microwave networks. Prerequisite: Electrical Engineering 451. Mr. German

638. Antennas and Propagation. (3-0). Credit 3. II

Application of Maxwell's equations to determine the electromagnetic fields of antennas. Course includes studies in radiation, directional arrays, impedance characteristics, aperture antennas, propagation in free space, and propagation through the ionosphere. Prerequisite: Electrical Engineering 451. Mr. German

642. Transistors. (3-3). Credit 4. I, S

Theory of junction triodes; voltage, current, power and frequency limitations. Small signal parameters and equivalent circuits for transistors; analysis of design of circuits at both small and large signal levels. Prerequisite: Electrical Engineering 326. Mr. Druce

644. Sampled Data Servomechanisms. (3-0). Credit 3. II

A study of techniques for the analysis of sample data and discrete data servo systems and associated synthesis procedures. Prerequisites: Electrical Engineering 605; Mathematics 617. Mr. Rekoff

646. Statistical Communication Theory. (3-0). Credit 3. II

Generalized harmonic analysis of deterministic and random signals; elements of probability and statistics; detection of signals in noise; sampling theory; optimum linear systems. Prerequisites: Electrical Engineering 601; Mathematics 601. Mr. Hallmark

648. Electromagnetic Wave Propagation. (3-0). Credit 3. II

A study of electromagnetic surface waves; direct and ground-reflected space waves; tropospheric refraction, reflection, and scattering; ionospheric refraction, reflection, and scattering; propagation via meteor trails and whistlers; space communication. Prerequisite: Electrical Engineering 451. Mr. German

653. Electronic Computer Design. (3-3). Credit 4. I, S

Special function generation and system simulation for analog solution of both linear and nonlinear differential equations, simulation techniques applied to control systems; advanced study of digital adders, subtractors, accumulators, multipliers, and dividers; digital error-detection; digital control; design of general purpose and special purpose digital computers. Prerequisite: Electrical Engineering 457. Mr. Roots

685. Problems. Credit 1 to 4 each semester. I, II

Research problems of limited scope designed primarily to develop research technique. Staff

691. Research. Credit 1 or more each semester. I, II

Research for thesis or dissertation. Staff

Department of Engineering Graphics

S. M. CLELAND, B. F. K. MULLINS, J. P. OLIVER, W. E. STREET* (Head)

The graduate courses in engineering graphics have as their main objectives the preparation of men in the profession of teaching, both high school and college; for the preparation of men specializing in industrial graphic methods; and for scientific investigation and research in science and engineering.

The Engineering Graphics Department is well equipped with drafting machines, lettering devices, models, reproduction equipment, projectors and other visual aids, and a complete library of the field of graphics.

*Graduate Advisor

FOR GRADUATES

601. Advanced Industrial Drawing. (2-3). Credit 3. I, S

Problems pertinent to all industrial fields. Solutions involve projections, primary auxiliary views, successive auxiliary views, revolutions, flat pattern layouts, perspective, and shades and shadows. Use of drafting machines and other special drafting equipment. Appropriate for high school and college teachers. Prerequisites: Engineering Graphics 106, 127 or equivalent. Staff

603. Advanced Machine Drawing. (1-6). Credit 3. II, S

Conventional practices, dimensioning, fastenings, machine and pictorial sketching. Empirical design including problems of stuffing boxes, piping, shafting, gears, cams, ship and aircraft parts. Use of special drafting equipment such as drafting machine, section liner, proportional dividers, erasing machines, light table, and mechanical lettering guides. Methods of reproduction. Appropriate for high school and college teachers. Prerequisite: Engineering Graphics 106 or equivalent. Staff

605. Spherical Projections. (2-0). Credit 2. I, S**

Advanced graphics including recent developments in drawing, review of graphical research, and related fields. Prerequisite: Engineering Graphics 106 or the equivalent. Staff

606. Stereographic and Clinographic Projections. (2-0). Credit 2. II, S**

Advanced graphics including recent developments in drawing, review of graphical research, and related fields. Prerequisite: Engineering Graphics 106 or the equivalent. Staff

607. Descriptive Geometry for Teachers. (4-0). Credit 4. II, S**

Fundamental concepts of descriptive geometry. The design and organization of problems and teaching devices for college teachers. Prerequisites: Engineering Graphics 106; Industrial Education 323; or the equivalent. Staff

611. Technical Illustration. (3-3). Credit 4. I, S**

Axonometric projection including shading. Design and construction of display layouts. Commercial and technical illustrating. Prerequisites: Engineering Graphics 106, 601, or the equivalent. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A course to enable an individual or a small group to undertake and complete with credit numerous problems in graphical communication. It may be limited investigations, laboratory work, or conferences and discussion. Prerequisites: Engineering Graphics 105, 106; Industrial Education 323 or the equivalent; graduate classification; approval of the instructor. Staff

Department of English

J. P. ABBOTT, J. Q. ANDERSON* (Head), R. H. BALLINGER, A. L. BENNETT, F. E. EKFELT, K. E. ELMQUIST, H. P. KROITOR, L. F. HAUER, J. Q. HAYS, H. E. HIERTH, P. C. HUNTER, JR., C. D. LAVERTY, L. J. MARTIN, S. S. MORGAN, E. E. STOKES, JR.

The general aim of the graduate program in English is to broaden and enrich the student's cultural background. Specific aims of the program are to prepare students (1) for further graduate study leading to the Doctor of Philosophy degree; (2) for the profession of teaching English in high schools, junior colleges, colleges, and universities; and (3) for those positions in business, industry, and government that require a broad knowledge of humanities.

A minimum of thirty credit hours is required for the M.A. degree in English, six of these hours being allowed for work on the thesis. The master's thesis may be written on topics in either English or American literature.

*Graduate Advisor

**Primarily for graduate students interested in education. Not available for major or minor work toward an engineering degree, except by permission of the Dean of Graduate Studies.

Candidates for the degree may present a minor of not more than nine credit hours in history, education, economics, mathematics, modern languages, or other liberal arts fields.

To be admitted to this program, students should have an undergraduate major in English. Those students with a B.A. degree in other fields in the humanities may be admitted provisionally and allowed to make up deficiencies.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

321. Nineteenth Century Literature (Romantic). (3-0). Credit 3. I

A study of the intellectual tendencies of the nineteenth century as reflected in the poetry of Wordsworth, Coleridge, Byron, Shelley, Keats, and others. Prerequisites: Two courses in sophomore English. Staff

322. Nineteenth Century Literature (Victorian). (3-0). Credit 3. II

A continuation of the study in nineteenth century thought as reflected in the writings of Tennyson, Browning, Arnold, and other Victorians. Prerequisites: Two courses in sophomore English. Staff

327. American Literature to 1870. (3-0). Credit 3. I

A study of American literature from the Colonial Period through the Civil War. Prerequisites: Two courses in sophomore English. Staff

328. American Literature from 1870 to 1920. (3-0). Credit 3. II

A study of American writing from Whitman and Mark Twain to Frost and Dreiser. Prerequisites: Two courses in sophomore English. Staff

340. Modern Drama. (3-0). Credit 3. II, S

A study of representative plays (in translation) by such dramatists as Ibsen, Hauptmann, Rostand, and Pirandello on the Continent, and Pinero, Shaw, Synge, O'Neill, and Maxwell Anderson in England and America. Prerequisites: Two courses in sophomore English. Staff

350. Modern Literature. (3-0). Credit 3. I

British and American novelists, poets, and dramatists from about 1920 to the present, with lectures on the social and intellectual background. Prerequisites: Two courses in sophomore English. Staff

409. Introduction to Linguistics. (3-0). Credit 3. II

Introductory study of the nature of language and of modern linguistic science, including phonetics and phonemics. Staff

410. History of the English Language. (3-0). Credit 3. I

Survey of the history of the grammar, vocabulary, and sounds of the English language, with brief discussion of related languages. Prerequisites: Two courses in sophomore English. Staff

412. Shakespeare. (3-0). Credit 3. II

Close attention to the plays themselves. The student will also devote time to the texts, to Elizabethan language, to Elizabethan dramatic theory and history and Shakespeare's relation to them, and to Shakespeare criticism and scholarship. Prerequisite: English 212 or six hours of 300 or 400 level courses in literature. Staff

428. The Novel in English. (3-0). Credit 3. I

A study of the novel in English in the eighteenth, nineteenth, and early twentieth centuries. Prerequisites: Two courses in sophomore English. Staff

431. Chaucer. (3-0). Credit 3. I

Readings from the works of Chaucer, with consideration of the institutions and society of the pre-Renaissance period and Chaucer's language. Prerequisite: English 231 or six hours of 300 or 400 level courses in English. Staff

461. Teaching of Language and Composition. (3-0). Credit 3. I, S

A study of the teaching problems involved in high school and college courses in composition. Points of view toward language study; organization of paragraphs and short papers; analysis of expository prose; practice in assigning, writing, grading, and criticizing short papers; the research paper; examination of composition texts. Prerequisite: Senior classification or approval of instructor. Staff

485. Problems. Credit 1 to 3. I, II, S

Individual supervision; no class meetings. Readings designed for the student with a major or a minor in English and selected to round out his over-all knowledge of literature and the criticism of literature. There will be written reports on the readings and a semester examination. Prerequisite: Eighteen hours of English. Staff

FOR GRADUATES

613. Studies in the Renaissance. (3-0). Credit 3. I

Reading in the poetry, prose, and drama exclusive of Shakespeare. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

614. Studies in the Renaissance: Non-Dramatic Literature. (3-0). Credit 3. II, S

Major writers of non-dramatic prose and poetry of the English Renaissance, from Wyatt; the works of Sidney, Spenser, Marlowe, Raleigh, Shakespeare, Drayton, Jonson, and Donne. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

615. Seventeenth Century English Literature. (3-0). Credit 3. I, II, S

Studies in the poetry and prose of the chief writers of the seventeenth century—Bacon, Donne, Jonson, Herrick, Milton, and Dryden. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

616. Studies in the Eighteenth Century. (3-0). Credit 3. II

Poetry and prose from Dryden to Blake. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

617. Studies in the Eighteenth Century: The Age of Johnson. (3-0). Credit 3. II, S

Prose in the latter half of the century. The works of Johnson, Boswell, Goldsmith, Sheridan, Hume, Gibbon, and others. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

633. Studies in the Nineteenth Century: The Romantic Age. (3-0). Credit 3. I

Romantic and Victorian writers, along with the literary, religious, and scientific issues of the century. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

634. Studies in the Nineteenth Century: The Victorian Age. (3-0). Credit 3. II, S

Prose and poetry from Carlyle to Shaw. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

649. Studies in the Twentieth Century: British Literature. (3-0). Credit 3. I

Reading in selected authors since 1900—Yeats, Joyce, Huxley, and others. Emphasis upon the development of a particular literary movement or literary form. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

650. Studies in the Twentieth Century: American Literature: (3-0). Credit 3. II

Reading in selected authors since 1900—Robinson, Frost, Eliot, Lewis, Faulkner, Hemingway, and others. Emphasis on a particular literary movement or literary form. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

674. Studies in American Literature: The Age of Transcendentalism. (3-0). Credit 3. I, S

Backgrounds of Transcendentalism in Europe; the movement in the United States; the works of Emerson, Hawthorne, Poe, Whitman, Melville, Thoreau, and others. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

675. Studies in American Literature. (3-0). Credit 3. II

Readings in American writers, with emphasis on a particular literary development or on a literary type. Research papers. Prerequisite: Graduate classification or approval of the Head of the Department. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Special readings designed to supplement the student's knowledge of English and American literature in subjects which he has not studied in other courses. Research papers. Prerequisites: Graduate classification; approval of the Head of the Department. Staff

691. Research. Credit 1 to 4. I, II, S

Research for thesis. Prerequisite: Graduate classification. Staff

Department of Entomology

See also **Animal Parasitology**

P. L. ADKISSON, H. R. BURKE, H. W. DOROUGH, J. C. GAINES* (Head), R. L. HANNA, D. A. LINDQUIST, M. A. PRICE, N. M. RANDOLPH, J. N. WEAVER

Work is offered for advanced degrees in the various phases of entomological science including taxonomy, morphology, parasitology, physiology, toxicology, economic entomology, and apiculture. Adequate facilities are available for research in these fields including a well equipped laboratory. Modern analytical equipment for biochemistry and insecticidal determinations, including radioisotope techniques, is available as well as apparatus for insecticide toxicity studies. Insect biologies may be studied under controlled conditions of temperature and humidity. A large working collection of insects is available to students interested in taxonomic research.

Prerequisite to major graduate work is the completion of no less than two years of approved entomological training, except that for a part of this requirement credit in certain other biological sciences may be substituted. Comprehensive courses in the biological sciences and general chemistry (and in most cases organic chemistry) are required of all students. Specific requirements, in addition to the elementary undergraduate courses pertaining to various lines of major work, are dependent upon previous training and professional experience.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Systematic Entomology. (2-3). Credit 3. I

A systematic study of the orders and families of insects, and the distinguishing characteristics of representative species. The preparation of insect collections and the use of keys for identification are emphasized in practice. Prerequisite: Entomology 201 or equivalent. Mr. Burke

*Graduate Advisor

302. Systematic Entomology. (2-3). Credit 3. II

A continuation of Entomology 301, including orders and families of insects not studied in Entomology 301. Prerequisite: Entomology 301. Mr. Burke

305. Insect Morphology. (2-3). Credit 3. I

General morphology of typical insects with special emphasis on those structures of particular importance in systematic and applied entomology. Prerequisite: Entomology 201 or equivalent. Mr. Schaffner

306. Insect Physiology. (2-3). Credit 3. II

Internal anatomy and principles of physiology as applied to insects. Prerequisite: Entomology 305. Mr. Schaffner

401. Principles of Insect Control. (2-3). Credit 3. I

A study of both applied and natural controls emphasizing the uses, practical application, and the physical and chemical properties of the more important insecticides. Prerequisite: Entomology 201. Mr. Hanna

402. General Economic Entomology. (2-3). Credit 3. II

The nature of injury, life history, habits and control of the common insects attacking stored products, cereal, forage, cotton, ornamentals, fruits, vegetables, man, household, and livestock are studied. Practical methods of insect control are demonstrated in laboratory. Prerequisite: Entomology 201. Mr. Randolph

FOR GRADUATES

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

A taxonomic study of the orders and families, including genera and species of the class Hexapoda; also a study of the International Rules of Nomenclature. A special study of some particular group of insects is required in practice. Prerequisite: Entomology 302. Mr. Burke

607. Economic Entomology. (3-3). Credit 4. I, S

This course is designed chiefly for workers in vocational agriculture and the Extension Service. It includes studies of agricultural pests, their biologies, economic importance as determined by making infestation records, and the use of control measures. Also, insecticides and methods of application are considered. Prerequisite: Approval of Head of Department. Mr. Randolph

608. Economic Entomology. (3-3). Credit 4. II

A detailed study of insect pests, including identification, distribution, principles and methods of natural, cultural, and chemical controls. Literature and research methods are also stressed. Prerequisite: Entomology 401 or 402. Mr. Hanna

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

A detailed study of anatomical structures of insects. Prerequisite: Entomology 305. Mr. Burke

615. Insect Physiology. (3-3). Credit 4. I

A study of the physiology of respiration, circulation, digestion, and excretion; the mechanical and chemical senses of insects are considered. Prerequisite: Entomology 306 or equivalent. Mr. Weaver

617, 618. Medical Entomology. (3-3). Credit 4 each semester. I, II

The taxonomy and biology of parasitic insects, ticks, mites, and their role in the causation and transmission of diseases affecting man and domestic animals. Prerequisite: Entomology 208 or equivalent. Mr. Price

619. Insect Toxicology. (3-3). Credit 4. II

Chemical compounds which possess toxic properties; actions of poisons on insects; evaluation of insecticides in the laboratory and field; and mathematical analysis of data. Prerequisite: Entomology 615. Mr. Dorough

685. Problems. Credit 1 to 4 each semester. I, II, S

Entomological problems not pertaining to a thesis or dissertation are considered. Prerequisites: Graduate classification with major or minor in entomology; approval of Head of Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research problems on taxonomy, life histories, biological control, ecology, and physiology of insects, and the toxicology of insecticides. Prerequisite: Graduate classification. Staff

Food Technology

Programs may be developed from the offerings of various departments and colleges which serve the needs of a food technologist. Students desiring such a program should consult the Dean of Graduate Studies and the appropriate departmental representative.

Department of Geography

E. B. DORAN, JR., G. W. SCHLESSELMAN (Head)

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. International Political Geography. (3-0). Credit 3. I

A study of some of the present social and political problems of world powers and also the weaker nations. An effort to find geographic factors back of these problems and possible geographic adjustments. Mr. Doran, Mr. Schlesselman

FOR GRADUATES

601. Economic Geography. (4-0). Credit 4. I

A regional survey of the world distribution of major agricultural and industrial commodities with particular attention to the causal action of natural, social, and economic factors. (Offered in 1963-64 and in alternate years thereafter.) Mr. Doran, Mr. Schlesselman

Department of Geology and Geophysics

H. R. BLANK, D. A. FAHLQUIST, K. J. KOENIG, T. J. PARKER* (Acting Head)
M. C. SCHROEDER*, C. L. SEWARD, JR., F. E. SMITH

In addition to advanced academic training, special emphasis is placed on macropaleontology, micropaleontology, subsurface structural geology, sedimentation, ground water, and geophysics.

Detailed surface and subsurface courses in the microscopic study of recent and fossil organisms and their relation to ancient sediments are available, with abundant material for individual stratigraphic problems, especially in the Tertiary formations of the Gulf Coast. Subsurface structural geology courses are based upon information obtained from well cuttings, cores, electric logs, and other well-logging devices. Field problems involving both Cenozoic structure and stratigraphy are aided by the numerous exposures of formations in the vicinity of the campus. Field problems in rocks of pre-Cambrian and Paleozoic ages are available in the Llano area. In geophysics emphasis is on principles. Research is in surface ship gravity measurements, observatory electromagnetic measurements, seismic model studies, long-period seismic recordings, marine crustal refraction work, and analyses with digital computers.

*Graduate Advisor

GEOLOGY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

303. Petrography and Petrology. (2-3). Credit 3. I

Principles of optical mineralogy; identification of minerals in fragments and thin sections by use of the petrographic microscope; thin section study of igneous rocks, and their classification. Prerequisites: Chemistry 207; Geology 204. Mr. Blank

304. Sedimentary Petrography. (2-3). Credit 3. II

Microscopic study of sedimentary and metamorphic rocks in thin sections; heavy mineral analysis; description, origin, and classification of sedimentary and metamorphic rocks. Prerequisite: Geology 303. Mr. Blank

406. Economic Geology. (3-0). Credit 3. I

The application of principles of geology, chemistry, and physics to the formation of useful minerals and rocks and a general survey of such deposits. Prerequisites: Chemistry 323; Geology 300, 306, 312. Mr. Blank, Mr. Schroeder

409. Geology of Non-Metallics Other than Petroleum. (3-0). Credit 3. II

The mineralogy, stratigraphy, and structural relations, origin, geographic distribution, uses, and economics of non-metallic mineral deposits other than petroleum. Prerequisites: Chemistry 323; Geology 300, 306, 312. Staff

423. Micropaleontology. (1-6). Credit 3. II

A systematic survey of the important groups of micro-fauna with particular emphasis on their classification and use. Prerequisite: Geology 305. Mr. Koenig, Mr. Smith

425. Subsurface Geology. (2-3). Credit 3. II

Study of well cuttings and cores; electrical, radioactive, drilling time, and caliper logs. Preparation of subsurface contour maps and cross sections. Prerequisites: Geology 300, 404; approval of Head of Department. Mr. Parker

433. Field Geology. (0-6). Credit 2. II

Two full afternoons per week devoted to the acquirement of techniques of field geology in areas adjacent to the campus. Prerequisites: Geology 300, 306. Mr. Seward

441. Advanced Engineering Geology. (3-3). Credit 4. I

A survey of those phases of mineralogy, petrology, historical geology, structural geology, and sedimentation that may be applied to engineering problems. Not available to geology or petroleum engineering majors. Prerequisites: Senior classification: approval of Head of the Department. Mr. Koenig

FOR GRADUATES

600. Earth Science for Secondary School Teachers. (2-3). Credit 3. S

Survey of the fundamental principles of physical geology, geologic processes, and earth history including the origin and nature of the solar system. Designed to aid secondary school instructors in presenting earth sciences. Prerequisites: Graduate classification; approval of Head of Department. Mr. Schroeder

601. Advanced Research Techniques. (1-0). Credit 1. I

An introduction to modern instrumentation techniques and methods used in geology. Prerequisite: Graduate classification. Mr. Koenig

609. Field Geology. Credit 2 to 6. I, II, S

Systematic geologic surveying of selected areas. Prerequisite: Geology 300. Staff

612. Structural Geology. (3-0). Credit 3. I

A detailed study of geologic structures and a consideration of theories regarding earth movements, with selected readings. Prerequisite: Geology 312. Mr. Parker

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

Study of microscopic fossils and their uses in correlation. Laboratory work in the examination of well samples. Prerequisite: Geology 423. Mr. Koenig, Mr. Smith

618. Sedimentation. (3-0). Credit 3. II

Investigation of processes of sedimentation with analytical laboratory work on sedimentary rocks. Seminar. Prerequisite: Geology 315. Mr. Koenig

619. Petroleum Geology. (3-0). Credit 3. II

A theoretical study of some of the problems in petroleum geology. Prerequisite: Geology 404. Mr. Parker

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

Principles of occurrence and movement of water beneath the earth's surface, and the influence of various geologic situations upon its behavior. Factors applying to estimates of supply. Engineering aspects of ground water. Mr. Schroeder

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

Sources and depositional environment of sediments, character and relation of sedimentany strata, and the principles involved in delimiting, correlating, and naming stratigraphic units. Mr. Schroeder

625. Advanced Ground Water Geology. (3-0). Credit 3. II

Seminar course in the application of the principles of advanced geology to the development and use of ground water supplies. Prerequisites: Geology 620 or the equivalent; approval of Head of Department. Mr. Blank, Mr. Schroeder

627. Continental Evolution Outside of North America. (2-0). Credit 2. II

A reading and conference course on the available literature, dealing with the basic geology of areas outside of North America. Staff

629. Structural Framework of North America. (3-0). Credit 3. II

Description of the important geologic structures of North America and of the development of regional structural features in geological times. Prerequisite: Graduate classification. Staff

631. Geology in Engineering Construction. (3-0). Credit 3. II

Geologic principles applied to the construction of highways, foundations, bridge abutments and piers, tunnels, dams, reservoirs, etc. Construction materials. Test borings and their interpretation. Prerequisites: Graduate classification; approval of instructor. Mr. Blank

639. Paleozoic and Mesozoic Paleontology. (3-0). Credit 3. I

Study of the important faunas of these eras. Prerequisites: Graduate classification; approval of Head of Department. Mr. Koenig, Mr. Smith

640. Cenozoic Paleontology. (3-0). Credit 3. II

Study of the important faunas of this era with emphasis on the megafossils of the Gulf Coast. Prerequisites: Graduate classification; approval of Head of Department. Mr. Smith

643. Paleozoic Stratigraphy. (3-0). Credit 3. II

Stratigraphy of the Paleozoic System with particular emphasis on the Paleozoic of West Texas and Oklahoma. Prerequisites: Graduate classification; approval of Head of Department. Mr. Schroeder

644. Mesozoic Stratigraphy. (3-0). Credit 3. II
Study of the stratigraphy of the Mesozoic System. Prerequisites: Graduate classification; approval of Head of Department. Staff

645. Cenozoic Stratigraphy. (3-0). Credit 3. II
Study of the Cenozoic System. Prerequisites: Graduate classification; approval of Head of Department. Mr. Smith

646. Gulf Coast Stratigraphy. (3-0). Credit 3. II
Detailed study of the Mesozoic and Cenozoic Systems of the Gulf Embayment. Prerequisites: Graduate classification; approval of Head of Department. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S
A course to enable graduate students with a major or minor in geology to undertake and complete with credit limited investigations which do not fall within their thesis or dissertation research and are not covered in the established curricula. Geological problems in engineering are included. Prerequisites: Graduate classification; approval of Head of Department. Staff

691. Research. Credit 1 or more each semester. I, II, S
Original research on problems in various phases of geology. Research for thesis or dissertation. Staff

GEOPHYSICS

FOR GRADUATES AND ADVANCED UNDERGRADUATES

435. Principles of Geophysical Exploration. (3-3). Credit 4. I
Principles of the different methods used in geophysical exploration with emphasis on the interpretation of geophysical data and physical properties of rocks. Prerequisites: Geology 312; Mathematics 122 or 210; Physics 219; approval of Head of Department for majors in other departments. Mr. Fahlquist

436. Seismic Exploration. (2-3). Credit 3. II
Study of seismic investigations with artificial sources, including field procedures, instrumentation, and interpretation of data. Prerequisite: Geophysics 435. Staff

446. Physics of the Earth. (3-0). Credit 3. II
A study of the earth's elastic and inelastic behavior, its gravitational, magnetic, electrical and thermal fields, the effect of forces acting within the earth, and implications of these factors during geologic time. Prerequisites: Geology 312; Mathematics 122 or 210; Physics 219; approval of Head of Department for majors in other departments. Staff

485. Problems. Credit 1 to 3. I, II, S
Advanced problems in Geophysics. Staff

FOR GRADUATES

651. Theoretical Seismology. (3-0). Credit 3. I
Mathematical development of elasticity theory and stress waves in bounded and unbounded solid media. Prerequisites: Geophysics 435 or registration therein; Mathematics 308; approval of Head of Department for majors in other departments. Mr. Fahlquist

653. Gravity and Magnetic Methods. (3-0). Credit 3. II
Study of the earth's gravity and magnetic fields; the role of gravity in geodesy; methods, instruments, and interpretation of data in gravity and magnetic methods of exploration. Prerequisites: Geophysics 435; Mathematics 308. Staff

655. Electrical and Radioactivity Methods. (2-0). Credit 2. II

Study of procedures, instruments, and interpretation of data obtained from electrical, electromagnetic, and radioactivity methods of exploration. Minor emphasis is on geothermal and geochemical methods. Prerequisites: Geophysics 435; Mathematics 308 or registration therein. Staff

657. Earthquake Seismology. (2-0). Credit 2. I

Study of earthquakes, their causes, effects, method of location, determination of wave paths, interpretation of deep structures; and instruments used for recording. Prerequisites: Geophysics 435, 651 or registration therein. Mr. Fahlquist

685. Problems. Credit 1 to 4 each semester. I, II, S

A course to enable graduate students with a major or minor in geophysics to undertake and complete with credit limited investigations which do not fall within their thesis or dissertation research and are not covered in the established curricula. Geophysical problems in engineering are included. Prerequisites: Graduate classification; approval of Head of Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Original research on problems in various phases of geophysics. Research for thesis or dissertation. Staff

Department of Health and Physical Education

W. M. DOWELL, C. W. LANDISS*, C. E. TISHLER* (Head)

Graduate study in health and physical education is offered leading to the Master of Education degree.

Graduate courses in health and physical education have been designed to serve the needs of those actively engaged in public school and recreational work. It is the purpose of the Department of Health and Physical Education to assist in the advanced preparation of master teachers, school administrators, and recreational leaders. A Professional Teaching Certificate for the state of Texas may be earned in this department.

HEALTH EDUCATION

FOR GRADUATES AND ADVANCED UNDERGRADUATES

415. Secondary School Health Education. (3-0). Credit 3. I, S

A study of health problems; needs of the individual; cooperation of home and community; resources for health in community, state, and nation; techniques of evaluation. Prerequisite: Approval of instructor. Mr. Dowell

421. Elementary School Health Education. (3-0). Credit 3. II

A study of modern trends and methods in the elementary school health program; survey of materials and agencies and their value to an adequate health program. Prerequisite: Approval of instructor. Mr. Dowell

FOR GRADUATES

631. Community and Public Health. (3-0). Credit 3. S

A study of community health problems and of public health measures to solve them. Typical organizations and specific functions of state and local health departments; relationship of local health department to state and federal health agencies and programs. Prerequisite: Health Education 415 or 421. (Offered in 1963-64 and in alternate years thereafter.) Mr. Dowell

*Graduate Advisor

PHYSICAL EDUCATION

FOR GRADUATES AND ADVANCED UNDERGRADUATES

423. Administration of Health and Physical Education. (3-0). Credit 3. II, S

Administrative problems involved in the coordination of the health, physical education, intramural, and athletic areas in a comprehensive program of physical education. Prerequisite: Senior classification. Mr. Tishler

425. Tests and Measurements. (3-0). Credit 3. I, II, S

Use, interpretation, evaluation, and administration of existing tests in health and physical education; application of elementary statistical procedures. Prerequisite: Senior classification. Mr. Landiss

FOR GRADUATES

601. Survey of Research. (3-0). Credit 3. S

A study of published reports and research in the field of health and physical education. Prerequisite: Education 426 or Physical Education 425. Mr. Landiss

603. Coaching and Officiating. (3-0). Credit 3. S

Advanced coaching and officiating techniques in football, basketball, track, and baseball. Prerequisites: Teaching and coaching experience. Mr. Landiss

610. Administration of Interschool Athletics. (2-0). Credit 2. S

This course is designed for school superintendents, principals, and athletic directors. A study of the University Interscholastic League rules and regulations and the various problems confronting the school administrator in administration of the interschool athletic program. Mr. Landiss

614. Philosophy and Principles. (3-0). Credit 3. S

Divergent origins, leaders, conditions, and forces affecting the development of health and physical education. Critical analysis of objectives. Principles of education, psychology, and physiology, and their implications in health and physical education. Prerequisite: General prerequisites for minor. (Offered in 1963-64 and in alternate years thereafter.) Mr. Tishler

622. Supervision of Health and Physical Education. (3-0). Credit 3. S

Methods and policies of the school supervisor; conferences, planning and presenting the program, evaluating results, improving teachers-in-service. Prerequisite: Physical Education 423. (Offered in 1964-65 and in alternate years thereafter.) Mr. Dowell, Mr. Tishler

636. Advanced Tests and Measurements. (3-0). Credit 3. S

Critical study of tests and measurements available; methods of constructing and evaluating new tests and measurements. Prerequisite: Physical Education 425. (Offered in 1964-65 and in alternate years thereafter.) Mr. Landiss

681. Seminar. (1-0). Credit 1. I, II, S

General discussions of laws, legislative certification, professional ethics, and other current problems relating to health, physical education, and recreation. Prerequisites: Eighteen hours of education and physical education; graduate classification. Staff

685. Problems. Credit 1 to 3 each semester. I, II, S

Directed study of selected problems of health, physical education, and recreation not related to a thesis. Prerequisites: Graduate classification; approval of the instructor. Staff

Department of History and Government

A. C. ASHCRAFT, W. E. BENTON, C. H. HALL**, H. H. LANG, T. L. MILLER, H. M. MONROE, JR., J. M. NANCE* (Head), A. B. NELSON, L. C. TAYLOR, JR.

Graduate study in government and history is offered leading to the degree of Master of Arts. The graduate programs in history and government are designed to give added preparation to students for teaching, government service, and for continuing graduate study in either history or government leading to a doctorate. In history the student may specialize in Texas history, United States history (colonial, early national, Old South, the West, Civil War period, recent), European history, Latin American history, agricultural history, and industrial history. In government the student will find opportunities for specialization in American national, state and local government; comparative government; international relations; and public administration.

Students will find acceptable minors in education, English, mathematics, science, or other social sciences, including either history or government depending upon their major field. The minor must be some field outside of the major field of study.

Prerequisites: For a major in government or history, the student must present a minimum of 24 semester hours (including 12 advanced hours) of acceptable courses in his major field and for a minor at least 12 semester hours (including at least 6 advanced hours) in the minor field of study. See page 46 of this catalogue.

GOVERNMENT

FOR GRADUATES AND ADVANCED UNDERGRADUATES

308. United States Constitutional Development. (3-0). Credit 3. II

A study of leading decisions of the Supreme Court. The various trends in our constitutional growths since 1789 are treated, as well as the expansion through judicial interpretation of the powers delegated to the national government. Some attention is given to legal terminology and to the composition and functioning of the national judiciary. Required of all pre-law students in the three-year pre-law program. Prerequisites: Government 206; History 105. Mr. Benton

310. Comparative Government. (3-0). Credit 3. II

A survey of major European governments. Stress will be placed upon the parliamentary democracies of Great Britain, France, West Germany, and Italy. The dictatorships of the U.S.S.R. and Spain will also be considered. Governmental background, structure, and operation will receive attention. Prerequisite: Junior classification. Mr. Benton

315. American Political Parties. (3-0). Credit 3. I

A study of the organization, history, and functions of political parties, and the place they occupy in the operation of national, state, and local governments in the United States. Attention is concentrated on the two major political parties, but some attention is given third party movements. Prerequisite: Junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

320. Elements of Political Thought. (3-0). Credit 3. II

A study of ancient, medieval, and modern concepts of government as developed by the principal contemporary political writers, and as reflected in political institutions. Prerequisite: Junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

*Graduate Advisor
**On leave of absence from February 1, 1964 to July 15, 1964.

321. Local Government in the United States. (3-0). Credit 3. II

Development, structure, nature, and legal status of the local government pattern; counties, towns, townships, school districts, and other special districts and units of local government. Relationship of local units to metropolitan areas and to the federal and state governments: revenue problems, and analysis of proposals for reform and reorganization. Special emphasis placed on Texas local government patterns. Prerequisites: Government 206, 207. (To be offered in 1964-65 and in alternate years thereafter.) Staff

325. Introduction to Public Administration. (3-0). Credit 3. I

A survey of American public administration with emphasis upon the following major areas: development of public administration in the United States, theories of administrative organization, principles and methods of administrative management, executive leadership, interpersonal and intergroup relationships, levels of decision making, ethics and responsibility. Prerequisites: Government 206, 207. Staff

331. International Politics. (3-0). Credit 3. I

An analysis of the contemporary world from the point of view of the nation-state; political principles, problems, and factors involved in the foreign policies, and relations of the nation states, with special emphasis on the sources and uses of national power and the difficulties in limiting the use of such power. Prerequisite: Six semester hours of government. (To be offered in 1964-65 and in alternate years thereafter.) Staff

333. International and Regional Organization. (3-0). Credit 3. II

Historical development of modern world-wide regional international organizations. Politics, structure, and functions of the United Nations; regional organizations, economic and political; international federalism; integration of Western Europe, Southeast Asia, Latin America, and the Middle East. Prerequisites: Government 206, 207. (To be offered in 1964-65 and in alternate years thereafter.) Staff

335. Government and Politics of Latin America. (3-0). Credit 3. I

The constitutional development, political institutions, and contemporary political problems of the principal Latin American countries, with special emphasis on the present day constitutions and government structure. Prerequisite: Six hours of government. (To be offered in 1965-66 and in alternate years thereafter.) Staff

431. Conduct and Control of American Foreign Relations. (3-0). Credit 3. I, S

The nature and control of the power to conduct foreign relations under the Constitution; treaties, agreements, and war. The role of the Foreign Service of the State Department: the nature, structure, and functions of the diplomatic and consular services; diplomatic practice and procedure; the relation of the State Department to other Federal agencies. Prerequisites: Twelve semester hours of government, or 6 semester hours of government and 6 semester hours of advanced American History. (To be offered in 1965-1966 and in alternate years thereafter.) Mr. Hall

436. Municipal Government. (3-0). Credit 3. I

Designed for students who may enter the municipal service as well as for those who desire only a general knowledge of city government. Urban growth; legal position of cities; forms of government; the mayor, council, city manager, and municipal courts; relation of city to state; the political process; municipal ownership; services; metropolitan problem; special reference to Texas cities. Prerequisite: Government 206. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Benton

438. American Legislative Process. (3-0). Credit 3. I, S

An analysis of the legislative process; the powers, structure, organization, political control, and procedure of Congress and state legislatures; other legislative authorities. Prerequisites: Government 206, 207. (To be offered in 1965-66 and in alternate years thereafter.) Mr. Arango

441. Public Personnel Administration. (3-0). Credit 3. II

The development of the merit system; problems of recruitment and selection; position classification and compensation; promotion; discipline, service ratings; and retirement. Selected cases in personnel management from the standpoint of the operating official and government. Prerequisites: Six semester hours of advanced government. Staff

FOR GRADUATES

611. Government of the Soviet Union and Eastern Europe. (3-0). Credit 3. II, S

The nature and structure of Soviet political institutions; communist ideology; Russian imperialism and international Communism; the role of bureaucracy and terror in the Communist system; the position of Eastern Europe in the Communist system; the "cold war". Prerequisites: Twelve semester hours of advanced government, or 6 hours of advanced government and History 318; graduate classification. Staff

632. International Law. (3-0). Credit 3. I, S

The nature and sources of international law; recognition of states and governments; jurisdiction on the high seas; rights and immunities of states and persons in foreign courts; the law of international claims, diplomatic immunity, treaties; and the law of war and neutrality. Prerequisites: Twelve semester hours of advanced government; graduate classification. Mr. Benton

685. Problems. Credit 1 to 3. I, II, S

Individual instruction in selected fields of government. The course will stress reports and wide reading in the field selected. Prerequisites: Eighteen hours of government and history; graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Thesis research. Credit will be given only upon acceptance of completed thesis. Prerequisites: Twelve hours of advanced government; graduate classification. Staff

HISTORY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

302. Colonization of North America. (3-0). Credit 3. II

Geographic setting; early English, French, Dutch, Swedish discovery, conquest, and settlement, 1497-1763; colonial administration; colonial life; intercolonial wars. Prerequisite: Twelve hours of history, or six hours of history and at least six hours of sophomore courses in other social sciences. Staff

315. The United States, 1901 to the Present. (3-0). Credit 3. II, S

A study of United States history during the twentieth century. Emphasis is placed primarily on the development and application of progressive principles from the "square deal" of the first Roosevelt to include the subsequent "new deal" and "fair deal" of the Roosevelt and Truman administrations; 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 participation in World War II, and post-war developments. The United Nations and problems. Mr. Miller

318. International Developments since 1918. (3-0). Credit 3. I, II, S

A general survey of world politics since the close of World War I. Particular attention will be given to the problems and ideologies of the great powers of Europe and to those factors and conditions which explain present political tendencies and policies. Due consideration will also be given to colonial problems in Asia and Africa, the Sino-Japanese question, and the clash of United States-Japanese policies. World War II; the conflict of ideologies. Mr. Hall

321. Europe, 1815-1870. (3-0). Credit 3. I

The Congress of Vienna and the reconstruction of Europe; the successive political changes in the major European countries in 1823, 1830, 1848, and 1870, together with the outstanding social, economic, scientific, and cultural developments in European life from 1815 to 1870. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

322. Europe, 1870-1919. (3-0). Credit 3. II

A treatment of the political, economic, social, intellectual, and cultural developments in Europe, 1870-1919, with special emphasis upon the diplomatic and military developments leading to World War I; World War I and the peace treaties. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

331. Medieval Civilization. (3-0). Credit 3. I

History of medieval thought ranging from the influence of Plato and Aristotle to the age of Erasmus and Machiavelli. The course outlines the intellectual history of the Middle Ages and includes in broad outline the interests of man in philosophy, science, education, law, and religion. Prerequisite: Six semester hours of history. Staff

332. Renaissance and Reformation. (3-0). Credit 3. II

A study of the fifteenth and sixteenth centuries with emphasis upon the intellectual history of the era. Political ideas, art, and humanism of the Renaissance are stressed. The doctrinal controversy and the beliefs of Luther, Calvin, and Zwingli are emphasized in the Reformation. Prerequisite: Six semester hours of history. Staff

341. South America to 1825. (3-0). Credit 3. I

Establishment of Spanish and Portuguese dominion in South America; political history of South America from European exploration and settlement to independence; colonial institutions; commercial systems of Spain and Portugal; the independence movement to the founding of the republics. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

342. South America Since Independence. (3-0). Credit 3. II

Political history of the independent South American nations since independence with emphasis upon the ABC countries; economic, social, and cultural development; relations with Europe and the United States; participation in world affairs. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1964-65 and in alternate years thereafter.) Staff

375. Tudor and Stuart England. (3-0). Credit 3. I, S

Study of the changes in the social, economic, and religious organization of England from 1485 to 1689; developments in the international position of England; the rise of Puritanism; the conflict between crown and Parliament; the Interregnum, Restoration, and "Glorious Revolution." Prerequisites: Twelve hours in history, including History 213, 214 or History 217, 218. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Taylor

411. The Old South. (3-0). Credit 3. I, S

A history of the antebellum South. Emphasis will be placed on the following topics: physical bases of Southern regionalism; Southern alignments on national issues; the slavery-plantation economy and society of the Old South; secession and formation of the Confederacy. Prerequisite: History 106 or 325. Mr. Monroe

412. Civil War and Reconstruction. (3-0). Credit 3. II

Survey of the background and causes of the war; military, political, economic, and diplomatic aspects of the war; life behind the lines; reconstruction and post-war adjustments, 1861-1877. Prerequisite: Twelve hours of history, or six hours of history and six hours in sophomore courses in other social sciences. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Ashcraft

413. Mexico and Spanish North America, 1492-1821. (3-0). Credit 3. I

Exploration and establishment of Spanish dominion in the West Indies, Central America, and Mexico; the northward advance of the Spanish frontier under the Hapsburgs and early Bourbons; Spanish colonial system and institutional development; the independence movement. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1965-66 and in alternate years thereafter.) Mr. Nelson

414. History of Mexico, 1821 to the Present. (3-0). Credit 3. II

The political, economic, and social development of Mexico since independence and her relation to other world powers. Prerequisites: Twelve semester hours of history, or 6 hours of history and junior classification. (To be offered in 1965-66 and in alternate years thereafter.) Mr. Nelson

415. The Institutional Background of Texas, 1519-1845. (3-0). Credit 3. I, S

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. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Nance

416. Texas Since 1845. (3-0). Credit 3. II, S

A history of Texas since annexation. Careful attention is given to social, cultural, economic, and political developments, and to the place of Texas in national affairs. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Nance

421. Far East, 1895 to Present. (3-0). Credit 3. II

Brief survey of the government, politics, and civilizations of China, Japan, India, Pakistan, and Southeast Asia; the political picture in the Far East at the end of the Sino-Japanese War, 1895; spheres of influence; Boxer Rebellion; colonialism and nationalism; rise of republicanism; Far East in two world wars; international developments in the Far East; Korean War. Prerequisite: Twelve hours of history, or six hours of history and at least six hours of sophomore courses in other social sciences. (To be offered in 1965-66 and in alternate years thereafter.) Staff

422. International Rivalry in the Gulf-Caribbean Area, 1840 to the Present. (3-0). Credit 3. I

Background of Spanish colonial policy, with British, French, and Dutch intrusion; conflict of interests; influence of islands on mainland settlement. Early United States interest; Monroe Doctrine and its extension; vital treaties with Columbia and Great Britain. European interests in the islands, Central America, Mexico, and Venezuela. Later policies of the United States, rise of Pan-Americanism and Pan-Hispanism. First reciprocal trade treaties and rise of United States imperialism. Policy of "the good neighbor" under Wilson and Roosevelt. Recent progress of Pan-Americanism toward western hemisphere solidarity. (To be offered in 1965-66 and in alternate years thereafter.) Mr. Nelson

423. American Foreign Relations. (3-0). Credit 3. I, S

The history of the United States foreign relations and development of our leading foreign policies to 1868. The Revolution and alliance with France; the development of isolation and neutrality; neutral rights and the War of 1812; nationalism and the Monroe Doctrine; Manifest Destiny and its consequences; diplomacy of the Civil War; the Monroe Doctrine applied to France in Mexico; the "Alabama" claims arbitration. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Hall

424. American Foreign Relations. (3-0). Credit 3. II, S

The history of the United States foreign relations and development of our leading foreign policies, 1875 to the present; America becomes a world power; imperialism; World War I and the failure of neutrality; the League of Nations and its desertion; Pan-Americanism; failure of disarmament and rise of aggression; neutrality fails again; World War II; United Nations and problems. (To be offered in 1964-65 and in alternate years thereafter.) Mr. Hall

FOR GRADUATES

607. The United States, 1763-1800. (3-0). Credit 3. I, S

A study of the causes of the American Revolution, the Revolution, the Articles of Confederation, and final union under the Constitution. Careful attention will be given economic and social developments as well as political developments. Prerequisites: Eighteen hours of history and government; graduate classification. Mr. Nance

609. American Historical Writing. (3-0). Credit 3. I, S

A survey of American historical writing and historiography from 1607 to the present, with some attention to bibliographical guides to sources and literature of the United States. Prerequisites: Twelve hours of advanced history; or 18 hours of history, 6 of which must be advanced, and 6 hours of advanced courses in other social sciences; graduate classification. Mr. Lang

610. The Trans-Mississippi West. (3-0). Credit 3. II

A study of the West in American history. The course will emphasize political, economic, social, and cultural influences of the frontier. Extensive reading will be required. Prerequisites: Eighteen hours of history and government; graduate classification. Mr. Lang

611. American Leaders. (3-0). Credit 3. II, S

The personalities and contributions of thirty-six American leaders from Samuel Adams to Dwight Eisenhower. Prerequisites: Twelve hours of advanced history; or 18 hours of history, 6 of which must be advanced, and 6 hours of advanced courses in other social sciences; graduate classification. Mr. Nance

612. The French Revolution and Napoleon. (3-0). Credit 3. II

Detailed consideration of the decline of the ancient regime, the influence of the Encyclopedists, the causes and course of events during the revolution and a study of the Napoleonic Era. Critical evaluation of the source material as well as interpretation of the historical importance of the period is stressed. Prerequisites: Eighteen hours of history and government; graduate classification. (To be offered in 1965-66 and in alternate years thereafter.) Staff

615. Growth of Spanish Institutions in America, 1492-1857. (3-0). Credit 3. I

A study of the growth of political, economic, religious, military, and related institutions, both in theory and in practice, as proposed, developed, and applied in the Spanish-American colonies and nations, 1492-1857. Prerequisites: Eighteen hours of history and government; graduate classification. (To be offered in 1965-66 and in alternate years thereafter.) Staff

685. Problems. Credit 1 to 3 each semester. I, II, S

Individual instruction in selected fields of history. The course will stress reports and wide reading in the field selected. Prerequisites: Eighteen hours of history and government; graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Thesis research. Credit will be given only upon acceptance of completed thesis. Prerequisites: Twelve hours of advanced history; graduate classification. Staff

Department of Industrial Education

H. D. BEARDEN, J. L. BOONE, E. R. GLAZENER, C. H. GRONEMAN* (Head), L. B. HARDEMAN, L. V. HAWKINS, F. J. KONECNY

It is the responsibility of the Industrial Education Department to develop master teachers and effective leaders in such human relationship vocations as teaching of industrial arts and vocational industrial education, vocational guidance, industrial school administration and supervision. It is a major function of the department to promote the interest of industrial education programs and to afford opportunities for professional education, both theoretical and practical. Graduate degree programs in this department are: Master of Education, Master of Science, and Doctor of Education. A professional teaching certificate for the state of Texas may be earned in this department to become a master teacher of industrial arts.

The classrooms, laboratories, shops and libraries of Texas A&M University are made available to students for studying industrial education. The high schools in the vicinity of the University afford ample opportunity for students to observe the most modern techniques of teaching industrial subjects.

Specialists in other departments and divisions of the University give instruction in subject material which is closely related to industrial education. The shops and laboratories embody the newest type of equipment, shop plans, and instructional aids.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

404. Visual Aids for Industrial Subjects. (1-2). Credit 2. I

This course is designed to develop an understanding of, need for, construction of, and use of visual aids for instruction in industrial subjects. Student activity consists of determining values of color in aids, use of projection and television equipment, and a variety of other audio-visual media. Staff

406. Industrial Guidance. (2-0). Credit 2. I

A study of the instruments and techniques of industrial guidance, its relation to education and industry, its meaning and purpose, and the analysis of methods of investigation and guidance procedures. Staff

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

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

419. Laboratory of Industries Methods. (1-3). Credit 2. II

A study of industries, with particular emphasis on the graphic arts. Student experimentation with methods of communicating through the media of type, engravings, lithography, and xerography. Laboratory work in platemaking, proofreading, copy-fitting, make-up and fundamentals of layout. Staff

*Graduate Advisor

420. Follow-Up, Visitations, and Coordination in Part-Time Schools. (2-0). Credit 2. S

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

423. Analysis Procedure. (1-2). Credit 2. I, II

Analysis is made of occupations to obtain content for instructional information. Jobs and operations are studied to determine the order and content of operation, job description, job evaluation, and job safety. Staff

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

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. Staff

FOR GRADUATES

601. History of Industrial Education. (2-0). Credit 2. I, II, S

A study of leaders, movements, and agencies with special emphasis on the economic, social, and philosophical factors which have contributed to the development of industrial education in the United States. Staff

602. Industrial Arts Administration and Supervision. (2-0). Credit 2. I, II, S

Problems of the local director or supervisor of industrial arts. Staff

603. Administration and Supervision of Vocational Industrial Education. (2-0). Credit 2. I, II, S

Problems of the local director or supervisor of vocational industrial education. Staff

604. Industrial Programs for Junior Colleges and Technical Schools. (2-0). Credit 2. I, II, S

A study of the kinds, purpose, size, accreditation, growth, and teaching problems in the junior colleges, technical institutes, and adult schools, with particular emphasis on the organization and presentation of industrial subject material in these schools. Staff

605. Problems in Industrial Safety. (2-0). Credit 2. I, II, S

Basic reasons for accidents; prevention of industrial accidents; qualifications and duties of safety consultants; methods of making investigations; making investigations and how to prepare safety reports. Staff

606. Organization of Industrial Arts Department. (2-0). Credit 2. I, II, S

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. Staff

609. Methods of Teaching High School Drawing. (2-3). Credit 3. I, II, S

A survey of the field of drawing. The designing and organizing of problems and teaching devices. Staff

614. Guidance Seminar. (2-0). Credit 2. I, II, S

The organization of occupational information; educational and vocational guidance; counseling case problems. Prerequisite: Industrial Education 406 or equivalent. Staff

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

Selecting and organizing instructional material for problems in a particular industrial activity. Staff

618. Tests and Measurements in Industrial Education. (2-0). Credit 2. I, II, S

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

619. Related Subjects in Part-Time Cooperative Programs. (2-0). Credit 2. I, II, S

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. Staff

621. Philosophy of Vocational Education. (2-0). Credit 2. I, II, S

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

622. Philosophy of Industrial Arts Education. (2-0). Credit 2. I, II, S

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

623. Vocational Guidance Procedures. (3-0). Credit 3. I, II, S

A workshop approach to the study of vocational guidance, programs, relationships, group techniques, and methodology of the clinical approach. Staff

626. Classroom Management and Shop Organization. (2-0). Credit 2. I, II, S

The organization of routine procedures to facilitate teaching; setting up roll-checking devices, issuing procedures for tools and materials; keeping material inventory, using assignment charts and progress charts, using student leadership in routine non-teaching class and shop routine, and keeping records. Staff

627. Teacher Training for Local Supervisors of Trade and Industrial Classes. (2-0). Credit 2. S

A discussion of problems related to the administration of industrial education programs, in-service training, and upgrading of programs on the local level. Methods of organizing and conducting teacher improvement programs, including methods of conducting organized research. Staff

628. Organization of Vocational Industrial Schools and Classes. (2-0). Credit 2. S

Methods of making surveys, determining the needs for various industrial education programs, and the organization of the curriculum and classes according to State certification requirements. Staff

630. Auto Mechanics. (1-4). Credit 2. I, II, S

Development and preparation of instructional materials and the testing of laboratory problems pertaining to the economic selection, operation and maintenance of internal combustion engines, power transmission systems, and automated control systems. Staff

631. Electricity. (1-4). Credit 2. I, II, S

Development and preparation of instructional materials for use by electricity and electronics teachers in industrial arts, vocational and technical education programs. Staff

632. Cabinet Making. (1-4). Credit 2. I, II, S

Development and preparation of instructional materials and the testing of laboratory problems pertaining to modern methods of kiln drying, veneer construction, upholstery, and fabrication within the furniture industry. Staff

633. Machine Shop. (1-4). Credit 2. I, II, S

Development and preparation of instructional materials and the testing of laboratory problems pertaining to modern practices and problems in the teaching of advanced machine shop. Staff

634. Ornamental Metal Work. (1-4). Credit 2. I, II, S

Development and preparation of instructional materials and the testing of laboratory problems pertaining to mild steel and tubular metal. Staff

635. Industrial Design and Development. (3-0). Credit 3. I, S

Advanced procedure in preparing teachers for industrial design and development. This includes a historical review of design, the effect of aesthetic, social, and economic factors on a design concept and the relationship between function and the production processes. Prerequisite: Industrial Education 336 or the equivalent. Staff

681. Seminar. (1-0). Credit 1. I, II, S

General discussions of laws, legislation, certification, professional ethics, and other current problems relating to the industrial education teaching profession. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A course designed to enable graduate majors to undertake and complete with credit limited investigations which do not fall within the thesis research and which are not covered by any other course. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis or dissertation. Staff

Department of Industrial Engineering

A. R. BURGESS* (Head), D. E. CLEVELAND, J. P. COVAN, D. D. DREW, J. N. NASH, R. L. SMITH

The graduate program of this department is concerned with the advanced study of various industrial engineering techniques as they apply to manufacturing plants. Facilities for digital computation, motion study, micromotion, methods analysis, statistical studies, and models of plant layout are available.

Recognizing the ever-increasing role being played by digital computers in the solution of a broad spectrum of engineering design and business system problems, a program leading to a Master of Science degree in Computer Science is available for students desiring to specialize in that field. The normal requirement for admission to this program is an undergraduate degree in engineering, mathematics, or physical science, with undergraduate credit in at least one course in the programming of digital computers, and one in numerical methods. The Computer Science Master's program normally comprises Mathematics 609 and 610, and Industrial Engineering 621, 641, 642, and 643 together with electives and thesis.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Survey of Industrial Engineering. (3-0). Credit 3. I, II, S

A survey of the industrial engineering field; administrative decisions, layout of equipment, materials handling, production control, quality control, motion and time study, cost determination, wage plans, job evaluations, operations research, use of computers by management. Prerequisite: Junior classification in engineering or business administration, or approval of Head of Department. Staff

404. Motion and Time Study. (2-3). Credit 3. I, II

Standardization of job conditions; methods improvement and motion economy; use of flow process charts and diagrams, micromotion analysis of motion pictures, simo-charts, multiple-activity charts; allowances; rating methods; taking time studies; use of standard data and development of time formulas. Prerequisite: Junior classification in engineering or business administration. Staff

*Graduate Advisor

412. Labor and Industry. (3-0). Credit 3. I, II

A brief review of the history of organized labor; critical study of fundamental Federal and State laws governing labor-management relations; study of current interpretations of labor laws, controversial labor-management issues and their solutions. Prerequisite: Senior classification in engineering or business administration, or approval of Head of Department. Staff

414. Statistical Control of Quality. (2-3). Credit 3. I

The engineering aspects of controlling quality through use of statistical methods. Frequency distributions, control charts for variables, control for fraction defective and defects per unit. Sampling inspection plans. Design of specifications; tolerance systems and gaging. Administration of inspection. Prerequisite: Junior classification in engineering. Mr. Burgess

415. Production Control. (1-3). Credit 2. I

The planning and control of production; operation analysis; routing; scheduling; dispatching; use of visual production charts and boards; inventory control; accumulation of material requirements; design of production control forms; forecasting production requirements; economic lot size; controls for job order, repetitive cycle, and straight line production; critical path techniques. Prerequisites: Industrial Engineering 302, registration in 404. Staff

416. Factory Layout. (1-6). Credit 3. II

The layout of a complete factory for a selected product. Use of machine templates and models; design of materials handling systems; machine erection; auxiliary services; design of storerooms; loading docks; choice of building types; machine selection; estimate of unit costs; estimate of capital requirements; personnel organization; safety considerations in plant layout. Prerequisites: Industrial Engineering 404, 415. Staff

420. Manufacturing Costs. (3-0). Credit 3. II

The study of modern techniques used by engineers for controlling manufacturing costs. Computing probable returns from investments in new plants and new equipment. Use of break-even charts, profit graphs, machine replacement studies, comparison of alternative methods, standard costs, and budgeting to control manufacturing costs. Introduction to operations research. Prerequisite: Industrial Engineering 414 or registration therein. Mr. Burgess

458. Programming of Digital Computers. (3-2). Credit 4. I, II, S

Operation of digital computer; flow charts; sub-routines; library programs; floating point; multiple precision; error analysis; optimum coding; symbolic coding; interpretive coding; automatic coding; practical applications. Prerequisite: Senior classification in engineering or physical sciences or approval of the Head of the Department. Staff

FOR GRADUATES

601. Industrial Surveys. (2-0). Credit 2. II

Engineering problems related to industrial investigations, reports on organizations, personnel, capital equipment, financial policies, market, etc. Prerequisites: Industrial Engineering 415, 416. Staff

603. Human Relations in Industry. (4-0). Credit 4. I

Causes of misunderstandings between management and labor; interdepartmental relations; conditions which influence the attitudes and productivity of the workers; principles of leadership; critical study of current labor-management problems. Direct worker incentive, seasonal bonuses, quality incentives, profit sharing plans for executives, profit sharing for wage earners. Prerequisites: Industrial Engineering 404, 412. Staff

604. Advanced Time and Motion Studies. (1-6). Credit 3. I

Advanced methods in time and motion study; balancing operations in a group or assembly line; learning curves; work sampling; memomotion and chronocyclegraph studies; fatigue effects; determination and application of elemental time data; statistical methods in time study. Prerequisite: Industrial Engineering 404 or the equivalent in practical time study experience in industry. Mr. CoVan

608. Industrial Case Analysis. (3-0). Credit 3. II

Practice in the application of principles to the solution of actual case problems involving broad management decisions. Special attention is given to problems indigenous to Texas industry. Prerequisite: Graduate classification in industrial engineering or approval of Head of Department. Staff

614. Advanced Quality Control. (3-3). Credit 4. I

Advanced statistical methods applied to quality control problems; significance tests; correlation analysis; sequential sampling; analysis of variance; design of engineering experiments; principles of reliability. Prerequisite: Industrial Engineering 414. Mr. Cleveland

615. Production and Inventory Control. (3-3). Credit 4. II

Recent developments in the techniques used to control inventories and production by means of statistical anaysis of the problems, simulation techniques, and mechanized execution of the inventory and production control functions. Prerequisites: Industrial Engineering 415; graduate classification in industrial engineering or approval of Head of Department. Mr. Burgess

620. Principles of Operation Analysis. (4-0). Credit 4. II

Use of mathematical models in making decisions; optimizing over-all policies; probability methods, linear programming; transportation models; queing theory; learning curves, information theory; Monte Carlo methods; use of high speed computers for managerial control. Prerequisites: Industrial Engineering 420, 614. Mr. Cleveland

621. Computer Methods in Industrial Engineering. (2-3). Credit 3. I, S

Principles and applications of computers to the solution of various industrial engineering problems. May not be taken for credit with Industrial Engineering 615 and 620. Prerequisites: Industrial Engineering 458; graduate classification in engineering or computer science. Mr. Cleveland

641. Computer Languages. (2-6). Credit 4. I, S

A study of design and use of computer oriented and problem oriented languages for digital computers. Prerequisites: Industrial Engineering 458; Mathematics 417. Mr. Drew

642. Computer Methods in Applied Sciences. (2-6). Credit 4. II

Techniques of analysis and programming required to utilize a stored program digital computer for solution of some typical physical systems. Prerequisites: Industrial Engineering 458; Mathematics 609. Staff

643. Logic of Information Processing. (2-6). Credit 4. II

Principles and application of digital computers to problems of data reduction, information retrieval, and large scale commercial data processing problem. Prerequisite: Industrial Engineering 641. Mr. Smith

645. Data Processing Management. (3-0). Credit 3. S

This course presents a comprehensive study of the problems associated with the management of a data processing facility. Particular emphasis is placed on the problems of machine configuration, personnel, systems planning and personnel training requirements. Prerequisites: Industrial Engineering 641. Mr. Smith

651. Tool Design. (3-3). Credit 4. II

Design of automatic machine tools; tracer and director control of tool paths; automatic feeding, holding, indexing and ejection of work pieces; tool replacement analysis. Study of cutting forces, workpiece and fixture distortion. Automatic inspection and sorting, assembly, and packaging. Prerequisite: Industrial Engineering 453. Mr. CoVan

681. Seminar. (2-0). Credit 2. II

Group study and discussion of current developments in industrial engineering practices as reported in the literature and as presented by representatives from industry. Prerequisite: Graduate classification in industrial engineering. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Investigation of special topics not within the scope of thesis research and not covered by other formal courses. Prerequisite: Graduate classification in industrial engineering. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research in the industrial engineering field; subject to meet the needs of the individual student. Staff

Department of Journalism

DELBERT McGUIRE (Head)

FOR GRADUATES AND ADVANCED UNDERGRADUATES

406. Publicity and Public Relations. (3-0). Credit 3. II

Practical analysis of the various fields of publicity and public relations. Students make surveys and perform laboratory work on actual projects. Theory and practice in various aspects of functioning publicity, including news writing, advertising, and radio. Staff

420. Law of the Press. (3-0). Credit 3. II

This course will include a detailed study of the laws of publication and consideration of defamation, sedition, privilege, and ethics for the news media. It will include sections of study on general laws of the United States and on the individual states with emphasis on Texas. Prerequisite: Journalism 307, or approval of the Head of the Department. Staff

462. High School Journalism and Publications. (3-0). Credit 3. S

Problems of advising and sponsoring school newspapers and yearbooks; the school publication as a public relations tool; selecting and training the staff; financing school publications; planning content of high school journalism course. Prerequisite: Twelve semester hours of English; approval of Head of Department. Staff

465. International Communications and Propaganda. (3-0). Credit 3. I

Study of communication problems and practices of the major nations of the world, with emphasis on the theory and functioning of the press under fascism, communism, and democracy; problems of international news distortion and propaganda; the place of the mass media in international relations. Prerequisite: Senior classification; approval of the Head of the Department. Staff

466. Techniques of Mass Communications. (3-0). Credit 3. II, S

Survey of the methods of research in mass communications. Directed reading and discussion of outstanding professional literature in the field of journalism, and the analysis of major issues in contemporary journalism. Prerequisites: Senior classification; approval of the Head of the Department. Staff

Department of Mathematics

R. E. BASYE*, B. W. BREWER*, DAN HALL, J. T. HURT*, J. T. KENT, E. R. KEOWN**, E. C. KLIPPLE* (Head), H. A. LUTHER, W. S. McCULLEY, B. C. MOORE, S. A. SIMS, M. E. TITTLE

The Mathematics Department has two main objectives in its graduate offerings. First, it offers courses from which a graduate student may choose an appropriate sequence for an advanced degree in mathematics; second, it attempts to furnish proper mathematical preparation for graduate students majoring in other departments.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

307. Calculus. (3-0). Credit 3. I, II, S

Introduction to series. Taylor's series, partial differentiation, multiple integrals, applications. Prerequisite: Mathematics 122 or 210. Staff

308. Differential Equations. (3-0). Credit 3. I, II, S

Elementary and linear equations with applications, solution by Laplace transforms and by series, Fourier series, applications. Prerequisite: Mathematics 307. Staff

405. Vector Analysis. (3-0). Credit 3. I, II

Elementary operations, vector and scalar products of two vectors, vector and scalar products of three vectors, differentiation of vectors, the differential operators, applications to electrical theory, dynamics, mechanics, and hydrodynamics. Prerequisite: Mathematics 307. Staff

409. Advanced Calculus. (3-0). Credit 3. I, II, S

The concept of a function, limit of a sequence, continuity, theorems on continuous functions, the definite integral, the derivative, mean value theorems, hyperbolic functions, improper integrals. Prerequisite: Mathematics 307. Staff

410. Advanced Calculus. (3-0). Credit 3. II

Theory of plane curves, mechanics of a particle, Taylor's theorem and applications, numerical integration, convergence and divergence of series, power series, periodic functions, Fourier series. Prerequisite: Mathematics 409. Staff

411. Mathematical Probability. (3-0). Credit 3. I, II

Event sets; probability concepts; functions based on discrete and continuous event sets; binomial, hypergeometric, gamma, beta and normal functions; moments and moment generators; determination of probability functions by inverse processes. Prerequisite: Mathematics 307. Staff

414. Mathematical Statistics. (3-0). Credit 3. I, II, S

History and terminology of statistics, probability theory, discrete and continuous distributions, expected values, moments, sampling, confidence intervals, tests of hypotheses. Prerequisite: Mathematics 307. Staff

415. Modern Algebra. (3-0). Credit 3. I, S

Integers, rational numbers, real numbers, complex numbers. Groups, rings, integral domains, fields. Polynomials over a field. Prerequisite: Mathematics 307. Staff

416. Modern Algebra. (3-0). Credit 3. II

Fundamental ideas in modern algebra centered around the basic concept of a group; the group concept; complexes and subgroups; groups of permutations; abelian groups. Prerequisite: Mathematics 415. Staff

*Graduate Advisor
**On leave of absence from September 1, 1963 to August 31, 1964.

417. Numerical Analysis. (3-3). Credit 4. I, II, S

Difference tables and applications, interpolation, numerical integration and differentiation, selected topics in Taylor's Series, orthogonal polynomials, error analysis, numerical solution of equations, elementary matrix theory, numerical solution of differential equations. The laboratory will consist of programming relevant problems on a high speed computer. Prerequisite: Mathematics 308 or registration therein. Staff

FOR GRADUATES

600. Fundamental Mathematics in Secondary Schools. (3-0). Credit 3. S

Basic concepts of arithmetic, algebra, geometry, and trigonometry as viewed from the standpoint of higher analysis; famous problems; construction of tables and slide rules; other topics designed to help vitalize the teaching of high school mathematics. Prerequisite: Mathematics 122 or 210. Staff

601. Higher Mathematics for Engineers and Physicists. (4-0). Credit 4. I, II, S

Surface integrals, line integrals, vector analysis, partial differential equations, elementary complex variables, applications. Prerequisite: Mathematics 308. Mr. Hall

602. Higher Mathematics for Engineers and Physicists. (4-0). Credit 4. I, II, S

Fourier integrals, Bessel and Legendre functions, Laplace's equation, the diffusion equation, the wave equation, Green's functions. Prerequisite: Mathematics 601. Mr. Basye

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

Markov processes, matrix theory applications, special limit theorems, transforms. Prerequisite: Mathematics 411. Mr. Tittle

607. Real Variables. (4-0). Credit 4. I

Fundamental theory of number sets and point sets, elementary applications to real functions, theory of linear measure. Prerequisite: Mathematics 409. Mr. Klipple

608. Real Variables. (4-0). Credit 4. II

Measurable functions, the Riemann integral, the Lebesgue integral, applications to real functions and series. Prerequisite: Mathematics 607. Mr. Klipple

609. Numerical Analysis. (3-3). Credit 4. I

Linear and non-linear programming; simulation, Monte Carlo techniques, game theory. The laboratory will consist of programming the solution of appropriate problems on a high speed digital computer. Prerequisite: Mathematics 417. Mr. Moore

610. Numerical Methods in Differential Equations. (3-3). Credit 4. II

Elementary numerical solutions, analytical foundations, systems of equations, higher order equations, two-point boundary problems, numerical methods for partial differential equations. The laboratory will consist of programming a high speed digital computer. Prerequisite: Mathematics 417. Mr. Luther

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

Definitions, general methods of solving first order differential equations, singular solutions, geometrical applications, trajectories, motions of a particle, special methods for the equation of the first order, linear equations of the second order, the method of successive approximations, systems of ordinary differential equations, interpolation and numerical integration, symbolic methods, numerical solution of differential equations. Prerequisite: Mathematics 601. Mr. Hurt

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

General solution of first order partial differential equations, solution of second order equations from physics and mechanics by separation of variables, solution of second order equations by Green's functions. Prerequisite: Mathematics 611 or the equivalent. Mr. Hurt

615. Vector Spaces and Matrices. (4-0). Credit 4. I

Development of the fundamental properties of matrices by use of vector spaces and linear transformations. Prerequisite: Mathematics 409 or 415. Mr. Luther

616. Linear Transformations and Matrices. (4-0). Credit 4. II

Development of canonical forms for matrices by use of transformations. Prerequisite: Mathematics 615. Mr. Luther

617. Complex Variables. (4-0). Credit 4. I, S

Fundamental theory of analytic functions, conformal mapping, applications. Prerequisite: Mathematics 601. Mr. Basye

618. Complex Variables. (4-0). Credit 4. II

The Schwarz-Christoffel theorem, infinite products, meromorphic functions, elliptic functions, special functions, applications. Prerequisite: Mathematics 617. Mr. Basye

620. Fourier Series and Allied Topics. (4-0). Credit 4. I

Convergence of Fourier series, the cosine series, the sine series, uniform convergence of Fourier series, differentiation and integration of Fourier series, Fourier integrals, Bessel functions. Prerequisite: Mathematics 608. Mr. Klipple

622. Laplace Transforms. (4-0). Credit 4. II, S

Fundamental theorems concerning Laplace transforms. Applications to ordinary and partial differential equations, difference equations, and integral equations. Prerequisite: Mathematics 601. Mr. Klipple, Mr. Sims

623. Higher Mathematics for Chemical Engineers. (4-0). Credit 4. II

Derivation and solution of the differential equations of chemistry and chemical engineering, mathematical theory of distillation, series solutions of differential equations, Bessel functions. Prerequisite: Mathematics 308. Mr. Moore

624. Higher Mathematics for Chemical Engineers. (4-0). Credit 4. I

Equations of finite differences, applications of partial differentiation, solution of partial differential equations, Fourier integrals, orthogonal systems, numerical and graphical methods, theory of errors. Prerequisite: Mathematics 623. Mr. Moore

625. Matrix Algebra and Tensor Calculus. (4-0). Credit 4. I, II, S

Elementary matrix operations; linear transformations; canonical and modified triangular forms of matrices; inverse of a non-singular matrix; diagonal and rotation matrices; characteristic roots of a matrix; symmetric matrices; tensor concept; covariance and contravariance; algebra of tensors; metric tensors; Christoffel's symbols; covariant differentiation of tensors; applications. Prerequisite: Mathematics 405 or 601. Mr. Hurt

627. Theory of Numbers. (3-0). Credit 3. I

Ordered rings; the ring of integers; Euclidean rings; unique factorization; congruences; the Fermat-Euler Theorem; residues of powers; quadratic residues; the Legendre, Jacobi, and Kronecker symbols; quadratic reciprocity; diophantine equations; the series of primes; tests for primality. Prerequisite: Mathematics 409 or 415. Mr. Brewer

628. Theory of Numbers. (3-0). Credit 3. II

Commutative rings; ideals and residue class rings; principal ideal rings; unique factorization rings; quadratic fields; fields of higher degree. Prerequisite: Mathematics 627. Mr. Brewer

633. Group Representations. (4-0). Credit 4. I

This course introduces the basic properties of groups necessary for the study of group representations. Based on this foundation, the remainder of the course develops the theory of the representation of finite groups. The course content will be somewhat determined by the interest and preparation of the students. Prerequisites: Mathematics 415; approval of the instructor. Mr. Keown

636. Topology. (3-0). Credit 3. II

Axiomatic treatment of topological spaces. The metrization problem. Application to arcs and curves. Prerequisite: Mathematics 607. Mr. Klipple

641, 642. Modern Analysis. (4-0). Credit 4 each semester. I, II

Recent developments in the theory of functions. Prerequisite: Mathematics 608. Mr. Klipple

685. Problems. Credit 1 to 4 each semester. I, II, S

A course offered to enable students to undertake and complete with credit limited investigations which do not fall within their thesis research and which are not covered by any other courses in the curriculum. Prerequisite: Mathematics 601. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis or dissertation. Staff

Department of Mechanical Engineering

A. B. ALTER, J. H. CADDESS, C. W. CRAWFORD, E. S. HOLDREDGE*, T. J. KOZIK, J. M. NASH, T. A. NOYES, L. S. O'BANNON, J. V. PERRY, JR., C. M. SIMMANG* (Head), J. G. H. THOMPSON, W. I. TRUETTNER, R. M. WINGREN*

The graduate program in mechanical engineering is designed to prepare a student to work in the more technical phases of this field. The courses are planned not only to give certain factual information but to emphasize fundamentals and methods, to clarify principles, to indicate their applicability in a growing field, to develop a rational analysis from basic fundamentals, and to develop skill in the formulation of solutions to engineering problems.

The student is allowed to choose his courses so as to specialize in the heat power field, mechanical design, or applied mechanics. Laboratory facilities are available for graduate study and research in metallurgy, stress analysis including photoelasticity, vibrations, internal combustion engines, refrigeration, heat transfer, fluid flow, and computer theory.

The Mechanical Engineering Department and other departments in the College of Engineering and in the College of Arts and Sciences offer a number of courses in engineering mechanics so that the student may specialize in this field if he desires.

Mathematics 308, Differential Equations, is required for a Bachelor of Science degree in Mechanical Engineering and students planning to do graduate work in mechanical engineering should have completed Mathematics 308 or its equivalent before entering.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

340. Physical Metallurgy. (2-3). Credit 3. I, II, S

The fundamentals of physical metallurgy; the structure of matter; physical and mechanical properties; corrosion; metals and alloy systems; precipitation hardening; heat treatments of steels; stainless steels, the light metals, copper alloys, and miscellaneous commercial alloys; metallurgy of fabrication methods. The laboratory includes demonstration and participation in metallographic techniques, physical testing, cold working and heat treatment. Prerequisites: Chemistry 102 or 104; Civil Engineering 305 or registration therein. Staff

*Graduate Advisor

410. Internal Combustion Engines. (3-0). Credit 3. I, II

Thermodynamics of cycles for internal combustion engines and gas turbines, including fuels and combustion. Performance characteristics of various types of engines. Prerequisite: Mechanical Engineering 323 or 327. Mr. Truettner

414. Steam and Gas Turbines. (3-0). Credit 3. I

Analysis of gas turbine cycles, high speed gas flow, turbine and compressor kinematics and thermodynamics; study of steam turbines and of special cycles. Prerequisites: Mechanical Engineering 328, 344. Staff

436. Air Conditioning and Refrigeration. (3-0). Credit 3. II

Application of the principles of thermodynamics to equipment and methods of practical production of refrigeration. The thermodynamics of conditioning air. Selection of equipment, piping, and duct layouts for heating, ventilating, and air conditioning. Prerequisite: Mechanical Engineering 323 for non-mechanical engineering majors; 328 for mechanical engineering majors. Staff

445. Machine Design. (2-3). Credit 3. I, II

The theory and practice of machine design applied to various machine parts, such as columns, screws, shafts (considering combined stresses), bearings, brakes, springs, and complete machines. Prerequisites: Mechanical Engineering 310, 338, 340. Staff

446. Machine Design. (2-3). Credit 3. I, II

The theory and practice of machine design applied to problems encountered in transmission of power by means of belts, chains, and gears. Prerequisite: Mechanical Engineering 445 or registration therein. Staff

457. Engineering Analysis. (3-0). Credit 3. II

Mathematical and experimental methods of solving problems in the various fields of engineering. Dimensional analysis, representation and analysis of experimental data, graphical and numerical solution of differential equations, analogies and computers. Prerequisites: Mathematics 308; senior classification in engineering. Mr. Holdredge

459. Mechanical Vibration. (3-0). Credit 3. I, II, S

The basic theory of vibrating systems with single and multiple degrees of freedom and the principles of transmission and isolation of vibrations. Prerequisites: Mathematics 308; Mechanical Engineering 313. Staff

461. Heat Transfer. (3-0). Credit 3. I, II, S

Study of conduction, convection, and radiation separately and in combination; steady and unsteady states; mathematical treatments; graphical and numerical solutions, dimensional analysis. Prerequisites: Mathematics 308; Mechanical Engineering 344. Staff

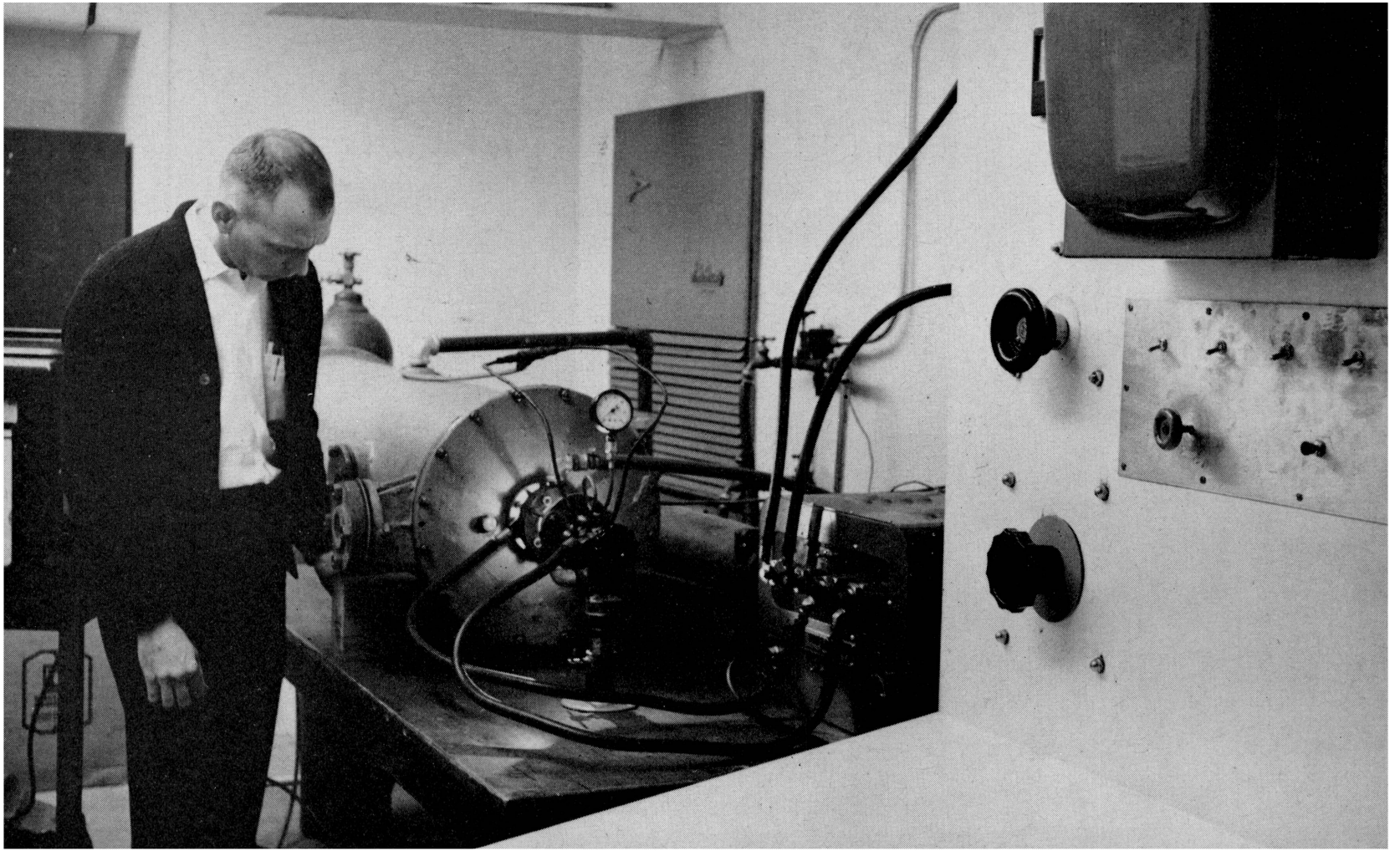
485. Advanced Problems in Mechanical Engineering. Credit 2 to 5. I, II, S

Special problems in the various phases of mechanical engineering are assigned to individual students or to groups. Readings are assigned, and frequent consultations are held. Prerequisites: By permission and senior classification in mechanical engineering. Staff

FOR GRADUATES

600. Mechanics for College Teachers: Dynamics. (3-0). Credit 3. S

Kinematics of absolute and relative displacement, velocity, and acceleration by graphical, algebraic, and vector methods to include Coriolis' component; kinetics and dynamics of translation and rotation, work, energy, impact, momentum, balancing; teaching techniques, associated seminar. Prerequisites: Mathematics 685 (2 hours); Mechanical Engineering 599. Mr. Caddess



601. Advanced Machine Design. (4-0). Credit 4. II

A study of special design problems in mechanical engineering such as design of piping systems subjected to thermal expansion, theory of lubrication, curved beams and flat plates. Prerequisites: Mathematics 308; Mechanical Engineering 445 or the equivalent. Mr. Wingren

603. Power Plants. (2-6). Credit 4. II

The design of central and isolated power plants with special attention to over-all economic operation. Prerequisite: Mechanical Engineering 417. Mr. Alter

605. Engineering Analysis. (4-0). Credit 4. I, S

A study of analytical, graphical, and approximate methods of solving problems common to engineering; dimensional analysis and model study; design of experiments; statistical analysis and interpretation of test data including derivation of empirical equations. Prerequisite: Mathematics 308. Mr. Holdredge

613. Engineering Dynamics. (4-0). Credit 4. II

A study of the dynamics of particles and of rigid bodies; the virtual work principle, Lagrange's and Euler's equations of motion, and Hamilton's principle applied to engineering problems. Prerequisites: Mathematics 601; Mechanical Engineering 313. Mr. Wingren

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

The theories of thermodynamics and their application to the more involved problems in engineering practice. Second law analysis and statistical theory are emphasized. Prerequisite: Mechanical Engineering 328. Mr. Simmang

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

The fundamental laws relating to heat flow, the application of these laws to engineering materials used in various industrial processes; a study of recent developments by reference to current literature. Prerequisites: Mathematics 601; Mechanical Engineering 605. Mr. Holdredge

617. Mechanical Vibrations. (4-0). Credit 4. I, S

The theory of vibrations of machines and structures. Vibration of elastic bodies and of non-linear systems. Prerequisites: Mathematics 308; Mechanical Engineering 313. Mr. Kozik

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

Thermodynamics of air-vapor mixtures as applied to air conditioning. Design and selection of equipment with emphasis on system planning, air distribution, controls, noise and vibration elimination, costs and economics. Prerequisite: Mechanical Engineering 436. Staff

620. Experimental Stress Analysis. (3-3). Credit 4. I

Study of photoelasticity, electric strain gauges, stresscoat. Prerequisite: Mathematics 308 or registration therein. Mr. Wingren

621. Fluid Mechanics. (4-0). Credit 4. I

A study of flow problems encountered in the design of water, gas, and steam turbines; centrifugal and axial-flow pumps and compressors. Prerequisites: Mathematics 308; Mechanical Engineering 344. Staff

631. Jet Propulsion. (4-0). Credit 4. I

Study of the fluid mechanics and thermodynamics of turboprop engines, ramjets, turbojets, rocket motors, and electric propulsion systems. Where applicable, an analysis of the performance of these systems will be made. Prerequisites: Graduate classification in engineering; approval of the Head of the Department. Staff

Checking the generator in graduate research for NASA in plasma acceleration.

640. Ferrous Metallurgical Design. (3-3). Credit 4. II
A detailed study of the phase transformations in steel, the resulting changes in mechanical properties, the peculiarities of the steels, and their influence upon the design of machine elements. Prerequisites: Mechanical Engineering 340, 409 or its equivalent. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S
The content will be adapted to the interest and needs of the group enrolled. Staff

691. Research. Credit 1 or more each semester. I, II, S
Methods and practice in mechanical engineering research for thesis or dissertation. Staff

Structural Mechanics 601. Theory of Elasticity. (4-0). Credit 4. I, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 602. Structural Stability. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 603. Theory of Plates and Shells. (4-0). Credit 4. I
See Structural Mechanics for a full description of this course.

Structural Mechanics 604. Vectors and Tensors in Mechanics. (2-0). Credit 2. I, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 605. Flow and Fracture of Solids. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 606. Theory of Thermal Stresses. (4-0). Credit 4. II
See Structural Mechanics for a full description of this course.

Structural Mechanics 607. Matrix Methods of Structural Analysis. (3-3). Credit 4. II, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 608. Experimental Structural Analysis. (2-3). Credit 3. II, S
See Structural Mechanics for a full description of this course.

Structural Mechanics 609. History of Structural Mechanics. (2-0). Credit 2. II, S
See Structural Mechanics for a full description of this course.

Department of Nuclear Engineering

R. G. COCHRAN (Head), J. D. RANDALL

The rapid growth in the relatively new field of nuclear engineering in the fields of research and power reactors and the utilization of radioisotopes have created quite a demand for trained nuclear engineers. With the preesent planned utilization of nuclear power in space applications, the need for nuclear engineers has now rapidly increased. This need led to the establishment of the Nuclear Engineering Department, which offers the Master of Engineering, Master of Science, and Doctor of Philosophy degrees. Admission to the program requires a Bachelor's degree in engineering, chemistry, mathematics, or physics. Some nuclear physics background is highly desirable.

Mathematics through differential equations is required. Degree programs are encouraged which include a minor field of study. This minor field would normally include graduate study in the area of the student's Bachelor's degree.

The facilities available for instructional purposes are a radiation measurements laboratory, a sub-critical reactor laboratory, an analog computer, a reactor simulator, a radiochemistry laboratory, a low power nuclear reactor, and a 5 megawatt research reactor located in the Texas A&M Nuclear Science Center.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Nuclear Engineering. (3-0). Credit 3. I

A non-rigorous treatment of the various elements of nuclear engineering. This course is especially offered for students not electing to pursue advanced study in this field. Prerequisites: Mathematics 122 or 210; Physics 219; senior classification. Staff

402. Industrial Applications of Radioisotopes. (3-0). Credit 3. II

The properties of radioactive nuclei and the interactions of radiation with matter are discussed. The behavior of radiation detection devices is covered. The properties of radioisotopes that lend themselves to industrial usage are presented and the individual applications are evaluated. Prerequisites: Mathematics 308; senior classification. Staff

409. Radiological Safety. (2-0). Credit 2. I, II, S

Lectures and demonstrations concerning the interactions of nuclear radiations with matter and especially with biological systems. Special emphasis will be given to the theory and practice of radiation dosimetry as applied to radiation protection. Discussion of biological and physical bases for radiation safety standards. Prerequisites: Mathematics 307; Physics 220; or approval of the instructor. Staff

FOR GRADUATES

601. Nuclear Reactor Analysis. (4-0). Credit 4. I

Nuclear transformations in fission reactors. Neutron cross-section and resonance reactions. The neutron balance and cycle. Neutron slowing-down and diffusion. Fermi age and multigroup criticality for bare, homogeneous cores. Reflected homogeneous and heterogeneous reactors. Reactor kinetics including the inhour equation, source multiplication in sub-critical reactors and fission product poisoning. Prerequisites: Mathematics 308, 601 or registration therein. Staff

602. Nuclear Reactor Analysis. (4-0). Credit 4. II

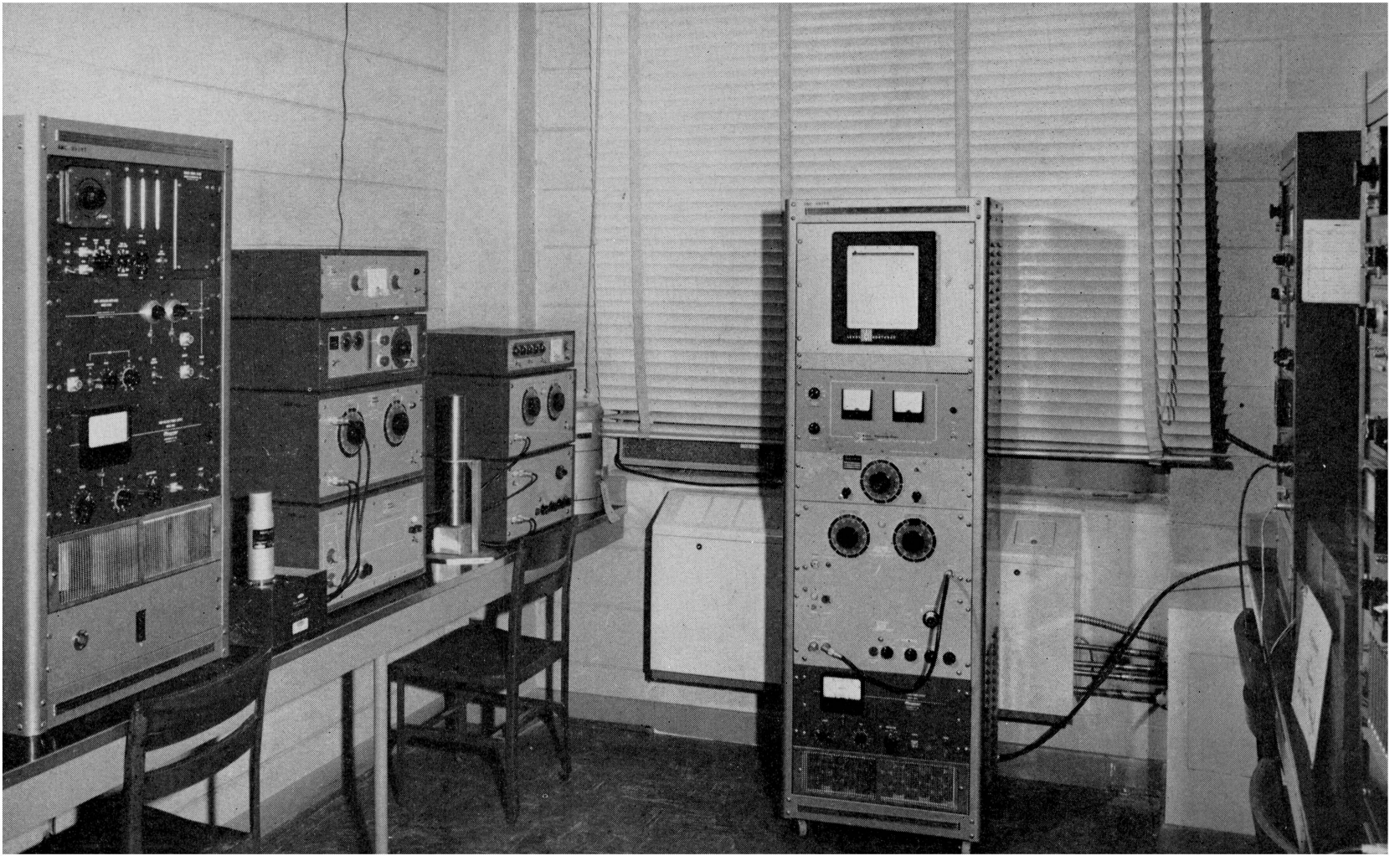
Introductory transport theory with emphasis on the limitations of diffusion and age theory. Multigroup slowing-down diffusion theory for bare and reflected cores. Thermal utilization, resonance escape, fast fission, homogenization and anisotropies in heterogeneous lattices. Temperature coefficients. Control rods. Reactor kinetics with and without temperature feedback. Perturbation theory for thermal reactors. Prerequisites: Mathematics 601; Nuclear Engineering 601. Staff

605. Nuclear Measurements Laboratory. (2-3). Credit 3. I

The basic techniques of nuclear measurements are discussed and practiced. The behavior of neutrons in multiplying and non-multiplying media is observed. Extensive use is made of the nuclear reactor. Prerequisite: Nuclear Engineering 601 or registration therein. Staff

606. Reactor Experimentation. (2-3). Credit 3. II

The techniques of Nuclear Engineering 605 are utilized in measuring the properties of a nuclear reactor. Control rod and power calibrations are performed. The effects of scattering, absorption, and moderation on the reactor are determined. The reactor core is disassembled and a critical experiment performed. Prerequisites: Nuclear Engineering 602 or registration therein, 605. Staff



608. Thermonuclear Engineering. (3-0). Credit 3. II

Fundamentals relative to the use of the fusion reaction as an energy source. Charged particle reactions. Reaction rates. Radiation losses. Transport theory for ionized gases. Liouville and Boltzmann equations. Macroscopic conservation laws and magnetohydrodynamics. Propagation of small amplitude waves. Instabilities. Confinement and heating problems. Diagnostics. Staff

610. Design of Nuclear Reactors. (3-0). Credit 3. II

This course applies the fundamentals of nuclear physics and reactor theory with engineering fundamentals to the design of nuclear reactors. Prerequisites: Nuclear Engineering 601, 602 or registration therein. Staff

615. Nuclear Radiation Detection. (3-0). Credit 3. I

The interaction of radiation with matter and the behavior of ion pairs in the presence of electric fields are discussed. The theory of operation is presented for the following radiation detection devices: ion chambers, proportional and G-M counters, scintillation detectors, Cerenkov counters, emulsions, cloud chambers, bubble chambers, and activation detectors. Prerequisite: Mathematics 307. Staff

618. Nuclear Control Systems. (3-0). Credit 3. II

The fundamentals of servocontrol are developed and applied to a nuclear reactor. The safety aspects of reactor control and operational problems are discussed. Prerequisites: Nuclear Engineering 601, 602 or registration therein. Staff

621. Nuclear Metallurgy. (3-0). Credit 3. II

The physical and metallurgical properties of metals used in nuclear reactors and the reasons for their use are considered. Prerequisite: Mechanical Engineering 409. Staff

622. Nuclear Power Plant Design and Analysis. (3-0). Credit 3. II

This course is designed to present the application of nuclear reactor systems to the field of power production, utilizing the general fields of thermodynamics and heat transfer, along with special problems arising from a nuclear system. Prerequisites: Mechanical Engineering 323 or 328; Nuclear Engineering 601. Staff

623. Analytical Nuclear Engineering I. (3-0). Credit 3. I

Unified analytical treatment of heat conduction in solids and thermal stress phenomena with application to nuclear energy sources. General and specialized formulations and methods of solution for predicting the response of solids to simultaneous thermal and external loads. Transient heat conduction in solids. Isothermal elasticity. Thermoelasticity. Viscoelasticity. Plasticity. Prerequisites: Mathematics 622 or 625; Nuclear Engineering 610; approval of the instructor. Staff

624. Analytical Nuclear Engineering II. (3-0). Credit 3. II

Unified treatment of mass, momentum, and energy transport with applications to nuclear energy sources. Transport coefficients. General and specialized formulations of mass, momentum, and energy balances. Potential, Newtonian, and non-Newtonian flows. Velocity and temperature distributions in laminar and turbulent flow. Liquid metal heat transfer. Flow and thermal stability. Prerequisite: Nuclear Engineering 623. Staff

625. Nuclear Reactor Theory. (4-0). Credit 4. I

Advanced treatment of neutron transport with and without spectrum regeneration. Integrodifferential and integral Boltzmann equations and their adjoints. Methods of solution including exact, complete set representations, integral theory. Spatially dependent and independent kinetics. Perturbation theory for steady-state and transient phenomena. Prerequisites: Mathematics 602 or 617; Nuclear Engineering 602. Staff

Graduate thesis research in progress using the Nuclear Engineering Department training reactor.

626. Nuclear Reactor Theory (4-0). Credit 4. II

Continuation of Nuclear Engineering 625. Variational principles for discrete and continuous eigenvalues with applications to problems with and without spectrum regeneration. Milne problem and the Weiner-Hopf technique. Serber-Wilson and Feynman methods. Spatially independent and dependent slowing-down theory. Neutron thermalization in light and heavy elements. Prerequisite: Nuclear Engineering 625. Staff

681. Seminar. (1-0). Credit 1. I, II

Special topics in nuclear engineering which are not covered by formal course work. Whenever possible, guest lecturers will discuss topics which they have personally investigated. Prerequisite: Graduate classification. Staff

685. Problems. Credit 1 to 4 each semester. I, II

This course is offered to enable students to undertake and complete limited investigations which do not fall within their thesis research and which are not covered by any other courses in the curriculum. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research toward thesis or dissertation. Staff

Department of Oceanography and Meteorology

E. E. ANGINO, K. C. BRUNDIDGE, R. A. CLARK, W. H. CLAYTON*, J. D. COCHRANE, S. Z. EL-SAYED, G. A. FRANCESCHINI, J. F. GRIFFITHS, W. K. HENRY, D. W. HOOD*, G. L. HUEBNER, JR., L. S. KORNICKER, D. F. LEIPPER (Head), H. J. McLELLAN, V. E. MOYER, W. E. PEQUEGNAT**, S. M. RAY, R. O. REID, A. H. THOMPSON

DEGREES

Graduate degrees are offered in oceanography and in meteorology.

OCEANOGRAPHY

Oceanography is the study of the oceans and their boundaries. It is based upon the unity of the sciences of the sea. Effective study of the subject requires thorough previous training in one of the basic sciences such as biology, chemistry, geology, mathematics, meteorology, physics, or in engineering. Therefore, much of the work in oceanography is conducted at the senior and graduate levels.

Oceanography may be utilized in solving certain problems arising in fisheries work, offshore oil and gas operations, navigation, prevention of beach erosion, weather forecasting, recreation, extraction of raw materials from the sea, marine construction, coastal sanitation, military operations, fresh water supply, and many other activities. It requires broad interest, numerous skills, a real liking for the sea, and an adaptability to shipboard life.

Five options and their corresponding engineering phases are offered in oceanography. These are the biological, chemical, geological, physical, and meteorological. The options differ primarily in the undergraduate work. Prerequisites required are the equivalent of a B.S. degree in one of the basic fields and some work in each of the other basic fields.

To qualify for an advanced degree in oceanography, the student must learn how to apply the training in his basic science to the marine environment, which requires a combination of principles and methods and a certain body of knowledge unique to oceanography; and he must develop an interest in the other marine sciences.

METEOROLOGY

Meteorology is the science of planetary atmospheres and their phenomena. It concerns the study of internal and boundary layer atmospheric processes.

*On leave of absence from September 1, 1963 to August 31, 1964.
**Acting head as of March 1, 1964.

The objective in meteorology is to determine the physical and chemical laws affecting atmospheres and to apply them in ways benefiting life and human endeavor, such as in weather forecasting. The greatest uses of weather information and forecasts have been in aviation, space exploration and travel, and in the general public interest. Increasing rewards are being found in applications to agriculture, shipping, engineering, civil and industrial planning, health and travel, recreation, space exploration, and related sciences.

Prerequisites for graduate work in meteorology are satisfied by the undergraduate program offered in the Department. Also, most graduates in science or engineering may qualify for a graduate degree in meteorology by scheduling approximately two extra semesters of work. Programs may be organized to provide specialization in certain applications such as marine, agricultural, radar, dynamical and numerical, chemical, physical, and synoptic meteorology.

FACILITIES AND PARTICIPATION IN RESEARCH

Graduate students often take an active part in one or more of the research contracts sponsored in the Department by industry and by state and federal agencies. In addition to campus facilities others are available for working at sea and in several coastal and offshore locations.

METEOROLOGY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

435. Dynamic Meteorology. (3-0). Credit 3. I

A continuation of Meteorology 336 with emphasis on applications of the vorticity equation, the movement of barotropic and baroclinic pressure systems, elements of numerical weather prediction, perturbation equations, and the general circulation. Prerequisites: Mathematics 308; Meteorology 336. Staff

453. Synoptic Meteorology. (1-6). Credit 3. I, II, S

A continuation of Meteorology 452 with emphasis on interpretation of weather events from analyzed and prognostic charts. Current weather is utilized on a local area chart. Weather elements are forecast. Weather briefing and presentation. Prerequisite: Meteorology 452. Staff

465. Agricultural Meteorology. (2-0). Credit 2. I

Study of principles of meteorology as they are related to agriculture, with special emphasis upon the climate of the surface layers of the atmosphere. Prerequisite: Approval of the instructor. Staff

467. Marine Meteorology. (3-0). Credit 3. I

Primary concern is with interactions between sea and air, and resulting modifications of the atmosphere and sea. Emphasis on energy budget and exchange relations employing hydrodynamic equations of conservation and transfer to determine fluxes and sources of atmospheric energy. Climatology of global exchanges and restricted area applications are considered. Prerequisite: Approval of the instructor. Staff

475. Radar Meteorology. (3-0). Credit 3. I, II

Study of the theory and practice of radar storm observations. Prerequisites: Meteorology 445, 451. Staff

479. Military Applications of Meteorology. (3-0). Credit 3. I, II

Applications of meteorological knowledge and data to related activities and problems in the national defense not under security classification. Prerequisite: Meteorology 451. Staff

FOR GRADUATES

600. Survey of Meteorology. (3-0). Credit 3. S

A survey course in meteorology designed for teachers of secondary school science. Prerequisite: Approval of Heads of Departments of Oceanography and Meteorology and of Education and Psychology. Staff

615. Instrument Theory and Design. (3-0). Credit 3. II

A study of modern methods of instrumentation as related to meteorology and allied geophysical fields; their basic concepts, design, use, and inherent errors. Prerequisite: Bachelor of Science degree in science or engineering. Mr. Huebner

625. Applied Climatology. (3-0). Credit 3. I

Practical application of fundamental climatology and microclimatology to various aspects of life such as botany, zoology, human physiology, engineering and hydrology, and the methods used to coordinate climatology with these other disciplines. Prerequisite: Meteorology 425 or approval of the instructor. Mr. Griffiths

636. Dynamic Meteorology. (3-0). Credit 3. II

A formal treatment of the principles of fluid dynamics as they apply to the atmosphere; the Navier-Stokes equations; perturbation theory, energy equations and transformations, vorticity, barotropic and baroclinic systems, cyclone theories, and numerical weather prediction. Prerequisites: Mathematics 601; Meteorology 435. Mr. Brundidge

637. Numerical Weather Prediction. (3-0). Credit 3. I

Numerical weather prediction: the scale of atmospheric motion; atmospheric modeling, stability, finite difference formulation and methods of solution; smoothing and filtering; accuracy of solutions; automatic processing of meteorological data; numerical solutions of boundary layer problems. Prerequisites: Mathematics 417; Meteorology 435. Staff

638. Meteorological Simulation. (2-3). Credit 3. I

Introduction to uses of simulation techniques in meteorological research with laboratory practice utilizing general purpose electronic analog computer; review of general simulation techniques; problem material from all phases of meteorology with major emphasis on physical processes occurring at earth-atmosphere and ocean-atmosphere interfaces. Prerequisites: Mathematics 308; Meteorology 445; or approval of the instructor. Mr. Clayton

645. Cloud and Precipitation Physics. (3-0). Credit 3. I

The physics of clouds and precipitation: condensation in clean ion-free air; atmospheric condensation and deposition nuclei; formation and growth of droplets and snow crystals; physics of natural and artificially-stimulated precipitation; atmospheric and cloud electrification. Prerequisite: Meteorology 446. Mr. Clark

647. Meteorology of the Upper Atmosphere. (3-0). Credit 3. I

Study of the composition, structure, and characteristic phenomena of the extratropospheric terrestrial atmosphere based on balloon, rocket, artificial satellite, and various indirect measurements. Prerequisite: Bachelor of Science degree in science or engineering. Mr. Moyer

648. Cosmic Meteorology. (3-0). Credit 3. II

Continuation of Meteorology 647. Examination of the properties and processes of the interplanetary plasma and of the atmospheres of the other planets: composition, structure, clouds, and circulations, and their implications in terrestrial meteorology. Prerequisite: Meteorology 647. Mr. Moyer

657. Mesometeorology. (2-6). Credit 4. II

Theory and analysis of mesoscale weather systems, including fronts, squall lines, tornadoes, thunderstorms, air-mass cumuli, and local circulation systems; the relation of mesoscale systems to individual cloud structures, which combine to form the mesoscale feature, and to large scale weather systems of which they are a part. Prerequisite: Meteorology 453 or approval of the instructor. Mr. Thompson

A research laboratory afloat: the ocean-going vessel Alaminos, the major research ship used by faculty and graduate students in the Dept. of Oceanography and Meteorology.

658. Synoptic Meteorology. (2-6). Credit 4. I

Discussion, application, and critical evaluation of synoptic procedures employed for analyzing and forecasting macroscale atmospheric structure over periods up to several days; detailed studies of specific atmospheric phenomena; recent developments in synoptic meteorology. Prerequisite: Meteorology 453 or the equivalent. Mr. Thompson

665. Micrometeorology. (3-0). Credit 3. II

A study of the physical processes occurring at the interface between earth and atmosphere, with special emphases upon evaporation, turbulent diffusion of gases, variations in wind, temperature, and humidity in the lowest few meters of the atmosphere. Prerequisites: Mathematics 308; Meteorology 445; or approval of the instructor. Mr. Clayton

666. Agricultural Meteorology. (3-0). Credit 3. II

Application of physical concepts of meteorology to problems arising in some aspects of agriculture and horticulture, with a detailed study of meso- and micro-climates so that an appreciation of local variations may be made. Prerequisite: Meteorology 465. Mr. Griffiths

674. Radar Meteorology. (3-0). Credit 3. II

Theoretical application of the principles of electromagnetic propagation, forward and back scattering, and polarization in cloud and precipitation physics and in the detection and diagnosis of atmospheric parameters and phenomena. Prerequisite: Meteorology 475. Mr. Clark

676. Hydrometeorology. (3-0). Credit 3. II

The role of weather and weather processes in land water problems. Prerequisite: Approval of the instructor. Mr. Clark

681. Seminar. (2-0). Credit 2. II, S

Presented by students and based upon their research work and upon surveys of the literature. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A course offered to enable majors in meteorology to undertake and complete with credit in their particular fields of specialization limited investigations which do not fall within their thesis research and which are not covered by any other courses in the established curriculum. Staff

691. Research. Credit 1 or more each semester. I, II, S

For thesis or dissertation. Topic subject to approval of the Head of the Department. Staff

OCEANOGRAPHY

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Introduction to Oceanography. (3-0). Credit 3. I, II, S

The various aspects of oceanography with emphasis upon those pertinent in the Gulf of Mexico. The principles upon which the disciplines of the subject are based. The unity of the marine sciences and their importance to man. The relations between oceanography and the fields of biology, chemistry, engineering, geography, geology, mathematics, meteorology, and physics. Opportunities in oceanography. Prerequisite: Senior classification in engineering or in a biological or physical science or the approval of the instructor. Staff

FOR GRADUATES

601. Research Methods in Oceanography. (1-0). Credit 1. I, II, S

Selection of a research problem for thesis work; planning the program of investigation. Prerequisites: General prerequisites for oceanography. Staff

603. Sea Laboratory Techniques. (0-6). Credit 2. I

Practice in techniques used regularly aboard ship and in collecting field data. Cruise planning, navigational methods, collection of hydrographic, bathymetric and meteorological data, sediment sampling, biological sampling, chemical analysis of water samples; current measurement by drogue and GEK; analysis of data. Prerequisites: General prerequisites for oceanography. Staff

610. Physical Oceanography. (3-0). Credit 3. I, II

Survey of the physics of the sea; physical properties, transmission of light and sound in the sea, sea ice; heat budget of the sea and transformation of energy within the sea and at the boundaries; evaporation from the sea, description of water masses and their origin; the horizontal and vertical circulation of the seas; the applied dynamic and kinematic formulas for circulation in the sea; the concept of dynamic equilibrium of the different concentrations within the sea; introduction to waves and tides of the sea. Prerequisites: General prerequisites for oceanography. Mr. Cochrane

611. Theoretical Physical Oceanography. (3-0). Credit 3. II

Theoretical and quantitative aspects; equations of motion; equation of continuity; boundary conditions; distribution of properties in the presence of diffusion; heat budget; stability; dynamics and computation of ocean currents; wind currents; thermodynamic considerations. Prerequisites: Mathematics 601 or registration therein; Oceanography 610 or approval of the instructor. Mr. Reid

612. Theory of Ocean Waves. (3-0). Credit 3. II

Theory of simple harmonic surface waves; wave groups and group velocity, wave energy and energy propagation, dispersion. Theory of generation and decay of surface waves. Waves of large steepness, including solitary and cnoidal waves. Modification of waves in shallow water, refraction; wave ray analysis and the phase diagram. Capillary waves; internal waves and shear waves. Prerequisites: Mathematics 308; Oceanography 610. (Mathematics 601 recommended) Mr. Reid

613. Engineering Aspects of Oceanography. (3-0). Credit 3. I

Applications of oceanographic knowledge in engineering. Sea disturbances, astronomical tides, seismic sea waves, seiches, surging in harbors, wind generation of ocean waves. Practical wave forecasting; wave refraction diagram analysis; propagation of waves in shallow water, breaking waves. Principles of similitude, fluid resistance, wave forces on fixed and floating structures. Prerequisites: Mathematics 308; Oceanography 610. Mr. Reid

614. Dynamics of the Ocean and Atmosphere. (3-0). Credit 3. I

Advanced theory of the ocean dynamics, a comparison of the hydrodynamic and thermodynamic character of the ocean and the atmosphere; the mutual dependence of the dynamics and thermodynamics of the sea on those of the air and vice versa; some special theories from the mean equations of motion, gradient wind, jet stream, mutual adjustment of the mass field and velocity field in the sea; mutually coupled temperature variations of the sea and the air; wind driven currents; the general hydrodynamic problem of the ocean and of the atmosphere, and an investigation of its uniqueness; the maintenance of the general circulation. Prerequisites: Mathematics 602; Oceanography 611. (Offered in 1963-64 and in alternate years thereafter.) Mr. Reid

620. Biological Oceanography. (3-0). Credit 3. II

Critical study of important contributions defining major biological divisions, provinces, and life zones of the oceans; effects of climate, chemical, and physical barriers, and phylogeny on zoogeography; factors relating to population cycles; productivity problems; ecological inter-relationships of major groups of plants and animals in the sea. Prerequisite: General prerequisites for oceanography. Mr. Pequegnat

621. Biological Oceanography of the Gulf of Mexico. (1-6). Credit 3. I

Detailed examination of selected aspects of biological oceanography which are of major importance to the Gulf of Mexico. Prerequisite: Undergraduate major in biology, or approval of instructor. Mr. Pequegnat

630. Geological Oceanography. (3-0). Credit 3. I

Topography and characteristic features of the ocean bottom; marine shorelines and processes operating in the coastal zone; nature of marine sediments; marine transportation and deposition of sedimentary materials; erosion of beaches. Prerequisite: General prerequisites for oceanography. Mr. Kornicker

631. Geological Oceanography of the Gulf of Mexico. (3-0). Credit 3. II

Carbonate sedimentation and coral reefs; processes involved in sediment transport and deposition; structure of ocean basins; effects of sea level changes on sedimentation and topography; origin of topographic features. Prerequisite: Undergraduate major in geology or approval of the instructor. Mr. Kornicker

640. Chemical Oceanography. (3-0). Credit 3. II

The chemical composition and properties of sea water; the definition and calculation of salinity; the pH, excess base, and carbon dioxide system in the sea; nutrients, their cycles and their distribution; oxygen and other dissolved gases; chemistry of sedimentation; composition of organisms and organic constituents of sea water; marine corrosion; extraction of raw materials from the sea. Prerequisite: General prerequisites for oceanography. Mr. Hood

641. Chemical Oceanography. (3-0). Credit 3. I

Detailed study of selected topics in chemical oceanography which pertain to the Gulf of Mexico; industrial utilization of sea water and chemical products obtained from marine plants and animals; water freshening; industrial corrosion problems; chemical aspects of photosynthesis and fertility of the sea; chemistry of estuarine waters. Prerequisite: Undergraduate major in chemistry or approval of the instructor. Mr. Hood

642. Laboratory Techniques in Oceanography. (0-6). Credit 2. I

Detailed study will be made of methods of preparation and analysis of samples for biological, chemical, and geological investigations. The methods of analysis will concern oxygen, phosphate, silicate, nitrate, nitrite, salinity, carbon, sediment particle size, mineralogy, organic production, and others. Prerequisites: Oceanography 603, 610, 620, 630, 640, or approval of the instructor. Mr. El-Sayed, Mr. Hood, Mr. Kornicker

643. Geochemistry of the Ocean. (3-0). Credit 3. I

Geochemistry of the oceanic hydrosphere, biosphere, and lithosphere; how these are related to the atmosphere; study of the elements within them. Prerequisites: Oceanography 630, 640, or 641, or graduate classification in Geology. (Offered in 1963-64 and in alternate years thereafter.) Mr. Angino

644. Geochemistry of the Ocean. (3-0). Credit 3. II

A detailed critical study of the geochemistry of sedimentation, the geochemical evolution of the ocean, the biogeochemistry of calcium carbonate and isotope geochemistry as related to the ocean. Prerequisite: Oceanography 643. (Offered in 1963-64 and in alternate years thereafter.) Mr. Hood

651. Meteorological Oceanography. (1-3). Credit 2. I

The use of the conservative characteristics of the sea in forecasting meteorological and oceanographic phenomena. Calculation of ocean waves and swell, transformation of waves in shallow water, statistical summaries, modification of air masses in contact with the ocean, forecasting of fog and squalls, effect of the oceans upon climate of the world, meteorological tides. Prerequisite: Oceanography 610. Mr. Leipper

652. Ocean Boundary Layer Problems. (3-0). Credit 3. I

The theory of turbulent flow over hydrodynamically rough and smooth surfaces with application to the evaluation of the fluid frictional stresses at the boundaries of the sea, the evaluation of wind stress, evaporation, etc.; the micro-structure of temperature and salinity near the ocean surface; evaluation of turbulent exchange coefficient. Nature of turbulence and associated dispersion phenomena. Prerequisite: Oceanography 611. Mathematics 411 or 414 recommended. (Offered in 1964-65 and in alternate years thereafter.) Mr. Reid

681. Seminar. (2-0). Credit 2. I

Presented by students and based upon their research work and upon surveys of the literature. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A course offered to enable majors in oceanography to undertake and complete with credit in their particular fields of specialization limited investigations which do not fall within their thesis research and which are not covered by any other courses in the established curriculum. An example of the solution of a special problem in oceanography would be the work done in analyzing a special set of data collected on a cruise at sea. The course may also consist of a special series of problem discussions not given periodically, such as those offered by visiting scientists. Prerequisite: General prerequisites for oceanography. Staff

691. Research. Credit 1 or more each semester. I, II, S

For thesis or dissertation. Topic subject to approval of the Head of the Department. Staff

Department of Petroleum Engineering

J. W. AMYX*, J. C. CALHOUN, JR., P. B. CRAWFORD, H. T. KENNEDY**, H. J. RAMEY, R. L. WHITING** (Head)

Graduate work in petroleum engineering is offered at both the master's and doctorate levels. On the master's level, courses are offered with the primary aim of giving the student a fundamental understanding of the performance of petroleum reservoirs, and their behavior under conditions imposed by pressure depletion, pressure maintenance, secondary recovery operations and cycling. Courses are also given which deal with the problems encountered in drilling and producing wells, and research on these problems is encouraged.

On the doctorate level, curricula are offered to give the student a broad understanding of the various phases of the petroleum industry as well as the ability to investigate and solve technical problems arising in the industry by original research. Laboratory facilities are available for advanced studies on all phases of reservoir equilibrium and mechanics, including equipment for work on permeability-saturation relationships, core analysis and interpretation, secondary recovery and model reservoir studies. Equipment is also available for investigating problems arising in subsurface engineering and in handling and formulating drilling fluids. Much special equipment has been provided for the study of reservoir behavior at high pressures and temperatures.

Specialized research and analytical equipment available include a potentiometric model, reservoir analog computer, mass spectrometer, low-temperature distillation equipment, and vapor phase chromatograph.

Students are encouraged to become proficient in the programming and utilization of the IBM 709 high-speed digital computer in engineering and research.

*Deceased January 27, 1964.
**Graduate Advisor

FOR GRADUATES AND ADVANCED UNDERGRADUATES

402. Petroleum Property Management. (3-0). Credit 3. II

Factors which influence the value of oil and gas properties; preparation of valuation reports, cost data, operating organization, regulation of petroleum production. Prerequisites: Petroleum Engineering 409, 413, 428. Mr. Whiting

405. Drilling and Production Design. (2-2). Credit 3. I

A study of the selection of drilling and production equipment used in oil field practice. Design of drilling and production systems. Prerequisites: Civil Engineering 305; Petroleum Engineering 305, 306, 307, 308, 310, 312. Mr. Pedigo

409. Subsurface Engineering. (1-3). Credit 2. I

Well logging, contour maps, isopachous maps, and the determination of the size, shape, and volume content of petroleum reservoirs. Prerequisites: Petroleum Engineering 305, 306, 307, 308, 310, 312. Mr. Pedigo

413. Petroleum Measurement and Transportation. (2-2). Credit 3. I

Theory and methods of gas and liquid measurements and transportation including mixed streams, horizontal and vertical flow, etc. Prerequisites: Mechanical Engineering 346; Petroleum Engineering 310. Staff

414. Petroleum Production Engineering. (2-0). Credit 2. II

Gas lift, surface separation and treatment of oil field fluids. 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. Prerequisites: Petroleum Engineering 405, 413. Mr. Pedigo

415. Measurements Laboratory. (0-3). Credit 1. I

Methods of metering petroleum and natural gas. Study of flow of liquid gas and mixtures of gas and liquid. Advanced study of properties of petroleum at elevated pressure and temperature. Prerequisite: Petroleum Engineering 413 or registration therein. Staff

416. Oil Measurements and Transportation Laboratory. (0-3). Credit 1. II

Gauging practices, treating of oil-water emulsion, heat and sulphur content of petroleum and its products, determination of viscosity, gravity water content, carbon residue, and the coefficient of expansion of petroleum. Determination of vapor pressure of natural gasoline. Distillation of crude oil and gasoline. Methods of metering petroleum. Water analysis. Prerequisite: Petroleum Engineering 414 or registration therein. Staff

419. Drilling Fluids. (0-3). Credit 1. II

A laboratory course in which field technique and control of mud fluids to facilitate drilling are taught. Prerequisites: Senior classification in petroleum engineering; approval of the Head of the Department. Mr. Whiting

428. Reservoir Engineering. (2-0). Credit 2. I

Material balance methods, including identification of type of reservoir mechanism, future production under primary recovery and gas injection; water influx calculations. Prerequisites: Petroleum Engineering 306, 308, 310. Mr. Whiting

429. Reservoir Mechanics Laboratory. (0-3). Credit 1. I

A laboratory course to supplement the theory of Petroleum Engineering 428. Advanced core analysis; fundamental tests of PVT properties of petroleum at reservoir conditions. Prerequisites: Petroleum Engineering 305, 306, 307, 308, 310. Staff

438. Reservoir Engineering. (2-0). Credit 2. II

Continuation of Petroleum Engineering 428. Displacement of oil by extraneous fluids, evaluation of performance of combination drive reservoirs, sweep efficiency. Prerequisite: Petroleum Engineering 428. Staff

481. Petroleum Engineering Seminar. (0-2). Credit 1. I

The study and presentation of papers pertaining to recent developments in the field of petroleum engineering. Prerequisites: Petroleum Engineering 305, 306, 307, 308, 310, 312. Staff

482. Petroleum Engineering Seminar. (0-2). Credit 1. II

The study and presentation of papers pertaining to recent developments in the field of petroleum engineering. Prerequisites: Petroleum Engineering 305, 306, 307, 308, 310, 312. Staff

FOR GRADUATES

601, 602. Drilling and Completing Wells. (3-3). Credit 4 each semester. S

An advanced study of the problems encountered in the drilling and completing of oil and gas wells. Prerequisite: Approval of Head of Department. Staff

603, 604. Advanced Reservoir Engineering. (3-3). Credit 4 each semester. I, II

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. Mr. Kennedy, Mr. Whiting

605. Phase Behavior of Petroleum Reservoir Fluids. Credit 2 to 4 each semester. I

A study of the pressure, volume, temperature, composition relationships of petroleum reservoir fluids. Prerequisite: Approval of Head of Department. Mr. Kennedy

607. Recovery Methods. Credit 2 to 4 each semester. II

A study of methods of increasing recovery of petroleum from petroleum reservoirs. Prerequisite: Approval of Head of Department. Staff

608. Well Logging Methods. (2-3). Credit 3. II

An advanced study of well logging methods for determining the nature and fluid content of formations penetrated by the drill. Prerequisite: Approval of Head of Department. Staff

681. Seminar. (1-0). Credit 1 each semester. I, II

A study and presentation of papers on recent developments in reservoir mechanics. Prerequisite: Approval of Head of Department. Staff

685. Problems. Credit 1 to 4 each semester. I, II

A course offered to enable students to undertake and complete limited investigations which do not fall within their thesis research and which are not covered by any other courses in the curriculum. Prerequisite: Graduate classification. Staff

691. Research. Credit 1 or more each semester. I, II

Advanced work on some special problem within the field of petroleum engineering. A thesis course. Prerequisite: Approval of the Head of Department. Staff

Department of Physics

P. W. BARKER, J. B. COON*, N. M. DULLER, JR., J. A. EISELE, MELVIN EISNER, J. L. GAMMEL, J. S. HAM, J. A. McINTYRE, J. G. POTTER (Head), O. D. SITTLER, C. F. SQUIRE, D. F. WEEKES

The present rapid advance in the development and application of fundamental physical theory has created unparalleled opportunities for specialists in the field. The offerings in physics enable graduates in physics, mathematics, chemistry, or engineering to prepare either for a career in applied physics and industrial research and development or for a career as a scientist in an industrial research or academic physics laboratory.

*Graduate Advisor

A comprehensive integrated coverage of the fields of classical and modern physics at the graduate level is afforded by the courses Physics 601, 603, 607, 612, 617, and 625, most of which are normally included in the program of a candidate for the Master's degree together with special work in the field of his thesis and in mathematics. More advanced courses in a number of fields are available primarily for candidates for the Doctor's degree. The current research activities of members of the Department in nuclear magnetic resonance, molecular structure, magnetic phenomena at very low temperatures, crystalline imperfections, the liquid and solid states, ultrasonics, plasma, and high and low energy nuclear phenomena afford superior opportunities for student research in these general fields.

A 100 kilowatt nuclear reactor provides opportunities for study and research in nuclear physics. An 88-inch cyclotron is under construction.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

302. Mechanical Properties of Matter. (3-0). Credit 3. I, S
Fundamentals of mechanics of particles, liquids, and solids. Prerequisites: Mathematics 308 or registration therein; Physics 218. Mr. Weekes

311. Quantum Physics. (3-0). Credit 3. I, II
Atomic and nuclear phenomena that led to the establishment of modern physics; introduction to special relativity and quantum relationships. Prerequisites: Mathematics 308; Physics 220. Mr. Duller

317. Celestial Mechanics. (4-0). Credit 4. I
A mathematical formulation of the principles of celestial mechanics; central forces, potentials and attractions of bodies, the problem of two bodies, the problem of three bodies, the problem of **n** bodies. Prerequisites: Mathematics 307; Physics 201 or 218. Mr. Kent

401. Optics. (3-0). Credit 3. I
A systematic treatment of physical and geometrical optics, applications to optical instruments. Prerequisites: Mathematics 122 or 210; Physics 220. Mr. Ham

405. Physical Mechanics. (3-0). Credit 3. II
A comprehensive formulation of the principles of mechanics, employing the calculus and vector methods. Orbital motion, coriolis acceleration, motions of rigid bodies, vibrations. Introduction to advanced mechanics. Prerequisites: Mathematics 405 or registration therein; Physics 302 or the equivalent. Mr. Weekes

413. Electricity and Magnetism. (3-0). Credit 3. II
DC and AC circuit theory, introduction to electronic circuits. Prerequisites: Mathematics 308; Physics 219. Mr. Barker

414. Electricity and Magnetism. (2-3). Credit 3. I
Non-linear circuits, functions of tubes and transistors in electrical circuits, electronic circuits and circuit elements for physical measurements. Prerequisite: Physics 413 or approval of the instructor. Mr. Duller

416. Electromagnetic Fields. (3-0). Credit 3. II
Electric and magnetic field theory with emphasis on vector analysis, Maxwell's equations, introduction to electromagnetic radiation, properties of dielectrics and magnetic materials. Prerequisites: Mathematics 405 or 601; Physics 413 or approval of the instructor. Mr. Barker

418. Theoretical Physics. (3-0). Credit 3. II
An introduction to theoretical physics with emphasis on fundamental concepts and general principles. Prerequisites: Mathematics 307; Physics 219. Mr. Weekes

420. Introduction to Astrophysics. (4-0). Credit 4. II

An introduction to the theory and application of astrophysics. The physics of the sun's core, the internal structure of stars, spectroscopic and dynamic aspects of stellar atmospheres, radiation from the sun and stars, interstellar matter, the origin and evolution of planetary atmospheres. Prerequisites: Mathematics 307 or registration therein; Physics 220, 314, and a course in heat or thermodynamics. Mr. Kent

421. Celestial Mechanics. (4-0). Credit 4. II

A continuation of Physics 317. The laws of binary star systems, the determination of orbits, perturbations of the moon, general perturbations, the problem of satellites. Prerequisite: Physics 317. Mr. Kent

FOR GRADUATES

600. Physics for Secondary School Teachers. (2-3). Credit 3. S

This course taught by members of the Physics faculty will aim to develop convictions concerning the fundamental principles of classical and modern physics which should be taught in a course in high school physics and to develop techniques and methods of preparing and conducting demonstrations and laboratory exercises. Prerequisites: Graduate classification; approval of the Heads of the Education and Psychology and Physics Departments. Staff

601. Analytical Mechanics. (4-0). Credit 4. II

Dynamics of particles and of rigid bodies, gyrodynamics, potential theory, Hamilton's principle, principle of least action. Lagrange's equations, and the Hamilton-Jacobi equation, with applications. Prerequisites: Mathematics 405 or 601; Physics 405. Mr. Gammel

602. Fluid Mechanics and Elasticity. (4-0). Credit 4. I

Mechanics of continuous media. Foundations of elasticity with application to theory of beams, plates, and shells. Hydrodynamics of viscous and nonviscous fluids. Supersonic flow and shock wave propagation. Boundary layer theory. Lubrication theory. Prerequisite: Physics 601 or the equivalent. Mr. Eisner

603. Electromagnetic Theory. (4-0). Credit 4. I, S

Theory of electromagnetism; static and time-varying fields; propagation, reflection, and refraction of electromagnetic waves. Prerequisites: Mathematics 601 or the equivalent; Physics 416 or the equivalent. Mr. Weekes

605. Thermodynamics. (4-0). Credit 4. II

The fundamentals of classical thermodynamics, including the first and second laws, thermodynamic potentials, conditions for equilibrium, properties of gases; thermodynamics of electromagnetic systems, and a brief treatment of kinetic theory including Maxwell's velocity distribution law, viscosity, and diffusion. Prerequisites: Mathematics 308; Physics 301 or the equivalent. Mr. Sittler

607. Statistical Mechanics. (4-0). Credit 4. I, S

Maxwell-Boltzmann distributions, Gibbs ensembles, statistical foundations of entropy and thermodynamics, elementary quantum statistics, Bose-Einstein and Fermi-Dirac distributions. Applications to electrons in metals, lattice specific heats, magnetic systems, perfect gas, and electromagnetic radiations. Prerequisite: Physics 408 or approval of the instructor. Mr. Squire, Mr. Eisner

611. Advanced Optics. (4-0). Credit 4. II

The electromagnetic theory of optical phenomena in discontinuous, isotropic, and anisotropic media. Prerequisite: Physics 603. (Offered in 1963-64 and in alternate years thereafter.) Mr. Ham, Mr. Weekes

612. Quantum Mechanics I. (3-0). Credit 3. S

Foundations of quantum mechanics; theories of Heisenberg and De Broglie, with applications. Prerequisite: Physics 412, registration in Physics 601. Mr. Coon, Mr. Gammel

614. Molecular Structure. (4-0). Credit 4. II

The quantum mechanical theory of valence; the hydrogen molecule ion, molecular orbitals for diatomic molecules; the hydrogen molecule; coulombic and exchange integrals; Pauli exclusion principle and the covalent bond; hybrid atomic orbitals; general molecular orbital method. Prerequisite: Physics 612. (Offered in 1963-64 and in alternate years thereafter.) Mr. Coon

617. Physics of the Solid State. (3-0). Credit 3. II

A study of the electrical, magnetic, thermal, and mechanical properties of crystalline solids. Lattice energy of ionic crystals, lattice vibrations, dielectric phenomena, luminescence and phosphorescence, electron theory of metals, band theory, semi-conductors, low temperature behavior of solids. Prerequisites: Physics 412, 607 or the equivalent. Mr. Weekes, Mr. Squire

618. Nuclear Theory. (3-0). Credit 3. II

Application of quantum mechanics to nuclear phenomena. Prerequisites: Physics 623, 625 or the equivalent. Mr. McIntyre

623. Quantum Mechanics II. (4-0). Credit 4. I

A continuation of Physics 612. A postulational development of the foundations of quantum mechanics, Hamiltonian formalism, canonical transformations, representation and expansion theory, relativistic quantum mechanics. Prerequisite: Physics 612. Mr. Eisner

624. Quantum Mechanics III. (4-0). Credit 4. II

A continuation of Physics 623. Quantum electrodynamics, quantum field theory, fundamental particles, meson field theories, high energy phenomena. Prerequisite: Physics 623. Mr. Eisner

625. Nuclear Structure. (3-0). Credit 3. I, S

Properties of fundamental particles; theory of simple nuclear models; scattering, spins, magnetic moments and cross sections; alpha, beta, and gamma decay; detection, measurement, and production of nuclear particles; nuclear spectroscopy; interactions of nuclear radiations with matter; nuclear reactions; high energy nuclear phenomena. Prerequisite: Physics 612 or the equivalent. Mr. McIntyre

627. Relativity. (3-0). Credit 3. S

Special relativity and its application to covariant formulations of mechanics and electrodynamics. Theory of general relativity including development of necessary tensor calculus and non-Euclidean geometry. Predictions of general relativity and experimental tests of theory; cosmological problems and unified field theories. Prerequisites: Physics 601, 603. Mr. Eisner

631. Quantum Theory of Solids. (3-0). Credit 3. II

Development of solid state theory from the basic theory of quantum mechanics. Theory of perfect and imperfect crystal lattices. Interaction of electromagnetic radiation with non-conducting crystals. Electrons in perfect crystal lattices. Theory of metallic cohesion. Transport phenomena. Electric and magnetic properties of solids. Semiconductors, superconductors, superfluids. Prerequisite: Physics 617. Mr. Ham

633. Experimental Physics. (0-3). Credit 1. I, II, S

Experiments in atomic, nuclear, and solid state physics, designed to complement theory courses in these fields and to prepare the student for experimental research in physics. Prerequisite: Graduate classification. Staff

635. Scattering Theory. (3-0). Credit 3. I

Scattering of particles by non-central fields, polarized particles, scattering of pions and nucleons by nucleons, the optical model, the deuteron stripping reaction, other direct interactions, Regge poles, scattering in quantum field theory. Prerequisite: Physics 623. Mr. Gammel

661. Radiological Physics. (3-0). Credit 3. II

Interaction of radiation with matter, health physics and radiation protection, reactor sources of radiation, shield design. Prerequisites: Mathematics 308; Nuclear Engineering 401 or Physics 311. Staff

663. Reactor Theory. (3-0). Credit 3. I

Mathematical theory of the diffusion and slowing down of neutrons in the homogeneous nuclear reactor without reflector and with reflector. Prerequisites: Mathematics 308, 601 or registration therein; Physics 311. Mr. Weekes

664. Reactor Theory. (3-0). Credit 3. II

A continuation of Physics 663. The steady state and transient behavior of the heterogeneous reactor. Theory of reactor control. Special mathematical methods in reactor analysis. Extensive problem work to illustrate the applications of the theory. Prerequisites: Mathematics 602 or registration therein; Physics 663. Mr. Weekes

665. Theory of Accelerators. (3-0). Credit 3. II

Description and classification of accelerators. Cockcraft-Walton accelerators, electrostatic generators; linear accelerators; theory of magnetic focusing; cyclotron; theory of electrostatic focusing; stability conditions, betatron; synchrocyclotron; synchrotron; low energy pulse devices; energy measurement and control; instrumentation and techniques; reactions; radiological safety. Prerequisites: Mathematics 307; Physics 311. Mr. McIntyre

681. Seminar. (1-0). Credit 1. I, II, S

Examination of subjects of current importance. Prerequisite: Graduate classification. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Individual problems not related to thesis. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research toward thesis or dissertation. Staff

Physiology of Reproduction

A major in physiology of reproduction may be undertaken by selecting appropriate courses in animal husbandry, biology, dairy science, genetics, and poultry science.

Plant Breeding

A major in plant breeding may be undertaken by selecting appropriate courses in genetics and in agronomy, floriculture, or horticulture.

Department of Plant Sciences

H. G. APPLEGATE, J. V. AMIN, L. J. ASHWORTH, JR., E. C. BASHAW, L. S. BIRD, M. S. BROWN, T. C. CARTWRIGHT*, D R. ERGLE, M. C. FUTRELL, C. B. GODBEY, JOSEPH HACSKAYLO, W. C. HALL, R. S. HALLIWELL, A. L. HARRISON, H. E. JOHAM*, R. G. LANGSTON, C. S. MILLER, P. W. MORGAN, H. L. MORTON, R. D. POWELL, T. R. RICHMOND*, D. W. ROSBERG* (Head), H. W. SCHROEDER, J. D. SMITH*, W. H. THAMES, JR., J. P. VAN BUIJTENEN, G. M. WATKINS

GENETICS SECTION

Training in both theoretical and applied genetics is provided by associated departments. Students should consult the Dean of Graduate Studies, who will advise them concerning the department that can best administer their program.

*Graduate Advisor

Laboratory facilities are available for research with various species of plants and animals. Active investigations are in progress on most of the agronomic and horticultural crops in this region and also with sheep, swine, poultry, and cattle.

Students may be encouraged to participate in genetical and cytogenetical research now in progress in corn, grain sorghum, cotton, and species related to these crops. Species, genetic stocks, and hybrids are maintained for these phases of research. In this work cytogenetics and cytotaxonomy of species hybrids are emphasized.

In the animal field, progress is being made with studies of inheritance of economic characters in large animals and poultry. Students interested in both theoretical and practical aspects of animal and poultry breeding are given opportunity to do research on poultry and large animal breeding projects as well as research of more theoretical nature using laboratory animals.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Genetics. (3-2). Credit 4. I, II, S

Fundamental principles of genetics: variation, heredity, the physical basis of Mendelian inheritance, the expression and interaction of genes, linkage, sex linkage, and mutation. Laboratory includes demonstrations of Mendelian ratios with Drosophila and an introduction to biometrical methods. Prerequisite: Biology 101 or 107. Mr. McNiel

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

See Department of Soil and Crop Sciences for a full description of this course.

Animal Husbandry 306. Animal Breeding. (2-2). Credit 3. I, II

See Department of Animal Husbandry for a full description of this course.

Poultry Science 414. Poultry Breeding. (2-2). Credit 3. I

See Department of Poultry Science for a full description of this course.

Statistics 406. Statistical Methods. (2-2). Credit 3. I, II, S

See Institute of Statistics for a full description of this course.

FOR GRADUATES

603. Genetics. (3-0). Credit 3. I

Advanced study of genetics with special attention focused on the evidence supporting the principles of heredity. Development of fundamental concepts including dominance, the chromosome theory of heredity and linkage, sexuality, mutation and position effect, the gene concept and extra nuclear inheritance. Prerequisites: Genetics 301; approval of the instructor. Mr. Smith

604. Genetics Laboratory. (0-3). Credit 1. I

Inheritance studies principally with Drosophila including laboratory techniques and methods. Arranged to complement Genetics 603 and required for genetics majors. Mr. Smith

612. Plant Genetics. (3-3). Credit 4. II

Specialized study of genetics as related to plant breeding. Emphasis is placed on quantitative inheritance, heterosis, selection, ploidy, reproductive systems and the processing of quantitative data. Prerequisites: Genetics 603; Statistics 406. Mr. Smith

620. Cytogenetics. (3-3). Credit 4. II

A study of correlated genetical and cytological phenomena. Prerequisites: Biology 615; Genetics 603. Staff

623. Special Topics in Genetics. Credit 1 to 3. I

Content of this course will depend upon the interest of the students and the specialty of the instructor. Lecturers who have attained distinction in genetics or related fields will conduct this course. Staff

624. Statistical Genetics. (2-0). Credit 2. I

Probability as applied to genetic systems; the derivation of genetic expectations; the theory of inbreeding; estimation and testing of genetic parameters; statistical aspects of quantitative inheritance; the partition of variance; covariances among relatives; mathematical models for quantitative inheritance. Prerequisites: Genetics 603; Statistics 406; approval of the instructor. (Offered in 1964-65 and in alternate years thereafter.) Mr. Smith

625. Speciation. (2-0). Credit 2. I

A study of the genetic and environmental forces which operate in species formation together with a critical examination and comparison of the more important current explanations of speciation. Prerequisites: Biology 349; Genetics 301. (Offered in 1964-65 and in alternate years thereafter.) Staff

631. Biochemical Genetics. (2-0). Credit 2. I

A study of the genetic control of cellular metabolism and a theoretical consideration of the mechanism of gene action. A consideration of nutrition and the genetic capacity for biosynthesis, gene-enzyme relationships, pleiotropism, plasmagenes, and the chemical nature of the agents of heredity. Prerequisites: Biochemistry and Nutrition 410 or Chemistry 227; Genetics 301. Staff

633. Forest Genetics. (2-0). Credit 2. I

Specialized study of genetics as applied to forest trees; forest genetics, forest tree improvement and forest tree breeding, with emphasis on genetics of conifers, especially pines. Fundamental and applied phases are included. Prerequisites: Genetics 603; approval of the instructor. (Offered in 1964-65 and in alternate years thereafter.) Mr. van Buijtenen

634. Forest Genetics Laboratory. (0-3). Credit 1. II

Methods and techniques in forest genetics, forest tree breeding; crossing, grafting, air layering, field layouts, seed handling, greenhouse techniques. Prerequisite: Genetics 633. (Offered in 1964-65 and in alternate years thereafter.) Mr. Van Buijtenen

685. Problems. Credit 1 to 4 each semester. I, II, S

Technical research problems subject to approval of Head of Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Prerequisite: Genetics 603. Staff

Animal Husbandry 616. Animal Genetics. (3-3). Credit 4. II

See Department of Animal Husbandry for a full description of this course.

Animal Husbandry 628. Animal Breeding. (2-0). Credit 2. I

See Department of Animal Husbandry for a full description of this course.

Poultry Science 613. Breeding and Genetics of Poultry. (3-3). Credit 4. II

See Department of Poultry Science for a full description of this course.

Statistics 605. Statistical Analysis. (3-3). Credit 4. I, II

See Institute of Statistics for a full description of this course.

PLANT PHYSIOLOGY AND PATHOLOGY SECTION

Facilities are available for research on various phases of plant physiology and plant diseases. The major objectives are concerned with basic training in plant physiology and plant pathology for majors and minors in the plant sciences and also for the professional training of plant physiologists and plant pathologists. Greenhouse space and field plots are available for experimental work. Laboratory facilities include equipment for maintenance of microbiological cultures, preparation of slides for microscopic study, studies on effects of light on plants, radiochemical and isotope studies, and analysis of plant tissues for various chemical constituents. Special emphasis is placed on physiological studies of cotton, plant hormones, breeding for resistance to diseases of cotton, tomatoes, small grains, peanuts, and corn, plant parasitic nematodes, and on new fungicides for various crops.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

314. Principles of Plant Physiology. (3-3). Credit 4. II

A more advanced and detailed study of the physiology of green plants than Plant Physiology and Pathology 313, with emphasis on nitrogen metabolism, respiration, mineral nutrition, photosynthesis, and growth. Prerequisites: Chemistry 231; Physics 213; Plant Physiology and Pathology 313. Mr. Morgan

FOR GRADUATES

605. Plant Metabolism. (3-0). Credit 3. I

Photosynthesis and respiration are discussed in detail, including the history and recent developments in these fields. Prerequisites: Plant Physiology and Pathology 314; approval of instructor. (Offered in 1963-64 and in alternate years thereafter.) Mr. Morgan

607. Physiology of the Fungi. (3-0). Credit 3. II

A general course in the physiological activities of fungi, including growth and development, mineral nutrition, carbon and vitamin nutrition, the chemistry of metabolic products, fungicides, and the physiology of parasitism and resistance. Prerequisite: Plant Physiology and Pathology 314. (Offered in 1963-64 and in alternate years thereafter.) Mr. Joham

609. Quantitative Plant Physiology. (2-6). Credit 4. II

Methods employed in the various types of physiological investigations and the interpretation of results obtained by them. Prerequisite: Plant Physiology and Pathology 314. (Offered in 1963-64 and in alternate years thereafter.) Mr. Hacskaylo

611. Plant Nutrition. (3-0). Credit 3. II

This course deals with the inorganic nutrition of plants. It includes solute absorption, accumulation and translocation; growth of plants in artificial media; physiological roles of various elements in the plant, and biochemical problems associated with salt absorption. Prerequisite: Plant Physiology and Pathology 314 or equivalent. (Offered in 1964-65 and in alternate years thereafter.) Mr. Joham

612. Phytohormones and Plant Growth Regulators. (3-0). Credit 3. I

This course includes material on the classification, properties, and action of naturally occurring plant hormones as well as a discussion of the synthetic growth regulators. Material is included on practical application and uses of phytohormones and growth regulators. Prerequisite: Plant Physiology and Pathology 314 or equivalent. (Offered in 1963-64 and in alternate years thereafter.) Mr. Langston

613. Plant Growth and Development. (3-0). Credit 3. I

A course dealing with the growth, differentiation, and development of higher plants. A comprehensive study of vernalization and photoperiodism is included as well as a discussion of the influences of water relations, mineral

nutrition, and hormones on the developmental cycle. Consideration is also given to differentiation within the plant as related to such qualities as winter hardiness and drought resistance. Prerequisite: Plant Physiology and Pathology 314 or equivalent. (Offered in 1964-65 and in alternate years thereafter.) Mr. Applegate

616. Methods in Plant Pathology. (2-6). Credit 4. II

A presentation of the methods by which plant diseases are identified and investigated. Emphasis is placed on preparation for research work in plant pathology. Prerequisite: Plant Physiology and Pathology 301 or the equivalent. (Offered in 1964-65 and in alternate years thereafter.) Mr. Ashworth

617. Parasitism in Plant Disease. (3-3). Credit 4. I

A critical presentation of the literature on the invasion of plant tissues by parasitic bacteria, fungi, and nematodes. Mechanisms of host defense are examined. Processes are illustrated in the laboratory through the study of histological preparations and by experimentation. Prerequisite: Plant Physiology and Pathology 301. (Offered in 1963-64 and in alternate years thereafter.) Mr. Watkins

618. Bacterial Plant Diseases. (2-3). Credit 3. II

A detailed study of bacterial diseases of fruit and vegetable crops, field crops and ornamental plants, with special emphasis upon the nature of the disease, dissemination of the pathogen and methods of control. Prerequisite: Plant Physiology and Pathology 301 or the equivalent. (Offered in 1964-65 and in alternate years thereafter.) Mr. Rosberg

620. Plant Viruses. (2-0). Credit 2. II

Lecture presentation and discussion of the nature and properties of plant viruses. Methods of virus transmission, host plant reactions to viruses, serological reactions, and methods of purification of viruses for examination under the electron microscope, and the study of economically important plant virus diseases and their control. Prerequisite: Plant Physiology and Pathology 301 or the equivalent. (Offered in 1963-64 and in alternate years thereafter.) Mr. Halliwell

621. Plant Parasitic Nematodes. (2-3). Credit 3. I

The morphology, identification, and biology of plant parasitic nematodes; the damage they cause; methods of control. Non-plant-pathogenic nematodes commonly found in the soil will be studied also. Prerequisite: Approval of the instructor. Mr. Thames

622. Plant Nematology. (1-6). Credit 3. II

Advanced study of the principal groups of plant parasitic nematodes with emphasis on methods used in research. Prerequisite: Plant Physiology and Pathology 621. (Offered in 1964-65 and in alternate years thereafter.) Mr. Thames

623. Diseases of Field Crops. (2-3). Credit 3. I

An intensive study of both the fundamental and the practical aspects of the more important and representative diseases of field crops. The plant disease problems peculiar to extensive cultivation methods will be stressed. Prerequisite: Plant Physiology and Pathology 301. Mr. Futrell

624. Diseases of Fruits, Vegetables, and Ornamentals. (2-3). Credit 3. II

Identification and control of the important diseases of fruit, vegetable, and ornamental crops in Texas. Consideration will also be given to diseases of major berry crops and pecans. Various diseases and types of decay affecting products in shipment and storage will be studied. Each student will be required to carry out an inoculation-isolation exercise employing a bacterial or fungus pathogen. A virus inoculation exercise will be done by students working in pairs. Prerequisite: Plant Physiology and Pathology 301. (Offered in 1963-64 and in alternate years thereafter.) Mr. Ashworth

681. Seminar. (1-0). Credit 1 each semester. I, II

Reports and discussions of topics of current interest in plant physiology and plant pathology, including reviews of literature on selected subjects. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Individual problems or research not pertaining to a thesis or dissertation. Prerequisite: Plant Physiology and Pathology 314 or the equivalent (for physiology), 301 or the equivalent (for pathology). Staff

691. Research. Credit 1 or more each semester. I, II, S

Original investigations in support of thesis or dissertation. Staff

Department of Poultry Science

See also **Animal Breeding** and **Animal Nutrition**

R. L. ATKINSON, J. R. COUCH, C. R. CREGER, R. C. FANGUY, T. M. FERGUSON, F. A. GARDNER, W. F. KRUEGER, J. H. QUISENBERRY* (Head)

Growth of the poultry industry and the need for a rapid expansion of scientific and technical knowledge in the various fields of science basic to successful poultry production have supplied the motivation for the development of graduate courses in this phase of agriculture. In no field of agriculture is an understanding of the science and practice of feeding, breeding, physiology, pathology, heating, ventilation, processing and marketing more necessary or more rewarded than in the modern intensive methods of producing poultry meat and eggs.

In offering graduate courses the major objectives of the Department are to offer training for work in teaching, research, or extension; to bridge the gap in both directions between courses in fundamental biochemistry, genetics, physiology, and economics and their practical application to poultry and poultry products; and to give men planning to go into some productive phase of poultry science a more thorough scientific background of knowledge and approach to problems than is possible in an average four-year college curriculum.

Through cooperation with the Departments of Agricultural Economics and Sociology, Biochemistry and Nutrition, Biology, and the Genetics Section of the Department of Plant Sciences, the Department is in a position to offer graduate work leading to the Master of Science and Doctor of Philosophy degrees in the fields of poultry genetics and breeding, poultry nutrition and feeding, avian physiology, incubation, brooding and rearing, poultry processing and marketing, and poultry products technology.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

401. Management and Selection. (1-2). Credit 2. II

How to select breeding males and females; culling the farm flock; planning a poultry program for a community with emphasis on good management and soundness of health; how to plan and manage county poultry shows. A thorough study of the National Poultry Improvement Plans, with enough practice work in selecting and testing to qualify students for official Plan participation. Mr. Ryan

411. Poultry Feeding. (3-2). Credit 4. I

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. Compositions, 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 the analysis of feedstuffs, the formulation of poultry rations, and diagnosis of lack of essentials in poultry rations. Prerequisites: Chemistry 223, 231. Mr. Couch

*Graduate Advisor

414. Poultry Breeding. (2-2). Credit 3. I

The basic principles of poultry breeding. The inheritance of characters of economic importance. The records essential for a sound breeding program; the selection of breeders on the basis of records and standardbred characteristics. Practice includes taking records on the breeding birds, interpreting the records, and the techniques involved in pedigree breeding. Prerequisite: Genetics 301. Mr. Fanguy

FOR GRADUATES

603. Principles and Practices of Incubation. (3-3). Credit 4. II

A study of the developmental stages of the chick during incubation. Correlation of development with genetic and environmental factors. Study of the fundamental principles underlying successful artificial incubation of eggs. Relation of egg characters to hatchability. Effects of pre-incubation treatment on hatchability of chicken and turkey eggs. Control of disease during the incubation process. Relation of maternal diet to embryonic development and hatchability of the chick. Prerequisite: Poultry Science 308 or equivalent. Mr. Fanguy

604. Principles of Brooding and Rearing. (3-3). Credit 4. I

A study of principles involved in brooding poultry. Relative cost and efficiency of different brooding and rearing methods. Relation of brooding practice to growth, livability, and subsequent adult performance. Such factors as diet, levels of protein, minerals, vitamins, medicants, and growth stimulants are analyzed in relation to growth, livability, malformations, and feed efficiency. Physiological factors such as temperature control mechanisms and hormones are covered. Research methodology and thorough literature review are stressed. Prerequisites: Poultry Science 201 and 303 or equivalent. Mr. Krueger

609. Avian Physiology. (3-3). Credit 4. I

A study of basic physiological principles pertaining specifically to the avian species. The chicken will be used as the laboratory animal. The vascular, digestive, neural, respiratory and reproductive systems will be stressed. Prerequisites: Biology 433; approval of instructor. Mr. Ferguson

611. Poultry Processing, Storing, and Distribution. (3-0). Credit 3. II

A study of egg quality and of egg quality maintenance. Effects of storage on egg and meat quality. The latest methods of processing eggs and poultry; feeding of market birds to improve grade; costs of production for various areas, and for various sized flocks and methods of management; planning optimum sized units for economical production. Prerequisites: Agricultural Economics 314 or equivalent; Poultry Science 407 or the equivalent. Mr. Gardner

612. Laboratory Problems in Poultry Processing, Storing, and Distribution. (0-3). Credit 1. II

A survey of improved methods of processing poultry and eggs. Certain selected modern processing plants will be visited and a study made of operating methods. Students may assist with experimental work in progress on poultry and egg processing and storage. Laboratory comparisons of various methods of fattening and their effects on market and storage quality of fowl. Effects of temperature and methods of dressing on market and storage quality. Prerequisite: Poultry Science 611 or registration therein. Mr. Gardner

613. Breeding and Genetics of Poultry. (3-3). Credit 4. II

An advanced and specialized study of poultry breeding and genetics covering such areas as causation, interrelations among traits, effective size of populations, methods of measuring genetic improvement, the heterosis concept, measures of general and specific combinability, and genetic homeostasis. Efficiency of various systems of breeding poultry will be analyzed. Scientific journals and technical literature will be reviewed. Prerequisites: Genetics 301 and Poultry Science 414 or the equivalent. Mr. Krueger

681. Seminar. (1-0). Credit 1 each semester. I, II

Intensive review and reporting of literature on poultry feeding, breeding, incubation, marketing, and management problems. Development of familiarity not only with literature but with organizations, agencies, and personnel working with poultry problems. Prerequisite: Graduate classification. May be repeated as many semesters as desired but a maximum of two credits allowed toward Master's degree. Mr. Quisenberry

685. Problems. Credit 1 to 6 each semester. I, II, S

An intensive study of newer principles and methods in the various specialized fields of poultry science—breeding, nutrition, market technology. Prerequisite: Approval of the Head of the Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Intensive study of research methods and techniques in poultry breeding, nutrition, physiology, physical aspects of marketing, or poultry products technology. Students will be required to carry out some experimental projects in one of these fields. Reviews of specific literature, collection, analysis and presentation of experimental data will be stressed. Designed for thesis and dissertation credit. Staff

Department of Range and Forestry

F. W. GOULD, D. L. HUSS, C. L. LEINWEBER* (Head), W. G. McCULLY, R. R. RHODES, O. E. SPERRY, W. J. WALDRIP

Research in progress in range and forestry deals with the fundamental and practical problems associated with the management of range lands. This includes studies on proper utilization, range ecology, soil and water conservation, range reseeding, and revitalization practices of range and forest areas. Other specific problems deal with eradication and control of brush and poisonous plants and the application of proper management practices.

The natural plant resources of Texas are adapted to the various phases of research in the Department. An experimental range of approximately 1200 acres near the University is used for research. Several of the sub-stations of the Texas Agricultural Experiment Station cooperate on experimental projects. Many small grazing areas as well as outstanding ranches throughout the state lend themselves to our research needs. Equipment and supplies for range research are maintained to meet all the demands of the problems undertaken.

Students who take work in the Department of Range and Forestry must have adequate preparation in botany, agronomy, and animal husbandry, as well as in the fundamentals of economics, chemistry, and mathematics.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Plant and Range Ecology. (2-3). Credit 3. II

An analysis of habitat factors as they influence plant growth. Attention is given plant succession, competition and distribution of plants in relation to the environment. Prerequisite: Biology 102. Mr. Sperry

303. Agrostology. (2-3). Credit 3. I

A fundamental study of grasses, especially those of economic importance in Texas. A study of the characteristics of the various genera and species of grasses, their identification, distribution, propagation, improvement, and management with particular reference to their use and value in Texas ranges and pastures. Prerequisite: Biology 102 or equivalent. Mr. Gould, Mr. Sperry

*Graduate Advisor

304. Range Management. (2-3). Credit 3. I

A technical course dealing with problems met in managing native range lands, including a study of grazing regions, and the problems of each; revegetation of range lands; maintenance of production; utilization of range forage; and range livestock management as it affects vegetation. Field trips. Prerequisites: Range and Forestry 301, 303. Mr. Huss

409. Advanced Range Management. (2-3). Credit 3. II

A technical course dealing with the more advanced problems in managing native range lands. Special attention will be given to the study of the development of the range industry, cost of production, range land utilization, grazing systems, range trend, and condition classes. Field trips. Prerequisite: Range and Forestry 304. Mr. Leinweber

485. Range Problems. Credit 1 to 3 each semester. I, II, S

Individual study and research upon a selected range problem approved by instructor. Staff

FOR GRADUATES

605. Range Research Methods. Credit 2. I

A study of research methods in range management and related subjects. A review of scientific investigation in the field and analysis of results. Prerequisite: Graduate majors in range and forestry. Mr. Huss

606. Range Economics. (2-0). Credit 2. II

Range management practices, land utilization, and ranch operations as they affect economics of livestock industry and the nation. Prerequisite: Graduate majors and minors in range and forestry. Mr. Leinweber

607. Vegetation Influences. (3-0). Credit 3. I

Interrelationships between ecological factors and vegetation, influence of forest and range vegetation on watershed management and soil conservation. Prerequisite: Range and Forestry 301. Staff

609. Plant and Range Ecology. (3-0). Credit 3. I

A detailed study of plant communities, successions, and the effect of various degrees of utilization in vegetation types and edaphic factors. Prerequisite: Range and Forestry 301 or equivalent. Mr. Sperry

610. Range Grasses and Grasslands. (2-3). Credit 3. II

A study of range grasses as applied to utilization and sustained production. The ecological characteristics and geographical features of the native grasslands. Ecological principles as applied to range problems. Individual problems to be assigned. Prerequisites: Range and Forestry 301, 303; approval of Head of Department. Mr. Gould

611. Control of Noxious Range Plants. (3-0). Credit 3. II

An advanced study of native and naturalized noxious and poisonous plants on Texas ranges that are detrimental to good management practices. Their distribution, reproduction, dissemination, and methods and practices of control will be stressed in relation to conservation and economic importance. Field trips to be arranged. Mr. McCully

612. Range Management Practices, Policies, and Administration. (3-0). Credit 3. I

Advanced studies dealing with technical range management problems, social and economic background of legislation, and policies developed in the acquisition and administration of national, state, and private range properties. Field trips to be arranged. Prerequisite: Range and Forestry 409 or equivalent. Mr. Leinweber

681. Seminar. (1-0). Credit 1 each semester. I, II

Current scientific work in range management and related subjects in American and foreign fields. Prerequisite: Majors and minors in range and forestry. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

A course designed for investigations not included in the student's research for thesis or dissertation. Problems may be selected in applied ecology, range management, or forestry. Lectures, conferences, field work, reports. Prerequisite: Graduate majors or minors in range and forestry. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis or dissertation. Prerequisite: Graduate major in range and forestry. Staff

Department of Soil and Crop Sciences

I. M. ATKINS, E. C. BASHAW, H. T. BLACKHURST*, M. E. BLOODWORTH (Head), M. S. BROWN E. E. BURNS, J. W. COLLIER, E. D. COOK, A. F. DeWERTH*, M. H. FERGUSON, C. J. GERARD, C. L. GODFREY, H. E. HAMPTON*, E. C. HOLT, M. L. KINMAN, G. W. KUNZE, P. J. LYERLY, T. E. McAFEE, N. P. MAXWELL, J. F. MILLS, G. A. NILES, E. O. OLSON, D. R. PATERSON, P. E. PAWLISCH, B. A. PERRY, K. B. PORTER, R. C. POTTS, T. R. RICHMOND, G. W. RIVERS, J. R. RUNKLES, K. F. SCHERTZ, J. C. SMITH, R. D. STATEN, J. B. STOREY, R. M. WEIHING, E. L. WHITLEY

AGRONOMY SECTION

The Agronomy Section of the Department of Soil and Crop Sciences offers graduate programs designed as preparation for careers in research, teaching, extension, and other professional work. Facilities and equipment are available for advanced study in the various phases of agronomy.

Terminal programs leading to the M.S. degree are offered in crop production, soil and crop management, soil conservation, and turf management. Thesis research in these phases may be of an applied nature.

For those planning a career in research and teaching, a more basic program of study and research leading to the M.S. degree is recommended. Research programs for the Ph.D. degree in field crop science and soil science are expected to be basic in approach.

Research is in progress in cytology, genetics and breeding of field and forage crops, as well as in the various phases of production. Soil investigations are in the areas of soil chemistry, fertility, mineralogy, physics, and morphology and development.

Cooperative programs can be arranged with the Departments of Biochemistry and Nutrition and of Plant Sciences.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

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

The improvement of crops by hybridization and selection. Special breeding methods and techniques applicable to naturally self-pollinated, cross-pollinated, and asexually reproduced plants. Prerequisite: Genetics 301. (Offered in 1963-64 and in alternate years thereafter.) Mr. J. D. Smith

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

A study of the special problems in the utilization and management of soils and crops under varying soil and climatic conditions. Independent work in solving current agronomic problems in different parts of the Southwest required. Prerequisites: Agronomy 301; senior classification. Mr. Hampton

*Graduate Advisor

417. Pasture Management. (3-0). Credit 3. II

Adaptation and management of native and introduced pasture plants; their establishment, production, utilization, and maintenance in permanent and temporary pastures. Field trips are required. Prerequisite: Agronomy 301. Mr. Staten

422. Soil Conditions and Plant Growth. (3-4). Credit 4. II, S

The chemical, biological, and physical processes, activities, and conditions in soils as they influence plant growth. Prerequisites: Agronomy 301; approval of the instructor. Mr. Hampton

445. Soil Physics. (2-3). Credit 3. I

A study of the fundamentals of soil physics and their application to the solution of problems in crop production, irrigation, and engineering. Prerequisites: Nine hours of soils and physics, with a minimum of three hours of each (may include soil mechanics). Mr. Runkles

FOR GRADUATES

601. Grain and Cereal Crops. (3-0). Credit 3. II

An advanced study of grain and cereal ecology, utilization, physiology and morphology, including a critical review of world literature reporting recent investigations in this field. Mr. Atkins

602. Forage Crops. (3-0). Credit 3. I

An advanced study of forage production, utilization, ecology, physiology, and morphology. Factors affecting initiation of regrowth and seed and forage quality. It includes a review of world literature reporting recent investigations in this field. Mr. Staten

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

An advanced study of the development, morphology, constitution, and classification of soils. Mr. Godfrey

617. Advanced Soil Physics. (3-3). Credit 4. II

The physical constitution and properties of soil, including consistence and structure, aeration, soil water, and thermal relationships. Prerequisites: Agronomy 445 or the equivalent and a two-semester course in physics. (Offered in 1964-65 and in alternate years thereafter.) Mr. Runkles

618. Advanced Soil Analysis. (2-3). Credit 3. II

A course designed to familiarize the student with the more difficult problems of soil analysis and the interpretation of the data. Prerequisite: Agronomy 422. (Offered in 1963-64 and in alternate years thereafter.) Mr. Kunze

624. Physical Chemistry of Soils. (3-3). Credit 4. I

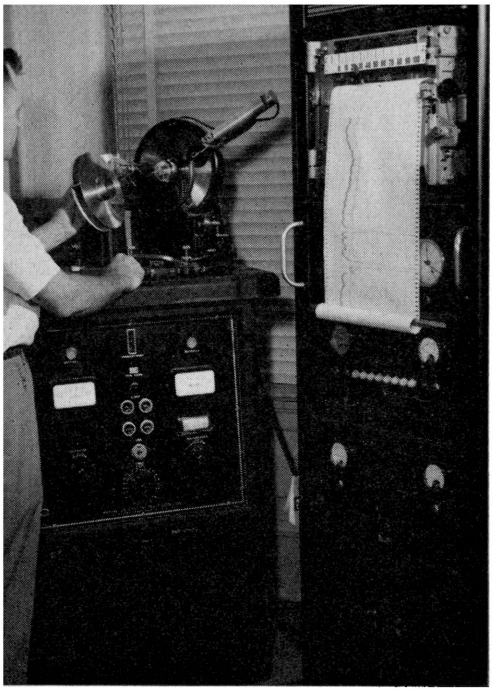
The physical chemistry of clay minerals and the inorganic and organic soil colloids. Prerequisites: Agronomy 617, 618, 626; Chemistry 323, 324. (Offered in 1964-65 and in alternate years thereafter.) Mr. Bloodworth

626. Soil Mineralogy. (3-3). Credit 4. I

A study of the crystal structures and properties of the more important agricultural and industrial clays combined with identification techniques involving X-rays, differential thermal analysis, and electron microscopy. (Offered in 1963-64 and in alternate years thereafter.) Mr. Kunze

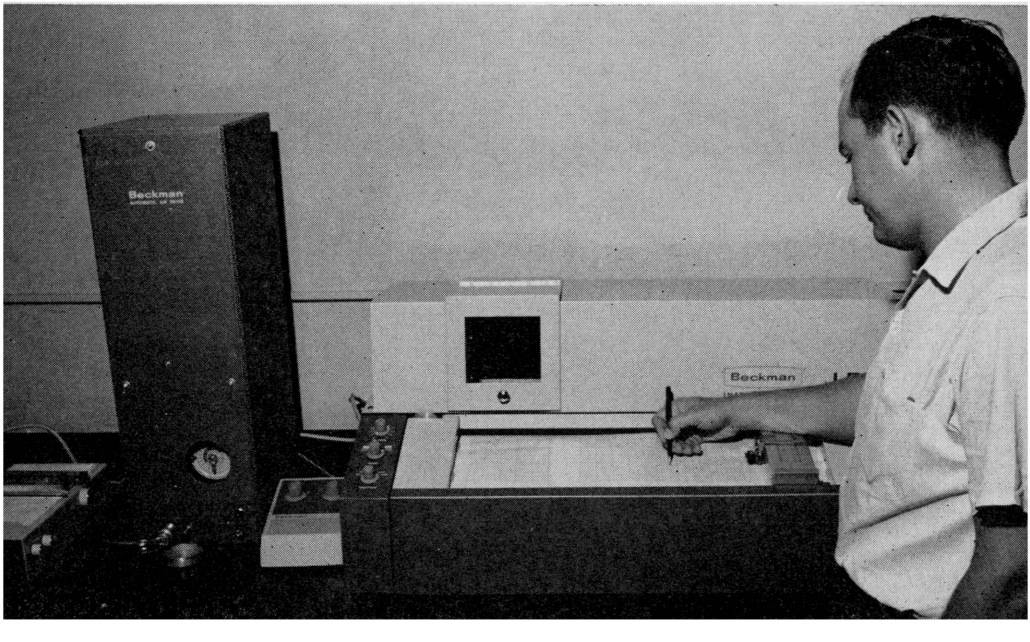
627. Soil Fertility Relationships. (2-0). Credit 2. II

An advanced study of the concepts and approximations that have been used to describe the relationships between nutrient supplies and plant responses, and the techniques of applying this information in the solution of problems. Prerequisites: Agronomy 422 and Plant Physiology and Pathology 314, or registration therein. (Offered in 1964-65 and in alternate years thereafter.) Staff



X-ray diffraction is used by soil scientists to study the crystal structure characteristics of soil clays.

Graduate student in soil science using an infra-red spectrometer to identify and characterize soil clays.



681. Seminar. (1-0). Credit 1 each semester. I, II

A seminar for graduate students and staff members in soils and crops. Presentation and discussion of special topics and research data in the field of agronomy. Participation is required of all graduate students in agronomy. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Advanced problems in some phase of agronomy not directly related to the thesis or dissertation. Staff

691. Research. Credit 1 or more each semester. I, II, S

Investigations leading to the thesis or dissertation. Staff

Genetics 612. Plant Genetics. (3-3). Credit 4. II

See the Genetics Section of the Department of Plant Sciences for a full description of this course.

FLORICULTURE SECTION

The field of research in floriculture and landscape horticulture affords excellent opportunities for original work. Studies in the propagation, nutrition, culture, harvesting, grading, marketing, and improvement of ornamental plants may be undertaken. Also, monographic studies of ornamental groups and their adaptability to use are suitable problems for investigation.

Many of the problems in this field are basically those of plant response in relation to environment and students should have adequate preparation in botany, plant physiology, genetics, agronomy, plant pathology, entomology, chemistry, and floriculture or horticulture.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

424. Propagation of Ornamental Plants. (2-2). Credit 3. II

A scientific study of plant propagation with special emphasis on the anatomical and physiological considerations involved and their importance to the highly technical procedures required in modern commercial propagation. Prerequisite: Plant Physiology and Pathology 313. Mr. DeWerth

429. Nursery and Greenhouse Crops. (3-3). Credit 4. I

The application of basic scientific developments to the principles and practices involved in the production, harvesting, grading, and distribution of crops grown in modern nurseries, greenhouses, and other forcing structures. Prerequisites: Floriculture 327; Plant Physiology and Pathology 313. Mr. DeWerth

FOR GRADUATES

609. Taxonomy of Ornamental Plants. (2-2). Credit 3. I

Specialized study of the genera, species, varieties and clons of woody and herbaceous ornamental plants including identification, forms, structure, and uses and their adaptability to the climatic conditions of the Southwest. Specific problems with these plants will be studied under field conditions. Emphasis on the taxonomy, physiology, and anatomy of these plants. Mr. DeWerth

610. Tropical Foliage Plants. (2-2). Credit 3. II

An intensive study of the rare and exotic plants of tropical and subtropical regions of the world including the identification, adaptation, cultural requirements, propagation, and economic importance. Specific problems in taxonomy, physiology, and anatomy of these plants. Mr. DeWerth

615. Greenhouse Problem Diagnosis. (0-3). Credit 1. I

Instruction in the diagnosis of routine problems encountered in the management and maintenance of greenhouse facilities and the problems involved in the propagation, care, and analysis of plants grown in greenhouses for scientific investigations. Prerequisite: Graduate classification. Mr. DeWerth

685. Problems. Credit 1 to 4 each semester. I, II, S

Individual problems or research not pertaining to a thesis or a dissertation. Prerequisite: Approval of Head of Department. Mr. DeWerth

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis or dissertation. Mr. DeWerth

HORTICULTURE SECTION

Advanced work in horticulture will be conducted in the major fields of fruit production, vegetable production, and fruit and vegetable products. The minor work, which supports the thesis research, will usually include courses in at least two additional departments. Supporting work may be required in several of the related fields, such as chemistry, botany, plant pathology and physiology, entomology, soils, genetics, nutrition, and agricultural engineering. The specific objective of the individual student will guide his committee in the choice of courses from the departments mentioned above and others in special cases.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

311. Processing Horticultural Crops. (2-3). Credit 3. I

A study of the principles and practices of canning, quick freezing, dehydration, pickling, and juice manufacture of fruits and vegetables. Fundamental concepts of the various techniques of preparation, processing, packaging, and use of additives will be given. Field trips to commercial processing plants will be made. Mr. Burns

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

Importance of nut crops, emphasis on pecan; problems of developing and maintaining pecan groves; developing native trees; study of varieties, fruit setting, soils, fertilizers, propagation methods, harvesting, handling, shelling, storage, and marketing the crop. Practice: Budding and grafting nursery stock, topworking native trees, storage and handling of budwood, examination of soils, spray application, visits to shelling plants. Mr. Brison

422. Citrus and Subtropic Fruits. (2-2). Credit 3. I

A study of the history, taxonomy, and factors limiting the distribution of citrus species. Planting, irrigation, soil management, pruning, factors influencing hardiness, packing, grades, post harvest physiology, and marketing of citrus will be studied. The scope of the industry, propagation, varieties, and orchard practices of the avocado, papaya, pineapple, banana, and other subtropical and tropical fruit plants are studied. (Offered in 1963-64 and in alternate years thereafter.) Mr. Storey

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

A study of principles and practices followed in the propagation of fruit trees. The course includes a study of graft union, congeniality between stocks and scions, adaptation of stocks to environment, and commercial propagation practices for important fruits. Practice includes special treatments for seeds, budding, grafting, and transplanting for important fruits. Mr. Brison

434. Grading and Packing Vegetables. (2-2). Credit 3. I

A consideration of the factors of good quality in market vegetables. Standard grades and packages. Shipping methods. The relation of production methods to quality. Transit losses. The methods of marketing open to the producer. Recent trends in marketing and packaging. Mr. Burns

444. Laboratory Examination of Processed Food. (1-2). Credit 2. II

Practice and theory in chemical, physical, microscopic, and microbiological methods of food analysis and interpretation of results. Federal and State regulations will be considered. Prerequisite: Approval of the instructor. Mr. Burns

446. Commercial Fruit and Vegetable Canning. (2-3). Credit 3. II

An advanced course in pilot plant and laboratory operations pertaining to the production of canned fruits and vegetables. Prerequisite: Horticulture 311. Mr. Burns

481. Seminar. (1-0). Credit 1 each semester. I, II

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. Mr. Burns

FOR GRADUATES

601. Environmental Relations of Fruit Plants. (3-3). Credit 4. I

Water, nutrition, and temperature relations of fruit plants will be studied. Practice will involve laboratory analyses of soil moisture relationships, leaf analyses by flame spectrophotometry, and a study of plant growth regulator control of dormancy. Basic principles will be applied to practical management problems. (Offered in 1964-65 and in alternate years thereafter.) Mr. Storey

602. Factors Influencing Fruit Production. (3-3). Credit 4. II

The influence of pruning, light, plant growth regulators, and structural factors on fruit setting will be studied. Practice will include chromatographic separation, spectrophotometric identification, and biological assay of endogenous plant growth regulators. Pruning, chemical fruit thinning, and fruit plant hybridization experiments will be conducted. (Offered in 1963-64 and in alternate years thereafter.) Mr. Storey

603. Structure of Vegetable Plants. (3-3). Credit 4. II

A consideration of the morphological and anatomical features of important families of vegetable plants and the relation of these features to growing practices and progressive improvements of the various plants. Mr. Blackhurst

604. Physiology of Vegetable Plants. (3-3). Credit 4. I

The topics of thermoperiodism, photoperiodism, nutrient deficiencies, water relations, temperature relations, fruit setting, growth, and seed germination will be taken up for each of the major vegetable crops. The recent developments in the use of hormones and selective herbicides in vegetable production will be discussed. Mr. Blackhurst

681. Seminar. (1-0). Credit 1. I, II

Intensive review and literature reporting on production and processing of horticultural crops. Development of familiarity with horticultural research literature, organizations, and personnel. Prerequisite: Graduate classification. Required of all graduate students in Horticulture. Mr. Burns

685. Problems. Credit 1 to 4 each semester. I, II, S

A comprehensive review of fundamental principles in research and methods employed in research. Practice in the various techniques which may be used in different investigations of horticultural problems. Staff

691. Research. Credit 1 or more each semester. I, II, S

Research in horticultural problems for thesis or dissertation. Staff

Soil Chemistry

See the Agronomy Section of the Department of Soil and Crop Sciences.

Soil Physics

See the Agronomy Section of the Department of Soil and Crop Sciences.

INSTITUTE OF STATISTICS

E. E. DAYHOFF, R. J. FREUND, H. O. HARTLEY (Director), R. R. HOCKING, J. D. WILLIAMS

The Institute of Statistics offers a graduate program leading to the Master of Science or Doctor of Philosophy degrees. The Institute also cooperates closely with all subject matter area departments in setting up a flexible graduate minor program in statistics.

The aim of the M.S. program is to provide a balanced training in Statistical Methods and Statistical Theory and yet to keep the requirements sufficiently flexible to permit students to develop their specific interests.

The aim of the Ph.D. program is to provide a comprehensive and balanced training in Statistical Methods and Statistical Theory. Particular emphasis will be placed on training students to independently recognize the relevance of statistical methods to the solution of specific problems and to enable them to develop new methods when they are needed. The training will also aim at conveying a sound knowledge of existing statistical theory, including the mathematical facility to develop new results in statistical methodology. At the same time, the program will be kept sufficiently flexible to permit students to develop their specific interests.

Normally, three semesters of calculus (Mathematics 307) are required for entry into this program.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

406. Statistical Methods. (2-2). Credit 3. I, II, S

A non-mathematical introduction to the concepts of random sampling and statistical inference; estimation and testing hypothesis of means and variances; the analysis of variance; regression analysis; chi-square tests. Not to be used for graduate credit by Statistics majors. Prerequisite: Approval of the instructor. Staff

FOR GRADUATES

601. Statistical Methods in Engineering and Physical Sciences. (3-2). Credit 4. I, II

Introduction to probability, probability distributions, and statistical inference; t, F tests and the analysis of variance; regression analysis; elements of experimental design. Prerequisite: Mathematics 122 or 210. Staff

603. Biological Statistics and Bioassay. (3-0). Credit 3. II

Bio-assay for quantitative and quantal responses; absolute and comparative potencies, does-, time- and dose x time response curves; stationary and dynamic models for biological populations, prey-predator studies. Prerequisite: Statistics 605. Mr. Dayhoff

604. Special Problems in Statistical Computations and Analysis. (3-0). Credit 3. I

An introduction to Fortran programming with emphasis on programming statistical analyses; the efficient uses of existing statistical computer programs; generation or random numbers and statistical variables; the programming of simulation studies; selected topics in statistical analysis not covered in Statistics 605. Prerequisite: Statistics 605. Mr. Freund

605. Statistical Analysis. (3-3). Credit 4. I, II

This course is intended for students in the life, agricultural, and social sciences. A review of estimation and testing hypotheses; analysis of variance and covariance; simple, multiple, and curvilinear regression; introduction to experimental design; introduction to non-parametric methods. Prerequisite: Approval of the instructor. Mr. Hartley

606. Design of Experiments. (2-3). Credit 3. II

The fundamental principles of the design and analysis of experiments; randomized blocks, Latin squares, split plots, factorial experiments; confounding; missing plot techniques. Prerequisite: Approval of the instructor. Mr. Dayhoff

607. Sampling. (2-0). Credit 2. I

The planning, execution, and analysis of sampling from finite populations; simple, stratified, multi-stage, and systematic sampling; ratio estimates. Prerequisite: Approval of the instructor. Mr. Hartley

608. Least Squares and Regression Analysis. (3-0). Credit 3. II

Regression analysis, simple, multiple, and curvilinear, orthogonal polynominals; analysis of non-orthogonal and incomplete experiments by least squares methods; computer methods for least squares problems. Prerequisite: Approval of the instructor. Mr. Freund

609. Order Statistics and Non-Parametric Methods. (3-0). Credit 3. II

The use of order statistics and other distribution free statistics for estimation and testing hypotheses. Prerequisite: Approval of the instructor. Mr. Hartley

611. Theory of Statistics. (4-0). Credit 4. I

The concept of probability, probability distribution, moment generating functions and limit theorem; the theory of estimation and testing hypotheses. Prerequisite: Approval of the instructor. Mr. Hocking

612. Theory of Linear Models. (3-0). Credit 3. I

Theory of least squares; theory of the general linear hypothesis and associated small sample distribution theory; analysis of multiple classifications. Prerequisites: Mathematics 416; Statistics 605, 611. Mr. Dayhoff

613. Intermediate Theory of Statistics. (3-0). Credit 3. I

General theory of estimation and sufficiency, including maximum likelihood, minimum variance estimation; Neyman-Pearson theory of testing hypothesis; elements of decision theory. Prerequisites: Mathematics 409; Statistics 611. Mr. Hocking

614. Advanced Theory of Statistics. (3-0). Credit 3. II

Probability measures and distribution functions, random variables, characteristic functions, asymptotic distributions. Prerequisites: Mathematics 608; Statistics 613. Mr. Hocking

615. Stochastic Processes and Time Series. (3-0). Credit 3. I

Stationary and non-stationary stochastic processes, autoregressive processes and correlogram analysis, harmonic - periodogram and spectral analysis. Markoff and diffusion processes. Prerequisites: Mathematics 409, 601; Statistics 611. Mr. Hartley

616. Multivariate Analysis. (3-0). Credit 3. I

Multivariate normal distributions and multivariate generalizations of classical test criteria, Hotellings T, discriminant analysis and elements of factor and canonical analysis. Prerequisites: Mathematics 409; Statistics 601 or 605; 611. Mr. Hartley

617. Theory of Sampling. (3-0). Credit 3. II

The general randomization theory of multistage sampling of finite populations, sampling with and without replacements and with equal and unequal probabilities, ratio and regression estimates in multiphase sampling, analytic studies and multiframe problems. Prerequisites: Statistics 607, 611. Mr. Hartley

685. Problems. Credit 1 to 4. I, II, S

Individual instruction in selected fields in Statistics; investigation of special topics not within the scope of thesis research and not covered by other formal courses. Prerequisites: Graduate classification; approval of the Head of the Department. Staff

691. Research. Credit 1 or more. I, II, S

Research for thesis or dissertation. Prerequisite: Graduate classification. Staff

Structural Mechanics

FOR GRADUATES AND ADVANCED UNDERGRADUATES

468. Statically Indeterminate Structures. (3-0). Credit 3. I

Matrix algebra; basic structural principles; displacement analysis by the real-work, differential-equation, Castigliano's first theorem, and auxiliary-load methods. Analysis of statically indeterminate structures by the consistent-distortion method. Displacements of statically indeterminate structures. Treatment of beams, trusses, frames, and curved members. Prerequisite: Aerospace Engineering 304 or Civil Engineering 345. Mr. Samson

469. Analysis of Structures. (3-0). Credit 3. II

Displacement analysis by the moment-area, elastic-weights, conjugate-beam, virtual-work, and Williot-Mohr methods. Analysis of statically indeterminate structures by the three-moment theorem, least-work, elastic-center, column-analogy, slope-deflection, moment-distribution, and relaxation methods. Treatment of beams, trusses, frames, and curved members. Prerequisite: Structural Mechanics 468. Mr. Samson

FOR GRADUATES

601. Theory of Elasticity. (4-0). Credit 4. I, S

Study of the analysis of stress and strain in two and three dimensions, equilibrium and compatability equations, strain energy methods, torsion of noncircular sections, flexure, axially symmetric problems. Prerequisite: Mathematics 601 or registration therein. Mr. Samson, Mr. Wingren

602. Structural Stability. (4-0). Credit 4. II

Primary buckling of centrally or eccentrically loaded columns; primary buckling of centrally loaded columns by torsion; built-up columns; lateral buckling of beams; buckling of rings. Prerequisites: Mathematics 308; approval of the instructor. Mr. Samson, Mr. Wingren

603. Theory of Plates and Shells. (4-0). Credit 4. I

Small-deflection thin plate theory for plates of various shapes and support conditions; bending of anisotropic plates; plates under combined lateral loads and in-plane forces; large-deflection thin plate theory; theory of shells; stability of plates and shells. Prerequisite: Mathematics 601 or registration therein. Mr. Samson, Mr. Wingren

604. Vectors and Tensors in Mechanics. (2-0). Credit 2. I, S

A unified study of continuous media using vectors and tensors. Mr. Thompson

605. Flow and Fracture of Solids. (4-0). Credit 4. II
Study of deformation of solids; elastic, very viscous, and ideally plastic substances. Prerequisite: Structural Mechanics 601. Mr. Hirsch, Mr. Samson

606. Theory of Thermal Stresses. (4-0). Credit 4. II
A basic study of heat conduction, thermoelasticity, and thermoinelasticity as related to thermal stresses. Prerequisites: Structural Mechanics 601; approval of the instructor. Mr. Samson, Mr. Wingren

607. Matrix Methods of Structural Analysis. (3-3). Credit 4. II, S
A unified treatment of two- and three-dimensional frames by specialized matrix methods. Prerequisite: Structural Mechanics 468. Mr. Samson

608. Experimental Structural Analysis. (2-3). Credit 3. II, S
Study of observations and measurements, dimensional analysis, prediction equations, and theory of similitude; design, construction, and use of structural models. Prerequisite: Structural Mechanics 468. Mr. Hirsch

609. History of Structural Mechanics. (2-0). Credit 2. II, S
A study of the history of the development of structural mechanics to the present time. Prerequisite: Approval of the instructor. Mr. Hirsch, Mr. Samson

Department of Veterinary Anatomy

L. W. GIBBS, A. G. KEMLER, J. H. MILLIFF* (Head)

FOR GRADUATES AND ADVANCED UNDERGRADUATES

301. Anatomy. (1-9). Credit 4. I †
The osteology, dentition, and arthrology of the domestic animals and topographical dissection of the dog. Staff

302. Anatomy. (1-9). Credit 4. II †
Topographical dissection of the cow and the comparative study of the horse, cat, and pig. Prerequisite: Veterinary Anatomy 301. Staff

303. Histology. (2-6). Credit 4. I †
A microscopic study of the basic tissues and of the organs, excluding the organs of reproduction. Staff

304. Embryology. (2-6). Credit 4. II †
A microscopic study of the reproductive organs of the domestic animals, and of serial sections of chick and pig embryos. Prerequisites: Veterinary Anatomy 301, 303. Staff

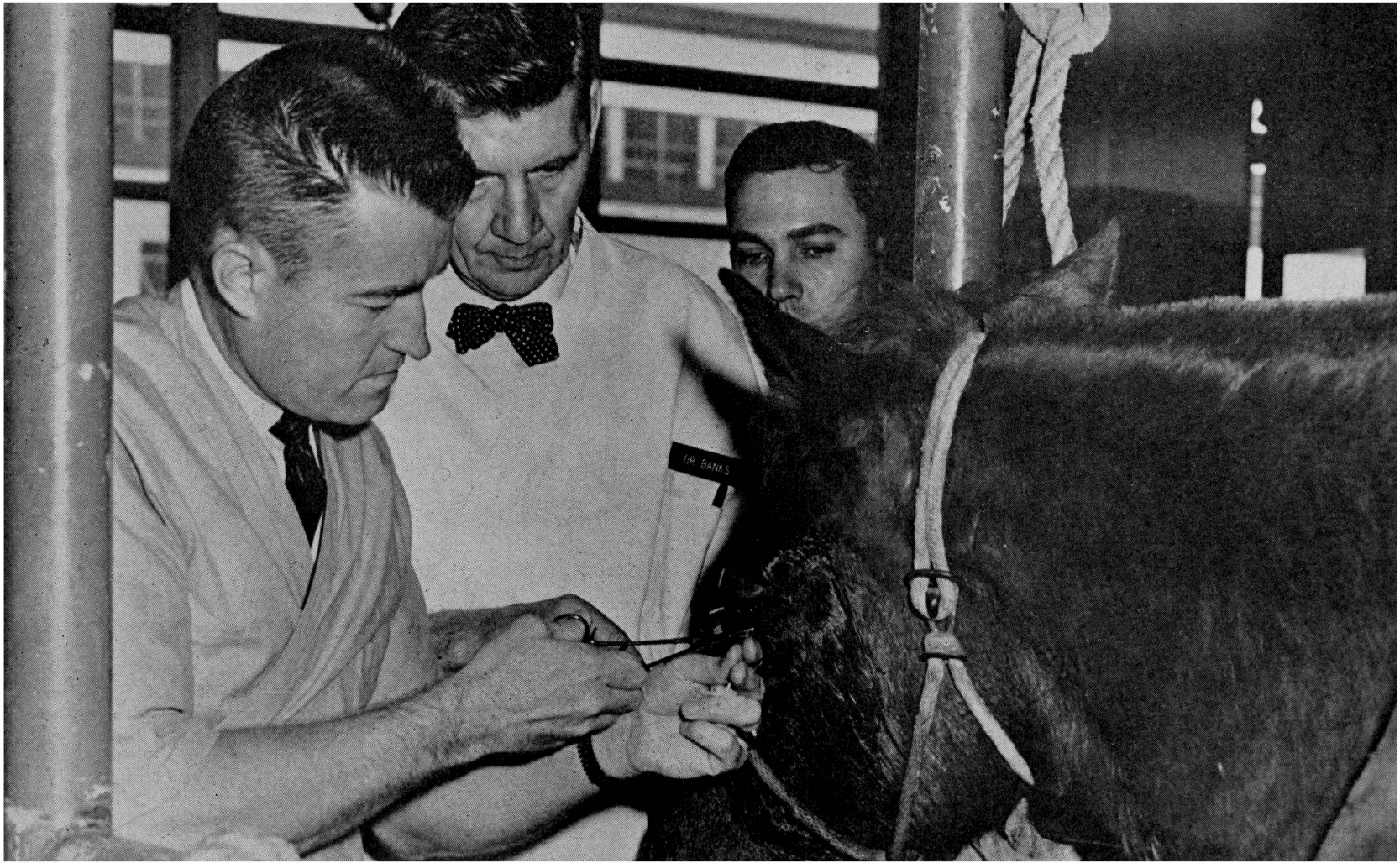
406. Neuroanatomy. (0-6). Credit 2. III †
The gross and microscopic anatomy of the nervous systems of the domestic animals. Prerequisite: Veterinary Anatomy 303. Staff

501. Applied Anatomy. (1-6). Credit 3. III
The anatomy of the areas of surgical and clinical importance in the domestic animals. Prerequisite: Veterinary Anatomy 302. Staff

FOR GRADUATES

601. Veterinary Anatomy. (1-9). Credit 4 each semester. I, II
The topographical dissection of domestic animals. Prerequisites: Veterinary Anatomy 301, 302. Staff

*Graduate Advisor
†May be taken for graduate credit by students not majoring in veterinary medicine.


DR BANKS

602. Veterinary Anatomy. (2-6). Credit 4. I, II

The microscopic structure of the anatomical systems of domestic animals. Prerequisite: Veterinary Anatomy 303. Staff

603. Neuroanatomy. (2-6). Credit 4. II

The study of the gross, developmental, and microscopic anatomy of the nervous systems of the domestic animals. Prerequisite: Veterinary Anatomy 406. Staff

604. History of Anatomy. (1-0). Credit 1. I, II, S

A discussion of the biographies and contributions to the field of anatomy of the most important anatomists from 500 B.C. to the present. Prerequisite: Graduate major in veterinary anatomy. Staff

681. Seminar. (1-0). Credit 1. S

The review and discussion of current scientific work in anatomy and related subjects. Prerequisite: Graduate major or minor in veterinary anatomy. Staff

685. Problems. Credit 1 to 4 each semester. I, II, S

Problems in either gross or microscopic anatomy along lines to be chosen by the individual. Prerequisites: Veterinary Anatomy 406; approval of the Head of the Department. Staff

691. Research. Credit 1 or more each semester. I, II, S

Original research on a selected thesis problem in anatomy. Prerequisite: Graduate major in veterinary anatomy. Staff

Department of Veterinary Medicine and Surgery

W. C. BANKS, M. R. CALLIHAM* (Head), E. W. ELLETT, D. L. PIERMATTEI, J. C. RAMGE

FOR GRADUATES

603. Veterinary Surgery. Credit 1 to 8 each semester. I, II

Special surgery of large or small animals. Prerequisite: Degree of Doctor of Veterinary Medicine. Staff

612. Diagnostic Radiology. Credit 2 or 3 each semester. I, II, S

Radiographic interpretation of large and small animals with special emphasis on film reading. The use of special techniques including contrast media as diagnostic aids will be discussed and demonstrated. Prerequisite: Degree of Doctor of Veterinary Medicine. Mr. Banks

621. Reproduction Diseases of Female Domestic Animals. (2-0). Credit 2. I, II, S

Advanced study of the diagnosis, treatment, and control of diseases primarily affecting reproduction in the female domestic animal. Prerequisite: Degree in Veterinary Medicine. Mr. Ramge

622. Veterinary Andrology. (2-0). Credit 2. I, II, S

Advanced study of the diagnosis, treatment, and control of diseases primarily affecting reproduction in the male domestic animal, including a study of the evaluation of semen and its preparation for use by artificial insemination. Prerequisite: Degree in Veterinary Medicine. Mr. Ramge

685. Problems. Credit 1 to 8 each semester. I, II

Original investigations of problems in the field of surgery, therapeutics, or radiology. Prerequisite: Degree of Doctor of Veterinary Medicine. Staff

691. Research. Credit 1 or more each semester. I, II

Research for thesis. Staff

Research in Veterinary Medicine and Surgery—Graduate professor supervises making a cobalt 60 needle implant in the cancerous eye of a horse.

Department of Veterinary Microbiology

A. I. FLOWERS, T. E. FRANKLIN, L. C. GRUMBLES* (Head), C. F. HALL, P. F. JUNGERMAN, C. W. LIVINGSTON, R. W. MOORE

FOR GRADUATES AND ADVANCED UNDERGRADUATES

335. Microbiology. (3-5). Credit 5. II †

The principles of bacteriology, infection, and immunity. The morphology, physiology, antigenic structure, and identifying characteristics of bacteria are studied in detail. Consideration is given to the production of antibiotics and biologicals. The mechanism of infections and the fundamentals of immunity are studied and correlated. Staff

436. Microbiology. (3-5). Credit 5. III †

A comprehensive study of the pathogenic microorganisms and their role in causing disease. Special emphasis is given to antigenicity and the relation of each organism to the immune phenomena. Laboratory diagnosis and species identification are stressed. Prerequisite: Veterinary Microbiology 335. Staff

FOR GRADUATES

643. Veterinary Microbiology. (3-4). Credit 4. I, II

A study of the pathogenic microorganisms; their cultural and biological characteristics and pathogenicity. Staff

646. Avian Virus Diseases. Credit 1 to 4. I, II

A study of the viral diseases of poultry including methods of isolation and identification of the causative agents. Practice consists of conducting post mortem examinations and special diagnostic procedures on birds received daily for necropsy. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Flowers

647. Veterinary Virology. Credit 1 to 4. I, II

A detailed study of virus infections in animals, including types of infections, mode of transmissions, intracellular pathology, epidemiology, isolation and identification of the inciting agents. Practice includes tissue cultivation, animal inoculations and diagnostic tests. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Staff

648. Veterinary Mycology. Credit 1 to 4. II, S

A study of actinomycetes, yeasts, and molds that are pathogenic to man and animals; the morphology, cultural characteristics, pathogenicity and identification. Practice consists of exercises in cultural methods, morphological characteristics, biochemical reactions and diagnosis. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Jungerman

685. Problems. Credit 1 to 4 each semester. I, II

Problems course in microbiology. Prerequisites: Degree of Doctor of Veterinary Medicine; approval of the Head of the Department. Staff

691. Research. Credit 1 or more. I, II

Research for thesis or dissertation. Staff

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*Graduate Advisor
†May be taken for graduate credit by students not majoring in veterinary medicine.

Department of Veterinary Parasitology

See also **Animal Parasitology**

R. R. BELL, T. J. GALVIN, R. D. TURK* (Head)

FOR GRADUATES AND ADVANCED UNDERGRADUATES

483. Parasitology. (2-2). Credit 3. I †

A study of the more important and commonly-occurring parasites and parasitic diseases of domestic animals. Practice consists of laboratory and diagnostic methods used in parasitology, utilizing fresh and preserved material obtained from the field, clinics, and necropsies. Signs, diagnosis, treatment, and control of parasitic diseases, are emphasized. Prerequisite: Veterinary Anatomy 302. Staff

484. Parasitology. (2-2). Credit 3. II †

A study of the more important and commonly-occurring parasites and parasitic diseases of domestic animals. Helminth, protozoan, and arthropod parasites and diseases are considered. Signs, diagnosis, treatment, and control are emphasized. Prerequisite: Veterinary Parasitology 483. Staff

487. Parasites of Farm Animals and Poultry. (2-2). Credit 3. II, S

A study of some of the more important internal and external parasites of domestic animals and poultry. The life cycles, pathogenicity, and economic and public health aspects will be stressed with suggested methods for control. Open to agricultural students. Prerequisite: Senior classification. Mr. Bell

FOR GRADUATES

601. Parasitology. Credit 1 to 4 each semester. I

A detailed study of the more important helminth parasites of domestic animals, including their identification, distribution, and life history. Prerequisite: Veterinary Clinics 583 or the equivalent. Mr. Galvin

685. Problems. Credit 1 to 4 each semester. I, II, S

Special problems concerned with the parasites of domestic animals or poultry. Prerequisites: Veterinary Parasitology 601 or the equivalent; approval of the instructor. Mr. Turk

691. Research. Credit 1 or more each semester. I, II, S

Research for thesis. Mr. Turk

Department of Veterinary Pathology

J. N. BEASLEY, C. H. BRIDGES* (Head), J. B. HENSON

FOR GRADUATES AND ADVANCED UNDERGRADUATES

447. General Principles of Pathology. (2-2). Credit 3. I, S

A study of the mechanisms of disease as encountered in the higher mammalian species. The course deals with the causes and pathogenesis of the various types of disease, the reactions of the body against them, and certain abstract principles governing their treatment. Open to non-medical students. Lectures and demonstrations. Prerequisites: Six hours of biological sciences; junior classification. Mr. Bridges

*Graduate Advisor
†May be taken for graduate credit by students not majoring in veterinary medicine.

FOR GRADUATES

643. Gross Pathology. Credit 1 to 6. I, II, S

The student studies gross pathological changes at the necropsies performed daily. He then follows selected tissues through suitable histopathological techniques and corrects his gross diagnoses in the light of the microscopic findings. Confirmatory bacteriological methods are utilized where indicated. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Beasley

644. Locomotor and Skeletal Diseases. Credit 1 or 2. I, S

The changes taking place in diseased bones, joints, and muscles are studied with respect to their nature and probable causes, and with special reference to lameness of the horse. Frequent use is made of the unsurpassed Mark Francis Collection of Bone and Joint Pathology. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Bridges

645. Neoplastic Diseases. Credit 1 to 8. I, II, S

Theoretical, histopathological, and clinical aspects of neoplasia. Diagnosis of neoplastic and related conditions in all species. Prerequisite: Degree of Doctor of Veterinary Medicine or the equivalent. Mr. Beasley, Mr. Bridges

646. Nutritional Diseases. Credit 2 to 4. II

Gross and microscopic tissue changes to be found in experimentally produced nutritional deficiencies are considered in comparison with clinically encountered deficiencies and with other conditions from which they must be differentiated. Prerequisite: Degree of Doctor of Veterinary Medicine or other suitable preparation. Mr. Bridges

647. Metabolic Diseases. Credit 1 or 2. S

The pathology of diseases due to major disorders of metabolism, nonnutritional and non-infectious. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Bridges

648. Reproductive Diseases. Credit 1 to 4. S

Theoretical and practical pathology of gross and microscopic lesions in the reproductive organs with especial reference to bovine sterility. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Henson

649. Gross Post-Mortem Diagnosis. Credit 1 to 6. I, II, S

Advanced training in recognition, interpretation, and description of tissue changes encountered. Specific diagnoses are derived and defended. Prerequisites: At least 4 semester hours of credit in Veterinary Pathology 643. Staff

650. Neuropathology of Animals. Credit 1 to 4. I, S

In addition to the study and interpretation of gross and microscopic lesions of the central and peripheral nervous systems, major attention is given in theory and practice to the special laboratory techniques necessary to demonstrate such lesions. Prerequisite: Degree of Doctor of Veterinary Medicine or equivalent. Mr. Bridges

651. Microscopic Diagnosis. Credit 1 to 6. I, II, S

Advanced training in diagnosis, applied especially to the "problem" cases currently encountered in the Department's pathological diagnostic service. Routine and special histopathological methods are employed. Prerequisites: A total of at least 10 semester hours of credit in Veterinary Pathology 643, 645. Staff

658. Pathological Technique. Credit 1 to 6. I, II, S

The art and science of preparing animal tissues, fluids, and exudates for microscopic or other special examination. Enrollment is limited to the number who can be accommodated in the routine of the departmental laboratory. Prerequisite: A fair knowledge of general chemistry. Mr. Beasley

659. Sheep Diseases. Credit 1 to 4. I

The pathology, etiology, and symptomatology of the economically important diseases affecting sheep in all of the major sheep-producing countries of the world. Prerequisite: Degree of Doctor of Veterinary Medicine or the equivalent. Staff

681. Seminar. (1-0). Credit 1. I, II, S

A seminar for graduate and special students in veterinary pathology. Presentation and discussion of special topics and research data concerning the pathology and pathogenesis of diseases. Prerequisite: Approval of the Head of the Department. Mr. Bridges

685. Problems. Credit 1 to 4. I, II, S

Advanced special problems concerned with the pathogenesis and pathology of disease. Prerequisite: Veterinary Pathology 444 or the equivalent; approval of the Head of the Department. Mr. Bridges

691. Research. Credit 1 or more each semester. I, II, S

Research to be reported by the writing of a thesis or dissertation as a partial requirement for the Master of Science or Doctor of Philosophy degree. Staff

Department of Veterinary Physiology and Pharmacology

P. W. BURNS* (Head), R. H. DAVIS, JR.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

326. Physiology. (3-3). Credit 4. II †

Introduction to physiology, physicochemical basis of cellular physiology, dynamics of nerve and muscle, functions of the circulatory system. Prerequisites: Biochemistry and Nutrition 312; Veterinary Anatomy 301, 303, and registration in 302 and 304. Staff

427. Physiology. (3-3). Credit 4. III †

Functions of the respiratory system, renal function and acid-base balance, mechanisms of digestion, absorption and excretion, metabolism and energy exchange, minerals and vitamins, neurophysiology. Prerequisite: Veterinary Physiology and Pharmacology 326. Staff

FOR GRADUATES

601, 602. Animal Physiology. (3-3). Credit 4 each semester. I, II

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: Basic courses in morphology and organic chemistry. Mr. Burns

605, 606. Veterinary Toxicology. (3-3). Credit 4 each semester. I, II

Original investigations and detailed studies of poisons or poisonous plants and their effects on domestic animals. Prerequisite: Veterinary Physiology and Pharmacology 530. Mr. Burns

607, 608. Veterinary Pharmacology. (3-3). Credit 4 each semester. I, II

Modern methods of research in pharmacology and pharmaceutical processes. Original research in studying the actions and uses of drugs. Prerequisites: Veterinary Physiology and Pharmacology 430, 529. Mr. Davis

611, 612. Veterinary Physiology. (3-3). Credit 4 each semester. I, II

A detailed study of specific phases of physiology of domestic animals. Prerequisites: Veterinary Anatomy 303, 304; Veterinary Physiology and Pharmacology 427. Mr. Burns, Mr. Davis

*Graduate Advisor
†May be taken for graduate credit by students not majoring in veterinary medicine.

685. Problems. Credit 1 to 4 each semester. I, II
Problems in physiology, pharmacology, or toxicology. Prerequisite: Degree of Doctor of Veterinary Medicine or appropriate specialized training. Mr. Burns, Mr. Davis

691. Research. Credit 1 or more each semester. I, II
Original investigations in veterinary physiology, pharmacology or toxicology to be submitted by writing of a thesis as partial fulfillment for the Master of Science degree. Prerequisite: Approval of Head of Department. Mr. Burns, Mr. Davis

Department of Veterinary Public Health

F. P. JAGGI, JR.* (Head), L. H. RUSSELL, JR.

FOR GRADUATES

631. Food Hygiene. (3-4). Credit 4. I
The study of causes and evidence of spoilage, and the detection of adulterants in fresh, canned, and cured foods of animal origin. Prerequisite: Veterinary Public Health 591 or 595. Mr. Russell

685. Problems. Credit 1 to 4 each semester. I, II
Problems course in veterinary public health. Prerequisite: Degree of Doctor of Veterinary Medicine. Mr. Jaggi

Department of Wildlife Management

R. J. BALDAUF, D. C. CARTER, R. B. DAVIS, W. B. DAVIS* (Head) J. G. TEER

Graduate work in the Department of Wildlife Management is intended to train the student in original work in vertebrate systematics, ecology, and management. Graduates in this field should be well equipped for a variety of work in vertebrate systematics and ecology, whether in museum, college or university teaching, wildlife or park management, or various phases of land use.

Lines in which this department is especially qualified to direct graduate research are: (1) ecology, life history, and management of vertebrates; (2) their distribution, differentiation, and taxonomy; and (3) limnology. Facilities are available through cooperative arrangements with the Texas Parks and Wildlife Department for students to work on problems basic to the management of both game and non-game species of wildlife and to pursue basic investigations in both fresh water and salt water fisheries. The Department has a research and reference collection of some 40,000 fish, 18,000 amphibians and reptiles, 8,000 birds 11,000 mammals, and can secure additional materials on loan from other institutions for use in distributional and taxonomic studies.

FOR GRADUATES AND ADVANCED UNDERGRADUATES

311. Ichthyology. (Fresh Water). (2-3). Credit 3. I
This course is designed to familiarize the student with the fresh-water fishes of the world. The approach to the subject matter will be mainly systematic, but the evolution, ecology, life history, and economy of the more important species will be treated. The fresh-water fishes of Texas will be emphasized and the practice will consist of the identification of 75-100 fish. Prerequisite: Biology 107. Mr. Baldauf

*Graduate Advisor

Graduate students in Wildlife Management have access to large collections of vertebrates for research studies.

312. Ichthyology. (Marine). (2-3). Credit 3. II

A study of the marine fishes of the world, emphasizing fishes of Texas. Life history, ecology, distribution, evolution, and economic values of important species will be treated. Prerequisite: Wildlife Management 311. (Offered in 1963-64 and in alternate years thereafter.) Mr. Baldauf

315. Herpetology. (2-2). Credit 3. II

An introduction to the study of the structure, adaptation, classification, distribution, and economic importance of amphibians and reptiles. Prerequisite: Biology 107. Mr. Baldauf

401. General Mammalogy. (2-2). Credit 3. I

Study of the structure, classification, and economic relations of mammals. Foundation for wildlife management, also for museum work. Prerequisite: Biology 107. Mr. Carter

402. General Ornithology. (2-2). Credit 3. II

Introduction to the study of birds, their structure, classification, geographic distribution, ecologic relations, and economic status. Foundation for wildlife management, also for museum work. Prerequisite: Biology 107. Staff

403. Animal Ecology. (2-3). Credit 3. I

Composition, structure, and energy relationships of plant-animal communities. The interaction of physical and biotic factors as they affect population levels and community development. Application of ecological principles to some current land use practices. Prerequisite: Range and Forestry 301 or approval of the instructor. Staff

408. Techniques of Wildlife Management. (2-3). Credit 3. II

Methods and techniques in maintaining and increasing desirable wildlife and regulating population generally, with emphasis on practical aspects. Use of natural vegetation, the place and methods of census, restocking, game preserves, predatory animal control, provision of food and cover, farmer-sportsman relations, significance of succession, and other ecologic concepts to game management and related enterprises. Prerequisite: Senior classification in wildlife management or approval of instructor. Mr. Teer

410. Conservation and Management of Fishes. (3-0). Credit 3. II

Basic knowledge from ichthyology, biology of fishes, and limnology is related to the applied aspects of fresh water and marine fishery science. Emphasis is placed on methods of fish culture, habitat and population manipulation, disease and parasites of fishes and fundamentals of farm pond management. Mr. Baldauf

417. Biology of Fishes. (2-2). Credit 3. I

Treats the biology of fishes, including respiration, sense organs, feeding habits, breeding habits, anatomy, and adaptations to the environment. Emphasis will be placed upon the various physiological and morphological features of fishes, particularly as they relate to problems of distribution, populations, and management in Texas. Prerequisite: Biology 107. Mr. Baldauf

FOR GRADUATES

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

The theory and practice of taxonomy as applied to vertebrates. Laboratory consists of individual problems on classification and distribution of selected groups of vertebrates; problems in nomenclature of birds, mammals, fishes and reptiles, based on Texas Cooperative Wildlife Collection. Survey of the literature of vertebrate taxonomy as related to the group selected; a study of vertebrate material from the systematic standpoint. Prerequisites: Wildlife Management 311, 315, 401, or 402, depending on group selected. (Offered in 1964-65 and in alternate years thereafter.) Staff

603. Vertebrate Ecology. (1-6). Credit 3. II

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. Consideration will be given to community and environmental relations. Prerequisite: Wildlife Management 403 or equivalent. (Offered in 1964-65 and in alternate years thereafter.) Staff

608. Techniques of Wildlife Management. (2-0). Credit 2. II

Special techniques and current development in wildlife management practices. Prerequisite: Wildlife Management 408 or equivalent. (Offered in 1964-65 and in alternate years thereafter.) Staff

609. Wildlife Research Methods. (2-0). Credit 2. I

A study of research methods as applied to wildlife management. (Offered in 1964-65 and in alternate years thereafter.) Staff

681. Seminar. (1-0). Credit 1 each semester. I, II

Important current developments in the wildlife field with special reference to the literature. Prerequisite: Senior or graduate classification. Staff

685. Problems. Credit 2 to 6 each semester. I, II, S

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

691. Research. Credit 1 or more each semester. I, II, S

Original research on a selected wildlife problem to be used in thesis or dissertation. Staff

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