GENERAL ANNOUNCEMENTS

SEPTEMBER, 1960—JUNE, 1961

WILLIAM MARSH RICE UNIVERSITY

formerly, The Rice Institute

HOUSTON, TEXAS

The name of the Rice Institute was changed to
WILLIAM MARSH RICE UNIVERSITY
on July 1, 1960

Publication of the *General Announcements* of the Rice University is annual. The next issue will be for the period from September, 1961, to June, 1962.

These *Announcements* are the catalogue of the Rice University.

THE RICE INSTITUTE PAMPHLET *containing selected monographs is also published occasionally at Houston, Texas.*

GENERAL ANNOUNCEMENTS

for

SEPTEMBER, 1960—JUNE, 1961

of

WILLIAM MARSH RICE UNIVERSITY

FOUNDED BY WILLIAM MARSH RICE

OPENED FOR THE RECEPTION OF STUDENTS IN THE AUTUMN OF NINETEEN HUNDRED AND TWELVE

Dedicated to the

Advancement of Letters, Science, and Art

HOUSTON, TEXAS

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1960

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August

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1962

January

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March

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April

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May

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June

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ACADEMIC CALENDAR

1960-61

Thursday, Sept. 1	Last Day for Returning Registration Cards
Sunday, Sept. 4	Arrival of Freshmen
Monday, Sept. 5-9	Freshman Week
Monday, Sept. 5	Matriculation Address, 5:00 P.M.
Monday, Sept. 12	Opening of Courses
Wednesday, Nov. 23	Beginning of Thanksgiving Recess, 6:00 P.M.
Monday, Nov. 28	Resumption of Courses, 8:00 A.M.
Tuesday, Dec. 20	Beginning of Christmas Recess, 6:00 P.M.
Tuesday, Jan. 3	Resumption of Courses, 8:00 A.M.
Saturday, Jan. 14	Last Day of First Term Classes
Tuesday, Jan. 17	Beginning of Mid-year Examinations
Monday, Jan. 30	Resumption of Courses, 8:00 A.M.
Tuesday, Mar. 28	Beginning of Easter Recess, 6:00 P.M.
Tuesday, Apr. 4	Resumption of Courses, 8:00 A.M.
Thursday, May 18	Last Day of Classes
Saturday, May 20	Beginning of Final Examinations
Friday, June 2	Baccalaureate Exercises
Saturday, June 3	Forty-eighth Commencement

1961-62

Friday, Sept. 1	Last Day for Returning Registration Cards
Sunday, Sept. 3	Arrival of Freshmen
Monday, Sept. 4-8	Freshman Week
Monday, Sept. 4	Matriculation Address, 5:00 P.M.
Monday, Sept. 11	Opening of Courses
Wednesday, Nov. 22	Beginning of Thanksgiving Recess, 6:00 P.M.
Monday, Nov. 27	Resumption of Courses, 8:00 A.M.
Wednesday, Dec. 20	Beginning of Christmas Recess, 6:00 P.M.
Wednesday, Jan. 3	Resumption of Courses, 8:00 A.M.
Saturday, Jan. 13	Last Day of First Term Classes
Tuesday, Jan. 16	Beginning of Mid-year Examinations
Monday, Jan. 29	Resumption of Courses, 8:00 A.M.
Thursday, Apr. 19	Beginning of Easter Recess, 6:00 P.M.
Friday, Apr. 27	Resumption of Courses, 8:00 A.M.
Thursday, May 17	Last Day of Classes
Saturday, May 19	Beginning of Final Examinations
Friday, June 1	Baccalaureate Exercises
Saturday, June 2	Forty-ninth Commencement

OFFICERS OF ADMINISTRATION

WILLIAM VERMILLION HOUSTON, PH.D., D.SC., LL.D.
President

THAD NORTON MARSH, M.A., B.LITT.
Assistant to the President

CAREY CRONEIS, PH.D., LL.D., D.SC., D.ENG.
Provost

GEORGE HOLMES RICHTER, PH.D.
Dean of the University

WILLIAM HENRY MASTERSON, PH.D.
Dean of Humanities

LEVAN GRIFFIS, PH.D.
Dean of Engineering

JAMES REDDING SIMS, PH.D.
Adviser to Men

NANCY MOORE EUBANK, B.A.
Adviser to Women

JAMES BERNARD GILES, M.A.
Director of Admissions

ALTA FISHER PATRICK
Assistant to the Director of Admissions

MICHAEL VINCENT McENANY, M.A.
Registrar

ELIZABETH MILLIGAN REYNOLDS, B.A.
Assistant to the Registrar

ROLAND HEYNE
Bursar

HOWARD ALEXANDER THOMPSON, M.A.
Development Assistant

BOARD OF GOVERNORS

TRUSTEES

GEORGE RUFUS BROWN: CHAIRMAN
GUS SESSIONS WORTHAM: FIRST VICE-CHAIRMAN
WILLIAM ALEXANDER KIRKLAND: VICE-CHAIRMAN
JESSE NEWTON RAYZOR: VICE-CHAIRMAN
JOHN SMITH IVY: SECRETARY-TREASURER
LAMAR FLEMING, JR.
HARMON WHITTINGTON

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JOHN R. SUMAN

WILLIAM MARSH RICE UNIVERSITY

HISTORICAL SKETCH

William Marsh Rice, a native of Massachusetts, founded the Rice Institute in Houston, where he had spent a great part of his life. The founder's ashes are contained in the base of a bronze statue by John Angel, at the center of the Academic Court.

The Rice Institute was incorporated in 1891 under a charter which allowed large freedom in the organization of an institution to be dedicated to the advancement of literature, science, and art. On December 28, 1907, the Board of Trustees appointed Dr. Edgar Odell Lovett, professor of mathematics and head of the astronomy department at Princeton University, to be the first president of the Institute. The new university was opened in September, 1912, after careful and extended planning, to an entering class of seventy-seven students.

The enrollment expanded rapidly at the Institute during the early years. Since 1924, annual admission of undergraduate students has been limited to about 450. No restriction has so far been placed on the acceptance of qualified graduate students. Up to 1960, the Rice Institute has enrolled more than twenty-one thousand students and has conferred more than ten thousand degrees.

In 1946, Dr. Lovett retired as president and was succeeded by Dr. William V. Houston. Dr. Lovett became president emeritus; he died in 1957.

During World War II, the Board of Trustees was actively planning the post-war development of the Institute. Based on a comprehensive survey undertaken early in 1945, a long-range development program was formulated, whose spirit is indicated by the first of its twelve points.

> It shall continue to be the objective of the Rice Institute to provide especially good training for a limited number of students. The Institute will provide a broad and sound basic program with a well-developed and strong curriculum in arts and letters and with the emphasis on science and research that is required to meet changing circumstances.

The development program has been carried forward very actively. The most visible evidence has been the number of new buildings erected in recent years. The M. D. Anderson Hall, a classroom and office building, was opened in 1947. The Fondren Library was opened for use in May, 1949. In rapid succession have come the Abercrombie Engineering Laboratory; Wiess Hall, a fourth residence hall for two hundred men; a nuclear research laboratory housing a six-million-volt Van de Graaff generator provided by the Atomic Energy Commission; a home for the President; a new football stadium which seats 70,000 persons; and a gymnasium containing a swimming pool and offices for the physical education department. In 1956-57, by enlarging the existing dormitories and erecting new dining halls, lounges, and homes for the masters, Rice created four residential colleges for men: Baker, Will Rice, Hanszen, and Wiess. The Mary Gibbs Jones College for Women was opened in September of 1957. A geology building, a biology building, and the Hamman Hall auditorium were all completed early in 1958, and the Rice Memorial Center, connected by a cloistered walk to the Rice Memorial Chapel, with associated offices and meeting rooms for various student religious groups, was opened in 1959.

Like the building program, all other phases of the post-war plans announced by the Trustees have been vigorously developed. The number of faculty members has grown from less than seventy before the war to over one hundred seventy. A department of geology and several courses in music have been added. The undergraduate curricula have been revised and are continuing to undergo revision; procedures for selecting students for admission have been made increasingly rigorous; and programs of graduate study and research have been greatly expanded. During the academic year 1959-60 there were 319 graduate students enrolled, and there were twelve post-doctoral fellows and research associates working in the laboratories of the Institute. In 1959 President Houston announced the appointment of two new academic deans as administrators of the humanities and engineering programs of the university.

In September, 1949, the directing body of the Institute was enlarged to a fifteen-member Board of Governors, composed of the

seven permanent trustees and eight governors appointed by the trustees for terms of one to four years. Then, in 1954, a new body, the Rice Institute Associates, was formed to provide a channel for the free exchange of ideas between the students and teachers of the Institute and a group of representative citizens who have influence in civic, cultural, and educational affairs of the region.

The name, the Rice Institute, was changed to William Marsh Rice University on July 1, 1960.

INSTRUCTIONAL AND RESEARCH STAFF

EMERITUS FACULTY

ALTENBERG, EDGAR

A.B. (Columbia) 1911, A.M. (Columbia) 1912, Ph.D. (Columbia) 1916
Professor Emeritus of Biology

BRAY, HUBERT EVELYN

B.A. (Tufts) 1910, M.A. (Harvard) 1916, Ph.D. (Rice) 1918
Professor Emeritus of Mathematics and Non-Resident Associate of Jones College

DEAN, ALICE CROWELL

B.A. (Rice) 1916, M.A. (Rice) 1919
Librarian Emerita

FREUND, FRIEDRICH ERNST MAX

Ph.D. (Leipzig) 1902
Professor Emeritus of German

MCCANN, SAMUEL GLENN

Ph.B. (Wooster) 1914, M.A. (Rice) 1917
Emeritus Director of Admissions and Honorary Associate of Wiess College

MCCANTS, JOHN THOMAS

B.S. (Marion Inst.) 1902, B.A. (Marion Inst.) 1905, M.A. (Virginia) 1906, M.A. (Yale) 1909
Bursar Emeritus and Honorary Associate of Baker College

MORAUD, MARCEL

Agrégé de l'Université (Paris) 1919, Docteur ès Lettres (Paris) 1933
Professor Emeritus of French

NICHOLAS, HENRY OSCAR

A.B. (Oberlin) 1919, Ph.D. (Yale) 1923
Associate Professor Emeritus of Chemistry

RYON, LEWIS BABCOCK

C. E. (Lehigh) 1917
Professor Emeritus of Civil Engineering and Honorary Associate of Hanszen College

SLAUGHTER, JOHN WILLIS

A.B., B.D. (Lombard) 1898, Ph.D. (Michigan) 1901
Lecturer Emeritus in Civics and Philanthropy

TSANOFF, RADOSLAV ANDREA

B.A. (Oberlin) 1906, Ph.D. (Cornell) 1910
Professor Emeritus of Philosophy and Honorary Associate of Will Rice College

WHITING, GEORGE WESLEY

A.B. (West Virginia) 1908, A.M. (Harvard) 1913, Ph.D. (Chicago) 1926
Professor Emeritus of English

WILSON, HAROLD ALBERT

M.Sc. (Leeds) 1897, D.Sc. (London) 1900, M.A. (Cambridge) 1904, F.R.S.
Professor Emeritus of Physics and Honorary Associate of Hanszen College

FACULTY

ADAMS, JOHN A. S.

Ph.B. (Chicago) 1946, B.S. (Chicago) 1948, M.S. (Chicago) 1949, Ph.D. (Chicago) 1951
Associate Professor of Geology

AKERS, WILLIAM WALTER

B.S. in Ch.E. (Texas Tech.) 1943, M.S. in Ch.E. (Texas) 1944, Ph.D. (Michigan) 1950
Professor of Chemical Engineering and Non-Resident Associate of Baker College

ANDERSEN, LAIRD BRYCE

B.S. (Minnesota) 1950, M.S. (Minnesota) 1951, Ph.D. (Illinois) 1954
Associate Professor of Chemical Engineering

AUTEN, JOHN H.

B.S. (Ohio State) 1947, Ph.D. (M.I.T.) 1954
Associate Professor of Economics

AWAPARA, JORGE

B.S. (Michigan State) 1941, M.S. (Michigan State) 1942, Ph.D. (Southern California) 1947
Associate Professor of Biology

BACKUS, KERBY DEWEL

B.S. (East Texas S.T.C.) 1956
Instructor in Engineering Drawing and Resident Associate of Wiess College

BARKER, J. R.

B.S. in Phy.Ed. (Rice) 1949, M.Ed. (Texas) 1954
Assistant Professor of Physical Education

BARTHELME, DONALD

B. Arch. (Pennsylvania) 1930
William Ward Watkin Professor of Architecture

BATTISTA, JOSEPH LLOYD

Certificat d'Études française (Bordeaux) 1919, Diplomé d'Études supérieures (Bordeaux) 1919, B.A. (Michigan) 1920, M.A. (Washington Univ.) 1923, M.A. (Harvard) 1929
Associate Professor of Romance Languages

BEARDEN, FRANCIS W.

B.S. (Texas Tech.) 1947, M.A. (Columbia) 1949, Ed.D. (Columbia) 1954
Assistant Professor of Physical Education and Non-Resident Associate of Will Rice College

BECKMANN, HERBERT

Dipl. Ing. (Hanover, Germany) 1944, Dr. Ing. (Hanover) 1957
Associate Professor of Mechanical Engineering

BIEDENHARN, LAWRENCE CHRISTIAN, JR.

S.B. (M.I.T.) 1944, Ph.D. (M.I.T.) 1949
Associate Professor of Physics

BLACK, HUGH CLEON

B.A. (Rice) 1941, M.Ed. (Texas) 1947, Ph.D. (Texas) 1949
Associate Professor of Philosophy and Education and Non-Resident Associate of Baker College

BLAND, ROBERT L.

B.A. (Central Washington) 1953, M.A. (Columbia) 1954
Assistant Professor of Physical Education and Non-Resident Associate of Hanszen College

BONNER, TOM WILKERSON

B.S. (Southern Methodist) 1931, M.A. (Rice) 1932, Ph.D. (Rice) 1934
Professor of Physics and Non-Resident Associate of Will Rice College

BOURGEOIS, ANDRÉ MARIE GEORGES

Bachelier ès Lettres (Paris) 1921, Bachelier en Droit (Paris) 1923, Certifié d'Études supérieures de lettres (Paris) 1930, M.A. (Texas) 1934, Docteur d'Université (Paris) 1945, Officier de l'Instruction Publique 1945
Professor of French

BRACKETT, THOMAS E.

B.S. (Maine) 1954, Ph.D. (California) 1958
Assistant Professor of Chemistry and Non-Resident Associate of Will Rice College

BROTHERS, DWIGHT STANLEY

B.A. (Colorado College) 1951, M.A. (Princeton) 1954, Ph.D. (Princeton) 1957
Assistant Professor of Economics and Non-Resident Associate of Wiess College

BROTZEN, FRANZ RICHARD

B.S. (Case Institute) 1950, M.S. (Case Institute) 1953, Ph.D. (Case Institute) 1954
Professor of Mechanical Engineering and Non-Resident Associate of Jones College

BROWN, ARLEN

Ph.B. (Chicago) 1948, Ph.D. (Chicago) 1952
Associate Professor of Mathematics

BRYAN, ANDREW B.

B.A. (Rice) 1918, M.A. (Rice) 1920, Ph.D. (Rice) 1922
Lecturer in Physics

BURGHARD, HERMAN C., JR.

B.S. in M.E. (Rice) 1950, M.S. (Rice) 1958
Assistant Professor of Mechanical Engineering

BURRUS, CHARLES SIDNEY

B.A. (Rice) 1958, B.S. in E.E. (Rice) 1958
Instructor in Electrical Engineering

BUSCH, ARTHUR W.

B.S. (Texas Tech.) 1950, S.M. (M.I.T.) 1952
Assistant Professor of Civil Engineering

CAMDEN, CARROLL

A.B. (Centre) 1925, M.A. (Iowa) 1928, Ph.D. (Iowa) 1930
Professor of English and Non-Resident Associate of Hanszen College

CAMPBELL, JAMES WAYNE

B.S. (Southwest Missouri) 1953, M.S. (Illinois) 1955, Ph.D. (Oklahoma) 1958
Instructor in Biology

CASON, CAROLYN

B.S. (Texas) 1934, M.A. (Teachers College, Columbia) 1939
Director of Food Service and Lecturer in Dietetics

CHAPMAN, ALAN JESSE

B.S. in M.E. (Rice) 1945, M.S. (Colorado) 1949, Ph.D. (Illinois) 1953
Professor of Mechanical Engineering and Non-Resident Associate of Hanszen College

CHILLMAN, JAMES, JR.

B.S. in Arch. (Pennsylvania) 1913, M.S. in Arch. (Pennsylvania) 1914, F.A.A.R. (Am. Acad. in Rome) 1922, Fellow A.L.A. 1950
Professor of Architecture and Non-Resident Associate of Jones College

CLASS, C. M.

A.B. (Johns Hopkins) 1943, Ph.D. (Johns Hopkins) 1951
Associate Professor of Physics and Master of Jones College

CONNER, JACK EDWARD

B.A. (Texas A. and I.) 1939, B.S. (Texas A. and I.) 1942, Ph.D. (Stanford) 1952
Associate Professor of English and Non-Resident Associate of Will Rice College

COPE, JACKSON I.

B.A. (Illinois) 1950, Ph.D. (Johns Hopkins) 1952
Associate Professor of English

COWLES, LAURENCE G.

B.S. in E.E. (Vermont) 1929, A.M. in Physics (Columbia) 1932
Lecturer in Electrical Engineering

CRAIG, HARDIN, JR.

A.B. (Princeton) 1929, A.M. (Harvard) 1931, Ph.D. (Harvard) 1937
Professor of History and Librarian and Non-Resident Associate of Will Rice College

CRONEIS, CAREY

B.S. (Denison) 1922, M.S. (Kansas) 1923, Ph.D. (Harvard) 1928, D.Sc. (Denison) 1945, LL.D. (Lawrence College) 1944, D.Sc. (Ripon) 1945, D.Eng. (Colorado Mines) 1949, LL.D. (Beloit) 1954
Harry Carothers Wiess Professor of Geology and Provost

CURL, ROBERT FLOYD, JR.

B.A. (Rice) 1954, Ph.D. (California) 1957
Assistant Professor of Chemistry

DAVIES, JOSEPH ILOTT

B.A. (Rice) 1928, M.A. (Rice) 1929, Ph.D. (Rice) 1937
Associate Professor of Biology and Non-Resident Associate of Hanszen College

DAVIS, SAM H., JR.

B.A. (Rice) 1952, B.S. (Rice) 1953, Sc.D. (M.I.T.) 1957
Assistant Professor of Chemical Engineering

DEANS, HARRY ALEXANDER

B.A. (Rice) 1953, B.S. in Ch.E. (Rice) 1954, M.S. in Ch.E. (Rice) 1956
Assistant Professor of Chemical Engineering

DE BREMAECKER, JEAN-CLAUDE

Ingénieur Civil des Mines (Louvain) 1948, M.S. (Louisiana State) 1950, Ph.D. (California) 1952
Assistant Professor of Geology

DENNY, VERNON E.

B.Ch.E. (Minnesota) 1953
Assistant Professor of Chemical Engineering

DE ZURKO, EDWARD ROBERT

B.S. in Ed. (Illinois) 1939, B.S. in Arch. (Illinois) 1940, M.S. in Arch. (Columbia) 1942, Ph.D. in Fine Arts (New York) 1954
Associate Professor of Architecture

DONNELLY, THOMAS WALLACE

B.A. (Cornell) 1954, M.S. (California Inst. of Tech.) 1956, Ph.D. (Princeton) 1959
Assistant Professor of Geology

DONOHO, PAUL LEIGHTON

B.A. (Rice) 1952, Ph.D. (California Inst. of Tech.) 1958
Assistant Professor of Physics

DOUGLAS, JIM, JR.

B.S. (Texas) 1946, M.S. (Texas) 1947, M.A. (Rice) 1950, Ph.D. (Rice) 1952
Associate Professor of Mathematics

DOWDEN, WILFRED SELLERS

B.A. (Vanderbilt) 1939, M.A. (Vanderbilt) 1940, Ph.D. (North Carolina) 1949
Associate Professor of English and Non-Resident Associate of Baker College

DREW, KATHERINE FISCHER

B.A. (Rice) 1944, M.A. (Rice) 1945, Ph.D. (Cornell) 1950
Associate Professor of History and Faculty Associate of Jones College

DUCK, HOWARD BECTON, JR.

B.S. (East Texas S.T.C.) 1956
Instructor in Engineering Drawing

DUNAWAY, JAMES KARL

B.A. (Rice) 1936, B.S. in Arch. (Rice) 1937, M.A. (Rice) 1938, M.S. (Columbia) 1941
Associate Professor of Architecture

DURST, LINCOLN KEARNEY

B.A. (U.C.L.A.) 1945, B.S. (California Inst. of Tech.) 1946, Ph.D. (California Inst. of Tech.) 1952
Assistant Professor of Mathematics and Non-Resident Associate of Baker College

DVORETZKY, EDWARD

B.A. (Rice) 1953, A.M. (Harvard) 1954
Assistant Professor of German

DYESS, ARTHUR D., JR.

A.B. (Yale) 1939, LL.B. (Texas) 1942
Lecturer in Architecture

EDWARDS, EDGAR OWEN

A.B. (Washington and Jefferson) 1947, M.A. (Johns Hopkins) 1949, Ph.D. (Johns Hopkins) 1951
Reginald Henry Hargrove Professor of Economics

ENDERS, ALLEN C.

A.B. (Swarthmore) 1950, A.M. (Harvard) 1952, Ph.D. (Harvard) 1955
Assistant Professor of Biology and Non-Resident Associate of Jones College

ETTLINGER, MARTIN GROSSMAN

B.A. (Texas) 1942, M.A. (Texas) 1943, Ph.D. (Harvard) 1946
Associate Professor of Chemistry

FORTEY, JOSEPH WILLIAM

B.Sc. (London) 1958
Instructor in Civil Engineering

FULTON, JAMES STREET

B.A. (Vanderbilt) 1925, M.A. (Vanderbilt) 1929, Ph.D. (Cornell) 1934
Professor of Philosophy and Master of Will Rice College

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B.A. (Rice) 1925, M.A. (Rice) 1926
Associate Professor of English

GILES, JAMES BERNARD

B.B.A. (Texas) 1936, M.A. (Texas) 1937
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GOODHAND, ROBERT H.

B.A. (Hamilton College) 1954, M.A. (Rice) 1956
Instructor in French

GRAHAM, MARTIN

B.E.E. (Brooklyn P.I.) 1947, M.Sc. (Harvard) 1948, D.E.E. (Brooklyn P.I.) 1952
Associate Professor of Electrical Engineering

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B.S. in Eng'g. (California Inst. of Tech.) 1937, M.S. (California Inst. of Tech.) 1938, Ph.D. (California Inst. of Tech.) 1941
Professor of Mechanical Engineering and Dean of Engineering

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B.S. (Iowa) 1953, M.S. (Iowa) 1957
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B.A. (Dijon) 1941, B.Sc. (Dijon) 1942, M.D. (Lyons) 1949, Ph.D. (Montreal) 1953
Lecturer in Biology

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B.S. in Ed. (Alabama) 1953
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HALL, ARTHUR E.

Mus. Bac. (Yale) 1924, M.M. (Baylor) 1952
Associate Professor of Music

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A.B. (Nebraska Wesleyan) 1911, S.B. in Ch.E. (M.I.T.) 1920, S.M. (M.I.T.) 1921
Professor of Chemical Engineering

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Professor of Physical Education and Non-Resident Associate of Baker College

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B.B.A. (Texas) 1935, M.B.A. (Texas) 1937
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HODGES, LEE

B.S. (Harvard) 1930, M.A. (Rice) 1934
Assistant Professor of Romance Languages

HOLT, EDWARD CHESTER, JR.

B.S. (M.I.T.) 1945, M.S. (M.I.T.) 1947, Ph.D. (Pennsylvania State) 1956
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B.A., B.S. in Ed. (Ohio State) 1920, S.M. (Chicago) 1922, Ph.D. (Ohio State) 1925, D.Sc. (Ohio State) 1950, LL.D. (California) 1956
Professor of Physics and President of the Rice Institute

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B.A. (Rice) 1940, LL.B. (Texas) 1946
Lecturer in Government

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B.A. (Rice) 1951, B.S. in M.E. (Rice) 1952, M.S. in M.E. (Rice) 1954
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Bachelor (Prague Inst. of Tech.) 1928, Master (Prague Inst. of Tech.) 1931
Lecturer in Russian

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B.S. (Texas A & M) 1943, M.B.A. (Harvard) 1947, M.S. (Texas A & M) 1952, Ph.D. (Rice) 1955
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B.A. (Temple) 1948, M.A. (Yale) 1949, M.A. (Princeton) 1954
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B.A. (Stephen F. Austin) 1940, A.M. (Kansas) 1942, Ph.D. (California) 1945
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A.B. (Rochester) 1917, A.M. (Harvard) 1920, Ph.D. (Harvard) 1925
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B.S. (Kansas State) 1958, M.S. (Kansas State Teachers) 1959
Instructor in Physical Education

LEHNERT, HERBERT HERMANN

Ph.D. (Christian Albrechts Universitaet) 1952
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LEIFESTE, A. A., JR.

A.B. (Southwestern) 1934, B.S. in Arch. (Rice) 1941
Assistant Professor of Architecture

LELAND, THOMAS W., JR.

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LOUIS, ANDREW

Ph.B. (Wesleyan) 1929, Ph.D. (Cornell) 1935
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B.S. in E.E. (Colorado College) 1929, M.A. (Dartmouth) 1931
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MCKILLOP, ALAN DUGALD

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MACKEY, LOUIS HENRY

B.A. (Capital) 1948, M.A. (Yale) 1953, Ph.D. (Yale) 1954
Associate Professor of Philosophy

MACKEY, WILLIAM STURGES, JR.

B.A. (Rice) 1943, C.P.A. 1948, M.B.A. (Texas) 1950
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MacLane, Gerald R.

B.A. (Yale) 1940, A.M. (Harvard) 1942, Ph.D. (Rice) 1946
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B.S. (Warsaw) 1917, Docteur ès Sciences (Paris) 1923; Professor at the Collège de France
Professor of Mathematics

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A.B. (Kansas) 1948, B.A. (Oxford) 1951, M.A. (Oxford) 1955, B.Litt. (Oxford) 1957
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Masson, Douglas Bruce

B.S. in Ch.E. (Washington State) 1954, M.S. (Chicago) 1956, Ph.D. (Chicago) 1958
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Masterson, William Henry

B.A. (Rice) 1935, M.A. (Pennsylvania) 1946, Ph.D. (Pennsylvania) 1950
Professor of History, Dean of Humanities, and Master of Hanszen College

Milligan, Winfred O.

A.B. (Illinois College) 1930, M.A. (Rice) 1932, Ph.D. (Rice) 1934, Sc.D. (Illinois College) 1946
Professor of Chemistry

Morehead, James Caddall, Jr.

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Professor of Architecture and Non-Resident Associate of Baker College

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B.A. (Rice) 1938, M.A. (Texas) 1942, Ph.D. (Texas) 1949.
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B.A. (Western Ontario) 1948, M.A. (Johns Hopkins) 1949, Ph.D. (Johns Hopkins) 1951
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Neely, Jess Claiborne

LL.B. (Vanderbilt) 1924
Director of Athletics and Head Coach of Football

NELSON, WILLIAM H.

B.A. (Omaha) 1944, M.A. (Columbia) 1945, Ph.D. (Columbia) 1957
Associate Professor of History

NIELSEN, NIELS C., JR.

B.A. (Pepperdine) 1942, B.D. (Yale) 1946, Ph.D. (Yale) 1951
J. Newton Rayzor Professor of Philosophy and Religious Thought and Non-Resident Associate of Baker College

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A.B. (Emory) 1945, B.D. (Yale) 1948, M.A. (N.Y.U.) 1954
Lecturer in Sociology

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ScB. (Brown) 1947, M.A. (Wesleyan) 1949, M.S. (Yale) 1949, Ph.D. (Columbia) 1952
Lecturer in Geology

OGG, DAVID

M.A. (Glasgow) 1907, B.A. (Oxford) 1912, M.A. (Oxford) 1914
Visiting Professor of History (1959-60)

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B.A. (Sam Houston) 1934, M.A. (Texas) 1938, Ph.D. (Columbia) 1951
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B.S. in M.E. (L.S.U.) 1950, M.S. in M.E. (Rice) 1952, Sc.D. (M.I.T.) 1955
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B.S. in E.E. (Rice) 1938, B.D. (Southern Methodist) 1943, M.S. in E.E. (Rice) 1948, Ph.D. (Rice) 1952
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B.S. in M.E. (Rice) 1950, M.S. in Engineering (California Inst. of Tech.) 1951, Ph.D. (California Inst. of Tech.) 1957
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B.A. (Rice) 1937, M.A. (Univ. of Houston) 1946, M.S. (Univ. of Houston) 1950, Ph.D. (Harvard) 1952
Lecturer in Biology

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B.S. (Rutgers) 1956
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B.A. (Rice) 1954, B.S. in E.E. (Rice) 1955, M.A. (Rice) 1957, Ph.D. (Rice) 1959
Assistant Professor of Electrical Engineering

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B.Arch. (Carnegie Inst. of. Tech.) 1947
Associate Professor of Architecture

READ, CLARK PHARES

B.A. (Rice) 1948, M.A. (Rice) 1948, Ph.D. (Rice) 1950
Professor of Biology

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B.A. (Rice) 1926, M.A. (Rice) 1927, Ph.D. (Rice) 1929
Professor of Chemistry and Dean of the Institute

RISSER, J. R.

A.B. (Franklin and Marshall) 1931, M.A. (Princeton) 1935, Ph.D. (Princeton) 1938
Professor of Physics and Non-Resident Associate of Wiess College

ROBERTS, JOHN MELVILLE

B.A.Sc. (Toronto) 1953, M.A.Sc. (Toronto) 1954
Assistant Professor of Mechanical Engineering

ROGERS, JOHN J. W.

B.S. (California Inst. of Tech.) 1952, M.S. (Minnesota) 1952, Ph.D. (California Inst. of Tech.) 1955
Assistant Professor of Geology and Non-Resident Associate of Hanszen College

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S.B. (M.I.T.) 1949, S.M. (M.I.T.) 1950, Ph.D. (M.I.T.) 1952
Associate Professor of Physics and Non-Resident Associate of Jones College

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B.S. in C.E. (Texas) 1949
Assistant Professor of Civil Engineering

SALSBURG, ZEVI WALTER

B.S. (Rochester) 1950, Ph.D. (Yale) 1953
Associate Professor of Chemistry

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B.A. (Augustana) 1954, Ph.D. (Southern California) 1957
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Studienrat (Heidelberg) 1956
Visiting Lecturer in German

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B.A. (Rice) 1926, M.A. (Rice) 1928, M.A. (Univ. Nac de Mexico) 1942
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B.F.A. (Oklahoma A & M) 1941, A.B. (Oklahoma A & M) 1947, A.M. (Oklahoma A & M) 1948
Assistant Professor of French and Spanish

SIMONS, VERNE FRANKLIN

A.B. (Kansas) 1923, A.M. (Kansas) 1925, C.P.A. 1931
Associate Professor of Accounting

SIMS, JAMES REDDING

B.S. in C.E. (Rice) 1941, M.S. (Illinois) 1950, Ph.D. (Illinois) 1956
Professor of Civil Engineering and Adviser to Men

SQUIRE, CHARLES FRANCIS

Ph.D. (Johns Hopkins) 1937
Professor of Physics

STEELE, HENRY B.

B.A. (Rice) 1953, Ph.D. (M.I.T.) 1957
Assistant Professor of Economics

TALMAGE, ROY V.

A.B. (Maryville College) 1938, M.A. (Richmond) 1940, Ph.D. (Harvard) 1947
Professor of Biology and Master of Wiess College

TAMMINGA, WILLIAM

B.S. (Illinois) 1948, M.Arch. (M.I.T.) 1950
Lecturer in Architecture

THIBODEAUX, MURPHY H.

B.S. in C.E. (Rice) 1949, M.S. in C.E. (Rice) 1951, Ph.D. (Illinois) 1958
Associate Professor of Civil Engineering and Non-Resident Associate of Wiess College

THOMAS, JOSEPH DAVID

Ph.B. (Chicago) 1929, A.M. (Chicago) 1930
Associate Professor of English

TOBOCMAN, WILLIAM

S.B. (M.I.T.) 1950, Ph.D. (M.I.T.) 1953
Assistant Professor of Physics

TODD, ANDERSON

B.A. (Princeton) 1943, M.F.A. (Princeton) 1949
Associate Professor of Architecture

TURNER, RICHARD BALDWIN

A.B. (Harvard) 1938, A.M. (Harvard) 1940, Ph.D. (Harvard) 1942
Professor of Chemistry

ULRICH, FLOYD EDWARD

B.S. in E.E. (Union College) 1926, M.S. in E.E. (Union College) 1928, A.M. (Harvard) 1929, Ph.D. (Harvard) 1938
Professor of Mathematics and Resident Associate of Baker College

VANDIVER, FRANK EVERSON

M.A. (Texas) 1949, Ph.D. (Tulane) 1951
Professor of History and Non-Resident Associate of Hanszen College

VOLTERRA, ENRICO G.

D.C.E. (Rome) 1928, Ph.D. (Cambridge) 1941
Lecturer in Mechanical Engineering

WALKER, DONALD E.

Ph.D. (Chicago) 1955
Assistant Professor of Psychology

WANN, TRENTON WILLIAM

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Associate Professor of Psychology and Non-Resident Associate of Will Rice College

WATERS, JAMES STEPHEN

B.S. (Rice) 1917
Professor of Electrical Engineering and Non-Resident Associate of Baker College

WELSH, HUGH CLAYTON

M.D. (Texas) 1923
Lecturer in Biology and Medical Adviser

WESTON, ARTHUR

B.A. (Maine) 1946, M.A. (Columbia) 1950, Ed.D. (Columbia) 1952
Professor of Physical Education and Non-Resident Associate of Wiess College

WILHOIT, JAMES CAMMACK, JR.

B.S. in M.E. (Rice) 1949, M.S. (Texas A & M) 1951, Ph.D. (Stanford) 1954
Associate Professor of Mechanical Engineering

WILLIAMS, GEORGE GUION

B.A. (Rice) 1923, M.A. (Rice) 1925
Professor of English

WILSON, JOSEPH BENJAMIN

B.A. (Rice) 1950, M.A. (Rice) 1953
Assistant Professor of German

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B.S. in E.E. (Rose Polytechnic) 1937, M.Eng. in E.E. (Yale) 1939, E.E. (Rose Polytechnic) 1942
Professor of Electrical Engineering and Master of Baker College

WRIGHT, LESLIE CHARLES

B.S. (Wales) 1936, Ph.D. (Edinburgh) 1950
Visiting Professor of Economics (Fall, 1959)

YOUNG, HOMER HARRY

B.A. (Austin College) 1930, M.A. (Southern Methodist) 1937, Ph.D. (Texas) 1949
Assistant Professor of Education

FACULTY IN MILITARY AND NAVAL SCIENCE

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B.S. (U.S. Naval Academy) 1945, M.S. (U.S. Naval Post Graduate School) 1952
Lieutenant Commander, U.S.N.
Assistant Professor of Naval Science

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Captain, U.S.N.
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Lieutenant Colonel, C.E.
Professor of Military Science and Tactics

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B.S. (Texas A & M) 1948, M.S. in C.E. (Missouri School of Mines and Metallurgy) 1957
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Major, U.S.M.C.
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BASS, REINER

Dr.Rer.nat. (Technische Hochschule Stuttgart) 1958, Ph.D. (University of London) 1958
Research Associate in Physics

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Research Associate in Physics

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B.A. (Rice) 1935, Ph.D. (Rice) 1951
Fellow in Biology

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Research Associate in Biology

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B.A. (Cambridge) 1952, M.A. (Cambridge) 1957
Senior Research Associate

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Research Associate in Physics

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M.S. (Osaka) 1952, D.Sc. (Osaka) 1958
Welch Postdoctoral Fellow in Physics

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Diplomas of Physics (Hamburg) 1953, Ph.D. (Hamburg) 1958
Research Associate in Physics

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Research Associate in Biology

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ASSISTANTS, GRADUATE ASSISTANTS, AND FELLOWS

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National Science Foundation Fellow in Biology

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B.S. (Texas A & I) 1949, M.S. (Houston) 1951, M.S. (California Tech.) 1952
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BILHORN, DAVID E.

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Graduate Assistant and Fellow in Physics

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B.A. (Rice) 1951, B.S. in M.E. (Rice) 1952, M.S. in M.E. (Rice) 1954
Shell Oil Company Fellow in Mechanical Engineering

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Graduate Assistant and Fellow in Architecture

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CAMPBELL, DAVID TEMPLE

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CARDNER, DAVID VICTOR

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CORRINGTON, JOHN WILLIAM

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CRAM, IRA H., JR.

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CRAMER, JOHN GLEASON, JR.

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National Science Foundation Fellow in Physics

CRIDER, JOHN RICHARD

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CYPRUS, JOEL HOWARD

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National Science Foundation Fellow in Electrical Engineering

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DARBY, RONALD

B.A. (Rice) 1955, B.S. in Ch.E. (Rice) 1955
National Science Foundation Fellow in Chemical Engineering

DATEO, GEORGE P.

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Graduate Fellow in Chemistry

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B.S. (Oklahoma State) 1958, M.A. (Oklahoma State) 1959
Graduate Assistant and Fellow in History

DAVIS, EDWARD ALEX

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Atomic Energy Commission Fellow in Nuclear Science and Engineering

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Mr. and Mrs. Benjamin N. Woodson
Mr. and Mrs. Andrew Jackson Wray

REQUIREMENTS FOR ADMISSION

In selecting the Freshman class from among the very large number of well-qualified high school graduates who apply, the Rice Institute undertakes to identify those of exceptional ability and potential who appear to be best prepared to grow to intellectual maturity through the formal curricula offerings and the intellectual and social atmosphere of the campus.

The materials on which a prediction of future performance and development may be based are (1) past scholastic performance as evidenced by high school grades, (2) scores made on the College Entrance Examination Board examinations, (3) evaluation from personal interviews and (4) statements obtained from high school advisers and teachers.

Scholastic performance is a reasonable indication of the applicant's study habits, scholastic enthusiasm and, to some extent, desire to learn. College Entrance Examination Board scores furnish a credible basis of comparison of one individual with a very large number of other persons of similar background and circumstance when set to a specific scholastic assignment. Interviews, references, and rating sheets give some insight into such currently unmeasurable factors as motivation, family background, emotional stability, etc., which must also be considered.

Experience at the Rice Institute seems to indicate that those most likely to succeed are the applicants who have, in addition to the obvious desirable personal traits, scholastic standing in the upper ten percent of their graduating classes and highest College Entrance Examination Board scores, *well above* the national norm of 500.

A word of caution or qualification should be noted however. Not all students with the very best scholastic standing and highest College Entrance Examination Board score become outstanding Rice students, nor do all those accepted who fall in lower brackets in these two factors have difficulty in college. Nearly all well-adjusted, well-motivated students of high intellectual capacity and intellectual curiosity have good chances of success.

For further information, publications, or application forms, candidates for admission as undergraduates should communicate with the Director of Admissions. On requesting application forms, the candidate should clearly indicate whether he is a prospective high-school graduate or a prospective transfer from another college.

ADMISSION OF FRESHMEN

THE QUALIFICATIONS of candidates for admission will be evaluated in four ways:

1. **The High School Record.** This will be carefully studied to appraise the candidate's past performance. Graduation from an approved public or private high school with not less than sixteen acceptable units is required. These units should include

English, 4
Social studies, at least 2
Algebra, 2
Plane geometry, 1
Trigonometry, ½
Foreign language, 2
Science, 2 (biology, chemistry, or physics)
Electives, 2½

Special attention is called to the fact that any student planning to major at the Rice Institute in the Science-Engineering program must complete a high school course in both Chemistry and Physics.

Variations from the above distribution of units are approved only in exceptional cases at the discretion of the Committee on Admissions.

2. **Entrance Examinations.** Marked preference will be given to those candidates who earn satisfactory scores on examinations given by the College Entrance Examination Board. All candidates should take the Scholastic Aptitude Tests (Verbal and Mathematical Sections), and candidates wishing to enter the science-engineering program should take, in addition, the achievement tests in (1) English composition, (2) intermediate mathematics, (3) chemistry or physics. The Scholastic Aptitude Tests may be taken in January, February, or in March, but the Achievement Tests must be taken in March.

The aforesaid tests are prepared and administered by the Col-

lege Entrance Examination Board, Box 592, Princeton, New Jersey. They are given in Houston, six times each year, and at other convenient centers throughout the United States.

General information regarding the nature of the tests and detailed information regarding locations of examination centers, the exact date, and the proper time for filing application for the tests is available in a bulletin of information which may be secured without cost from the College Entrance Examination Board.

When payment of the necessary fee and/or the cost of travel to the examination will work a *severe* financial hardship, an applicant in necessitous circumstances should not hesitate to complete the regular application forms for admission without planning to take the examinations. Such an applicant should communicate by *detailed confidential* letter before March 1 with the Committee on Admissions, and he will be granted consideration equal to that accorded the other prospective students who are taking the examinations. This is in accordance with the continuing policy of the Rice Institute of making its educational facilities available to highly qualified applicants regardless of financial circumstances.

3. **Personal Interviews.** All applicants who can conveniently present themselves at the Institute will be interviewed between December 15 and March 1 of each year. Applicants living at such a distance that they cannot conveniently come to Houston will be given opportunities for interviews during the month of March in certain cities of the Southwest, at a date and a place to be announced individually to each applicant who submits his application papers before March 1. It is contemplated that if sufficient need exists students will be interviewed in Beaumont, Dallas, Fort Worth, and San Antonio. Those who, because of distance, are unable to meet interview engagements either in Houston or at one of these cities will be interviewed individually by alumni; or, if that should be impossible, their applications will be given full consideration without the interview. In no case need such an applicant assume any responsibility for the interview until notified of the time and place.

4. **Ratings** from high school advisers or teachers.

The first notices regarding action on applications for admission are sent to applicants about the first week in May.

ADMISSION WITH ADVANCED STANDING

THE NUMBER of candidates who may be accepted as transfers from other colleges and universities is limited by the capacity of the Institute to absorb them. Severe competition for these places calls for high standing in scholarship. The unit of credit at Rice is the full-year course. Advanced credit will be given only for courses that are approximately the same in content as courses given at the Institute. Each case will be dealt with individually. Only those applicants who can qualify for full sophomore or junior standing will be considered.

Candidates for transfer should communicate with the Director of Admissions between the November 1–March 1 time limits, if possible. When requesting the proper forms the applicant should indicate clearly the number of years of work he will have completed in his present college by the following June. The transfer applicant must submit scores from appropriate college entrance examination board tests.

Decisions regarding transfer applications will be reached in the latter part of April, and notice mailed to candidates by approximately May 15.

ADVANCED PLACEMENT

ENTERING freshman students who have done work beyond the usual high school courses in certain subjects and who make superior scores on the College Board Advanced Placement Examination may be given recognition for their achievements. Degree credit and advanced standing in the subject-matter fields may be given in the following: mathematics, American history, French, German, Spanish, English, physics, chemistry, and biology.

SPECIAL INFORMATION

A STUDENT who has been admitted to the Institute will be required within two weeks after the date on the notice of acceptance to submit a written statement of his intention to enroll,

accompanied by a payment of $25.00, which will be credited to his account as part payment of the fees required at the opening of the session. The payment will be returned if the student changes his plans and serves notice before June 15. After June 15, it will be refunded only in cases of hardship, such as illness. Should a student fail to register, without giving notice of change of intentions prior to June 15, the $25.00 payment will be forfeited.

ADMISSION TO GRADUATE STANDING

A CANDIDATE for admission to graduate standing to work toward an advanced degree should communicate first with the chairman of the department in which he wishes to study. For more detailed information see the *Graduate Announcements*.

GENERAL INFORMATION

EXPENSES

THE OPPORTUNITIES for study and research offered by the Rice Institute are open without tuition to men and women who meet the requirements set forth in the preceding section and who are accepted for admission. Students are expected to meet all expenses incurred for textbooks and supplies, room and board, clothing and incidentals.

FEES

EACH STUDENT pays a comprehensive fee of $110 per year which covers a registration fee, a library fee, an examination fee, a fee for student activities, admission to athletic contests, use of the health service, use of the gymnasium, use of the memorial center, and participation in college activities. In addition each student pays $10 for each semester of the laboratory courses he is taking.

SPECIAL CHARGES

Freshman Week	$15.00
Late registration	15.00
Late examination (each course)	10.00
Diploma	6.00
Army R.O.T.C. (Deposit)	10.00

EVERY STUDENT is required to provide a $300 guaranty signed by himself and a parent, guardian or other responsible person.

If a student withdraws during the two weeks following the opening day of classes all fees will be refunded. When withdrawal occurs within the third or fourth week one-third of the fees will be refunded. No refund of fees is made after the end of the fourth week of classes.

No student in arrears in any financial obligation to the Rice Institute as of September 1 of any year will be registered. All accounts must be paid or satisfactory arrangements for payment made before a student will be issued any certificate of attendance, diploma or transcript of credit.

PUBLICATIONS OF THE RICE INSTITUTE

Among the publications of the Rice Institute are a General Catalogue, a Graduate Catalogue, and a book of Freshman Announcements. *The Rice Institute Pamphlet* has been a quarterly publication containing articles and monographs by members of the Institute faculty as well as lectures and monographs by visiting scholars, but has recently been made an occasional publication reserved for monographs.

LIBRARY AND LABORATORIES

The Fondren Library houses all of the Institute's library materials, except those working tools which must be maintained adjacent to laboratories. The Fondren Library is a fully modern building with excellent collections of books, reference materials, and periodicals for both undergraduate and graduate work. It has also a number of special collections of manuscripts and documents for individual graduate and faculty research; the library also contains extensive holdings of microfilms and microcards of fifteenth and sixteenth century books and more modern reference works and newspapers.

The Rice Institute buildings house numerous well-equipped laboratories for both undergraduate instruction and graduate research. The most modern laboratory facilities and instruments are available for demonstration and experiment in the fields of architecture, biology, chemistry, geology, physics, and chemical, civil, electrical, and mechanical engineering.

THE RESIDENTIAL COLLEGES

On entering Rice every undergraduate student becomes and thereafter remains a member of one of five colleges: Baker, Hanszen, Wiess, and Will Rice for men, and Mary Gibbs Jones College for women. Each college is a self-governing community of students, whose elected officers and representatives have powers commensurate with their responsibilities for maintaining not only an orderly routine of daily life, but also broad social, cultural, and athletic programs. While uniformity has not been sought and practices differ from college to college, all are alike in seek-

ing to foster in their members the intellectual awareness and the sense of individual honor and group responsibility that distinguish educated persons. Each college also has members of faculty rank: a Master, who with his family occupies a residence adjacent to the college, and a number of resident and non-resident Associates.

Students are assigned to membership in a particular college by the Masters' Office, as authorized by the five Masters. Two men who are entering Rice for the first time may ask to be assigned to the same college, but may not designate which college. A new student may request membership in the same college as a brother who is currently enrolled. No other choice of college can be allowed.

The buildings of each college include a dining hall and common rooms, available to resident and non-resident alike, as well as quarters for an average of about 215 students of all classes. Rooms are completely furnished except for linens.

Residence fees to cover costs of dining halls and operation of residences are established from year to year as requirements dictate. For 1959-60, the yearly fee for residence in the men's colleges was $795, in the women's college $845. This charge provides for room and three meals per day excluding the evening meals on Saturdays and Sundays. Meals are not served during the Thanksgiving, Christmas, mid-term, and Easter recesses. A room deposit of $50 is required of each student by June 1 in order to secure his assignment for the academic year to follow. New students are required to make a similar deposit upon notification of room assignment during the summer. These deposits are returnable only upon individual application for good and sufficient cause. One-half of the residence fee should be paid upon taking up residence in September. The remaining sum should be paid before the commencement of classes in February. Students whose financial situation makes difficult the usual method of payment, outlined above, may make arrangements with the cashier to make a substantial payment in September followed by monthly payments throughout the year.

A prospective student should indicate on his application for admission whether or not, if admitted as a student, he desires to

reside on the campus. Detailed information about residence in the colleges and room application forms will accompany the notice of admittance sent to each new undergraduate. To reserve rooms it is essential that applications be submitted as directed. New undergraduate women students who do not live with their families in metropolitan Houston are required to live in Jones College. All other undergraduate women, except those who live with their families in metropolitan Houston, must secure permission from the Adviser to Women if they wish to live off campus. Undergraduate women students are not permitted to live either alone or with other undergraduate women students in apartments, unless chaperoned by a responsible adult.

All items included, the young man or woman who is a resident member of one of the colleges will need to have available about $1300 for a year's work. For a student living at home the cost will run from $200 to $250. These figures are based on 1959-60 experience.

Correspondence from new students regarding housing in the residential colleges for men should be addressed to the Office of the Masters. Similarly, correspondence from new women students regarding residence in Jones College should be addressed to the Adviser to Women, Lovett Hall.

STUDENT HEALTH SERVICE

A HEALTH SERVICE located in Hanszen College is maintained for students. This service includes dispensary and infirmary care. The school physician makes scheduled sick calls and can be called in case of emergency. A registered nurse is on duty during school hours; qualified attendants are available at all hours. Information about the facilities and care, and about insurance, can be secured at the Office of the Student Health Service (reached by the east entrance of West Hall, Hanszen College). A Hospitalization and Accident Insurance policy with a nationally known company is available for students who desire this coverage.

MEMORIAL CENTER FACILITIES

THROUGH THE GENEROSITY of friends and alumni of the Institute, the Rice Memorial Center was built. Ground was broken for this

building on November 9, 1957, and it was dedicated on Homecoming weekend in the fall of 1958. The center and chapel comprise a memorial to those Rice Institute alumni who have died in the service of their country, and provision was made in the plans for commemorative inscriptions.

The center provides a chapel with associated offices, the latter are used by the various student religious groups. The chapel is utilized for regular interdenominational religious services, directed jointly by a faculty committee and the Student Religious Council. Denominational services are not held in the chapel, although it may be made available from time to time upon special request.

The center provides offices for the Association of Rice Alumni, the Student Association, the Honor Council, and various student publications. It also contains the Campus Store and Sammy's, the snack bar, as well as lounge and ballroom facilities.

ORGANIZATIONS AND STUDENT PUBLICATIONS

ALL STUDENTS, upon matriculation, become members of the Student Association, which organizes and directs the various activities named below and through its officers, who form the Student Senate, represents the students.

Each of the five classes, Freshman, Sophomore, Junior, Senior, and Class II Graduate,[1] has an organization for its government and for the solution of special problems.

The various activities, covering cultural, professional, and avocational needs, comprise publications: *The Campanile* (annual), *The Rice Engineer* (quarterly), and *The Thresher* (weekly); the Elizabeth Baldwin, Owen Wister, Pallas Athene, Sarah Lane, Chaille Rice, Cleveland Lovett, and Olga Keith, Literary Societies; musical groups: the Band and several choral groups; foreign-language clubs; the Architectural Society, the Engineering Society, the Student Affiliates of the American Chemical Society, and the student branches of the American Institute of Chemical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers and the Institute of Radio

[1] Composed of students of architecture and engineering working toward a professional degree, following award of the B.A. degree.

Engineers, and the American Society of Mechanical Engineers; and other specialized organizations including the Rally Club, the Premedical Society, the Forum Committee, A.P.O., the Rice Sextant, the Radio Club, the Film Society, and an informally organized dramatic club under the sponsorship of the Department of English. There are also several religious clubs, organized under a Student Religious Council.

Through the generosity of the late Mrs. James L. Autry, as a memorial to her husband, the late James L. Autry, of Houston, the Diocese of Texas of the Protestant Episcopal Church is maintaining Autry House in the immediate vicinity of the Rice Institute, as a social and religious center. The cornerstone of Autry House was laid during the commencement ceremonies of the Class of 1921. To this community group of the Episcopal Church, the late Mrs. E. L. Neville, of Houston, in memory of her brother, Edward Albert Palmer, contributed the beautiful Edward Albert Palmer Memorial Chapel, which was dedicated November 27, 1927. All the opportunities of these establishments are available to the students of the Rice Institute irrespective of religious affiliation. Other religious bodies are considering provision for similar undertakings in the neighborhood of the Rice Institute.

SERVICE AWARD

In memory of Hugh Scott Cameron, first Dean of Students at the Rice Institute, the Student Association annually presents the Rice Institute Service Award, in the form of a bronze medallion, to those currently enrolled or former students who have been most exemplary in rendering distinguished service to the school and to the student body. This coveted honor is sparingly bestowed after careful consideration of possible recipients by a committee of faculty and students appointed by the Association.

HONOR SYSTEM

Examinations are conducted under a student honor system, which is administered by an Honor Council whose members are elected annually from and by the student body. This council is responsible to the faculty, through the Adviser to Men, for the

validity of all examinations and for the investigation and prosecution of cases of violation of the system.

HONOR SOCIETIES

PHI LAMBDA UPSILON

Phi Lambda Upsilon, an honorary chemical society, has as its purpose "the promotion of high scholarship and original investigation in all branches of pure and applied chemistry." The Alpha Alpha chapter was installed at the Rice Institute in 1927.

THE PHI BETA KAPPA SOCIETY

The Senate of the United Chapters of Phi Beta Kappa at its meeting in December, 1927, voted to recommend the establishment of a chapter at the Rice Institute, and at a meeting of the National Council held in September, 1928, the institution of the Rice, or Beta of Texas, chapter was duly authorized. The chapter was formally installed on March 1, 1929, by the secretary of the United Chapters.

THE PI DELTA PHI SOCIETY

The Pi Delta Phi Society, organized to interest students of French in competing for high standing in scholarship, authorized in May, 1930, the formation of a chapter of the Society at the Rice Institute. The Theta chapter was formally installed in that year by a delegate of the national organization.

THE SOCIETY OF THE SIGMA XI

The Society of the Sigma Xi, for the promotion of research in science, on the occasion of its thirty-eighth annual convention in December, 1937, acting upon the recommendation of the Executive Committee, duly authorized the establishment of a chapter of the Society at the Rice Institute. The formal installation of the Rice chapter by the president of the national organization took place on March 23, 1938.

THE TAU BETA PI ASSOCIATION

The Tau Beta Pi Association, organized to interest engineering students in competing for high standing in scholarship, authorized at its annual convention in October, 1940, the establishment

of a chapter of the Association at the Rice Institute. The Rice chapter, the Gamma of Texas, was formally installed on December 18, 1940, by the national secretary of the Association.

DELTA PHI ALPHA

Delta Phi Alpha, German national honorary society, was founded to promote among university students an interest in the German language and literature. The National Council in April, 1949, authorized the organization of the Gamma Xi chapter at the Rice Institute.

THE SIGMA DELTA PI FRATERNITY

The Sigma Delta Pi, Spanish national honorary society, was founded to promote among university students an interest in the Spanish language and literature. The chapter at the Rice Institute was installed on May 14, 1953.

THE SIGMA TAU FRATERNITY

The Alpha Zeta chapter of Sigma Tau, an engineering society devoted to scholarship, practicality, and sociability, was installed at the Rice Institute on May 20, 1953.

CHAIRS AND LECTURES

THE M. D. ANDERSON VISITING PROFESSORSHIP

The M. D. Anderson Foundation for several years made possible the yearly appointment of a visiting professor in the humanities. In addition to academic instruction, the M. D. Anderson Visiting Professor each year delivered a series of public lectures. Such lectures have been given by Dr. Merle K. Bennett of Stanford University, Dr. Theodore Greene of Yale University, Dr. Willard Thorp of Princeton University, Sir John Sheppard of Cambridge University, and Dr. Arnold Toynbee of the University of London.

THE BARTLETT AESTHETICS PROGRAM

In the fall of 1959, the chamber music concerts which had been for several years supported by Dr. and Mrs. H. L. Bartlett were expanded into a week-long Aesthetics Program which, it is hoped, will be an annual feature of the Institute calendar. The first Bartlett Lectures were delivered by Dr. Theodore Greene.

THE REGINALD HENRY HARGROVE CHAIR OF ECONOMICS

The Hargrove chair was established in memory of Mr. Hargrove by Mrs. R. H. Hargrove and the Texas Eastern Transmission Corporation in 1958. The Hargrove Professor took up residence in 1959.

THE HARRIS MASTERSON, JR. CHAIR IN HISTORY

The late Reverend Harris Masterson, Jr. was deeply interested in the Rice Institute through his activities as Director of Autry House and his close personal association with Rice students through many years. His will provided a bequest to the Institute with which the Board of Governors established a memorial to him in this chair.

THE J. NEWTON RAYZOR CHAIR IN PHILOSOPHY AND RELIGIOUS THOUGHT

This chair was established in 1953 by Mr. J. Newton Rayzor, a trustee of the Rice Institute. Its purpose is to provide in the

Rice curriculum for distinguished instruction in religious and philosophical ideas which have powerfully influenced the history of civilization.

THE ROCKWELL LECTURES

These lectures are made possible by the Rockwell Fund, Inc. They were inaugurated by Sir Robert Alexander Falconer in April, 1938. Among the distinguished lecturers in the series have been Dean Roscoe Pound, Professor William Ernest Hocking, Dr. Ralph W. Sockman, Dr. George A. Buttrick, Professor Charles W. Hendel, Professor Kenneth S. Latourette, Mr. Charles P. Taft, Dr. Henry P. Van Dusen, Dr. Conyers Read, Professor Theodore Greene, and Dr. Joseph Sittler.

THE SHEPHERD SCHOOL OF MUSIC

Mrs. Sally Shepherd Perkins, of Asheville, North Carolina, provided in 1950 for the establishment of a school of music at the Institute. It is contemplated that when the income from this endowment is of sufficient size, appropriate buildings and other facilities will be provided for outstanding instruction in musical theory and appreciation. At present, income from the gift maintains a lectureship and a number of courses and activities in music.

THE HARRY CAROTHERS WIESS CHAIR OF GEOLOGY

In 1952, Mrs. Olga Keith Wiess gave a substantial endowment to the Institute for the establishment of a chair of geology to be named in memory of her husband, late Vice-Chairman of the Board of Governors of the Institute, in recognition of his profession and of his distinguished service to the university. Work in this department was inaugurated at both graduate and undergraduate levels in 1954.

THE RICE INSTITUTE LECTURES

From time to time the Rice Institute invites scholars of distinction to lecture for varying periods. In most cases these lectures are open to the public as well as to the faculty and students. Recent lectures have been delivered by Sir John Sheppard,

Dr. William B. Hesseltine, Dr. Felix Block, Dr. Edwin G. Nourse, Dr. Arne Tiselius, and Professor David Ogg.

"RESEARCH AT RICE" TELEVISION SERIES

For several years the Rice Institute has presented a series of programs in cooperation with KTRK-TV, Houston, representing to the region some aspects of research in the various areas of study in science, engineering, and the humanities at the university.

STIPENDS AND FUNDS

FELLOWSHIPS

PROVISION is made for a variety of fellowships available to graduates of this and other institutions. There are several memorial fellowships that have been founded and endowed by gift or bequest on the part of friends of the Rice Institute. These provide a stipend designed to enable the holder to devote his time to study and research in his chosen field. There are also several industrial fellowships maintained by companies interested in the development of technical fields and the training of competent scientists and engineers.

Persons desiring to be considered for appointment as fellows should consult with the department in which they desire to work and should make application to the Office of the Registrar as early as possible.

AMERICAN OIL COMPANY FELLOWSHIP in Chemical Engineering

ATLANTIC REFINING COMPANY FELLOWSHIP in Chemical Engineering

ORA N. ARNOLD FELLOWSHIP FUND

Graduates of the Rice Institute, or of Mexico may be appointed. An incumbent from Rice may study in Mexico, the South American States, the West Indies, or the Philippine Islands; an incumbent from the University of Mexico is expected to study at the Rice Institute.

SAMUEL FAIN CARTER FELLOWSHIP

Established in 1932 for Graduate study in Economics.

CELANESE CORPORATION FELLOWSHIP in Chemical Engineering

CONTINENTAL OIL COMPANY FELLOWSHIP in Chemical Engineering

M. N. DAVIDSON FELLOWSHIP in Architecture

DOW CHEMICAL COMPANY FELLOWSHIPS

One Fellowship is restricted to the field of Chemistry, Chemical Engineering, or Physics; a second Fellowship is restricted to the field of Mechanical Engineering.

FLUOR CORPORATION FELLOWSHIP

The field of study is unrestricted.

HUMBLE OIL AND REFINING COMPANY FELLOWSHIPS

Four Fellowships are available, one in each of the following departments: Chemistry, Geology, Physics, and X-Ray Diffraction.

IDEAL CEMENT COMPANY FELLOWSHIP in Civil Engineering

MAGNOLIA PETROLEUM COMPANY FELLOWSHIP in Physics

SCHLUMBERGER FOUNDATION FELLOWSHIP in Mathematics

SHELL OIL COMPANY FELLOWSHIPS

One Fellowship is available for study in Physics and another for study in Mechanical Engineering.

STANOLIND OIL AND GAS COMPANY FELLOWSHIP in Chemical Engineering

TEXAS COMPANY FELLOWSHIP in Electrical Engineering

TEXAS EASTERN TRANSMISSION COMPANY FELLOWSHIP in Chemical Engineering

TEXAS GULF PRODUCING FELLOWSHIP in Geology

WILLIAM WARD WATKIN MEMORIAL TRAVELING FELLOWSHIP in Architecture

Provision for a Rice Institute Traveling Fellowship in Architecture has been made by the Alumni of the Department of Architecture and the Architectural Society of the Rice Institute.

NON-INSTITUTIONAL FELLOWSHIPS

In addition to the above fellowships, students may pursue advanced research through Atomic Energy Commission Fellowships.

The Committee on Graduate Instruction processes applications for fellowships submitted by graduate students of the Rice Institute for research in other institutions and in other countries. Among available fellowships of this nature are the Rotary International Fellowship, the Rhodes Scholarships, the Charles A. Coffin and Gerard Swope Fellowships awarded by the General Electric Educational Fund, the Frank B. Jewett Fellowships awarded by the Bell Telephone Laboratories, and the National Science Foundation. Applicants for predoctoral fellowships under the Fulbright Act administered by the Institute of International

Education, and for postdoctoral research and teaching exchanges under the same act administered by the Committee on International Exchange of Persons, should also file with the Committee on Graduate Instruction.

Rice is one of the sponsoring universities of the Oak Ridge Institute of Nuclear Studies. The Oak Ridge Institute provides a number of fellowships to doctoral candidates who have completed their residence requirements and who want to work on a thesis problem at Oak Ridge because of the special facilities which are available.

GRADUATE ASSISTANTSHIPS-FELLOWSHIPS

Graduate students with high academic records and outstanding qualifications may receive assistance through awards of graduate assistantships-fellowships in the various departments of the Rice Institute. Inasmuch as these awards are of equal value, the minimum stipend for such dual appointments is $1650 with exemption from fees. A student holding a graduate assistantship must be a candidate for an advanced degree; he will be expected to devote a substantial part of his program to study and research, and at the same time to teach one section in an elementary course or to do an equivalent amount of other departmental work. He will thus get a certain amount of valuable practical training in preparation for an academic career. Appointments carrying larger stipends, with a schedule equivalent to a teaching load of two sections, are occasionally available; such appointments depend on the interests and attainments of the student and on the requirements of the department.

GRADUATE SCHOLARSHIPS

Students whose previous records show marked promise but for whom no graduate assistantships are available may, especially in their first year of graduate study at the Rice Institute, be awarded graduate scholarships with exemption from all fees but without stipend. Graduate scholars may carry a full schedule of graduate work, and are not required to render any service to the Institute.

PRIZES AND AWARDS

The **Ralph Budd Award** is a medal given for the best thesis in engineering submitted each year.

The **Max Freund Prize** was established in 1954 by former students of Professor Emeritus Max Freund for a student of high academic standing who is pursuing a course of study in the German language or literature.

The **John W. Gardner Award** is a medal given each year to a student presenting outstanding achievement in research in the humanities or social sciences.

The **Lady Geddes Prize in Writing** is awarded annually on the basis of a competition which is open to all Freshman and Sophomore students of the Rice Institute.

The **Hamilton Watch Award** is provided by the Hamilton Watch Company for the fifth-year engineering student who has most successfully combined proficiency in his major field with notable work in the humanities.

The **Robert Pilcher Quinn Award** is presented annually to a student who has demonstrated outstanding qualities in athletics, leadership, scholarship and sportsmanship.

The **H. A. Wilson Memorial Award** provides for a substantial prize for the best research in physics done by a graduate student each year.

The **Eloise Szabo Witte Studentship** in History is awarded to the member of the Freshman class who has demonstrated the greatest promise in that subject and has indicated a desire for further study of history, preferably Biblical or ancient history.

UNDERGRADUATE SCHOLARSHIPS AND GRANTS

To ENCOURAGE STUDENTS in devotion to learning and in striving to develop creative capacity in productive scholarship many friends of the Rice Institute have established undergraduate scholarships, awards and prizes. These are reserved principally for students who have been in residence at least one year although a few are designated for entering freshmen with exceptional records. Honorary scholarships without stipend are also granted to students who have demonstrated outstanding ability and promise of future development.

The **Alcoa Foundation Scholarships** are awarded to four students of engineering who are in either the Junior, Senior, or fifth year of study.

The **Alpha Chi Sigma Prize** honors the outstanding Junior student in chemistry or chemical engineering.

The **American Institute of Chemical Engineers, South Texas Section,** annually provides a scholarship for a student of chemical engineering who is a resident of the area served by the Section.

The **American Society for Metals, Texas Chapter,** has established a scholarship fund for an advanced student in engineering whose primary interest is in metallurgy.

The **Samuel S. Ashe Scholarship** is awarded annually to the student having highest standing at the end of the Freshman year.

The **Max Autrey Memorial Scholarships** were established under the will of the late Mrs. Nettie S. Autrey in memory of her son. First awarded in 1942, they are open annually to all current students.

The **Axson Club's Ellen Axson Wilson Scholarship** was established in 1922 for a young woman student of Junior or Senior standing.

The **Axson Club's Katie B. Howard Scholarship** for young women in memory of Mrs. A. R. Howard has been awarded annually since 1937.

The **B. & H. Instrument Company** has provided two scholarships annually since 1956 to encourage and assist worthy students in electrical and mechanical engineering.

The **Mr. and Mrs. Val T. Billups Scholarship** fund was established by the named donors in 1953 for students of engineering above Freshman standing.

The **Black-Brollier Scholarship** was established in 1956 for students in Architecture above Sophomore standing. Awards are made annually during the first semester.

The **Borden Freshman Prize** is given to the student having the highest grades for all work of the Freshman year.

The **Cabot Engineering Scholarships** are two and three year awards made available to Junior students in Engineering by the Cabot Foundation.

The **Chapman-Bryan Memorial Scholarship** was created in 1937 by the bequest of Miss Johnelle Bryan on behalf of her sister, Mrs. Bryan Chapman and the donor.

The **John B. Coffee Scholarships** are available for one Freshman or Sophomore student and one advanced student in Geology.

The **College Women's Club of Houston** established a fund in 1942 to provide a scholarship to assist a young lady in her first year of graduate study. The scholarship is awarded annually to a graduating Senior.

The **Millie Tutt Cook Scholarship** is for the benefit of a Junior or Senior student preparing for a career in teaching.

The **Thomas A. and Pauline M. Dickson Scholarships** were established in 1932 to assist young men and women students who are largely self-supporting.

John L. and Exna Doré provide a scholarship fund annually to assist deserving students of the Sophomore, Junior and Senior classes.

The Dow Chemical Freshman Awards in Chemistry and Chemical Engineering are given annually to the outstanding Freshman student in each of those fields of study.

The Eastern States Petroleum Company Scholarship in Mechanical Engineering gives financial assistance to an outstanding fourth or fifth-year student.

The **Edwards Scholarships** are given to entering Freshman students who are planning careers in government service.

The **Elizabeth Baldwin Literary Society Scholarship** is available to both men and women students of the Rice Institute on recommendation of the officers of the society.

The **Elks Scholarship** is provided by the B.P.O. Elks Lodge, No. 151, of Houston for a Sophomore student of the Institute.

The **Engineering Alumni Scholarship** is awarded a student who is a candi-

date for a Bachelor of Science degree in one of the four branches of engineering.

The **Farb, Miller & Beerman Company Scholarship in Accounting** is awarded to a student entering the Junior year.

The **Fish Foundation Scholarships** were established in 1958 by Mr. Ray C. Fish to benefit needy, worthy undergraduate students.

The **Thomas R. and Julia H. Franklin Scholarship Fund,** established in 1937, provides income to be devoted to the awarding of annual scholarships to well-qualified necessitous students.

The **Mary Parker Gieseke Scholarship** is awarded annually to a student who has been in residence at least one year.

The **Graham Baker Studentship** was the first undergraduate scholarship established at the Rice Institute. It is awarded annually to the student in the three lower classes earning the highest academic standing for the academic year.

The **Blanche Randall Haden Scholarship** is awarded annually to a deserving undergraduate specializing in economics.

The **Wm. D. and Lucy L. Haden Scholarships** were founded by Mr. Cecil R. Haden for entering students in Architecture.

The **Haskins & Sells Foundation Scholarship in Accounting** is awarded to one of the five Senior students having the highest academic standing in accounting.

The **Hohenthal Scholarships** are awarded to students of high scholastic standing who are earning a substantial part of their expenses.

The **Will Hogg Memorial Fund** was established by the will of the late William Clifford Hogg in 1936. From this fund two scholarships are awarded annually, the **Will Hogg Memorial Distinguished Studentship** and the **Will Hogg Memorial Scholarship.**

The **Houston Engineering and Scientific Society Scholarship** is awarded to a Senior or fifth-year engineering student who is recommended to the Society by a committee of the Rice Institute Faculty.

The **Hughes Tool Company Scholarship** is an award to a student entering the fifth year of the curriculum in mechanical engineering.

International Telephone and Telegraph Corporation Scholarship is awarded to a qualified deserving student of the Junior or Senior class in electrical engineering, mathematics or physics.

The **John McKnitt Alexander** Chapter of the Daughters of the American Revolution provides an endowed undergraduate scholarship for a young woman student of the Rice Institute.

The **Jones College Scholarships** are made available by the Mary Gibbs Jones College Cabinet for a member of the college who has maintained high academic standing and has contributed significantly to the college life.

The **Grant William Jordan and Cora Jordan Memorial Fund** is available in trust to assist young men and women in obtaining an education at the Rice Institute.

The **Lady Washington Texas Centennial Award** is made annually to a young woman student from funds donated by the Lady Washington Chapter of the Daughters of the American Revolution.

The **Charles L. Lake Memorial Scholarships** were established in 1955 by friends of the late Charles L. Lake to provide assistance to worthy students to enable them to attend required geology field trips and camps.

The **Patrons of E. L. Lester and Company Scholarship** is an annual award provided by E. L. Lester and Company for an entering male student in engineering, physical science or related fields of high scholastic standing and financial need in honor of its employees and customers.

The **Achille and Malline Meyer Memorial Scholarship** is awarded annually to a fully or partially self-sustained student of the Rice Institute.

The **Leonard S. Mewhinney Scholarship**, established in 1952 by the Brown Foundation, is awarded to a Naval R.O.T.C. student enrolled in a five-year engineering program at the Rice Institute who has attained high academic standing and demonstrated aptitude for the naval service.

The **Mission Manufacturing Company Scholarships in Mechanical Engineering** are supported by the Mission Manufacturing Company for meritorious students in that field of study who show potential capacity for leadership.

The **Monsanto Chemical Company Scholarship** is awarded to a fourth or fifth-year student of high standing in recognition of accomplishment in Chemical Engineering.

The **Jesse H. Jones Naval Scholarships** honor Fleet Admiral William F. Halsey, Jr. and General Alexander Archer Vandegrift. All members of the N.R.O.T.C. unit, including entering students, are eligible.

The **Ida R. and Hannah E. Nussbaum Scholarship** provides an undergraduate scholarship in memory of the late Miss Ida Nussbaum and her sister.

The **Rebecca and Lilly G. Nussbaum Scholarship** was established under the will of the late Miss Ida R. Nussbaum in memory of her mother and sister.

The **Pallas Athene Literary Society Scholarship** is available to young women students of the Rice Institute on recommendation of the officers of the society.

The Emanuel and Mose Raphael Scholarship was established by bequest of Miss Ida R. Nussbaum in memory of her uncles.

The **Alice Thielen Reader Prize and Internship in Public Accounting** provides annually a stipend and a part-time internship with W. W. Reader and Company for a Senior student who intends to enter professional accounting practice.

The **Richardson Fund for Rice Students** was bequeathed in trust by Mrs. Libbie A. Richardson, widow of Alfred S. Richardson who was a charter member of the Board of Trustees of the Rice Institute.

The **Daniel Ripley Scholarship** was established in 1927 to be awarded to a self-supporting young man or woman completing the Freshman year with outstanding scholarship.

The **Edith Ripley Scholarships** are awarded annually to three young women students from the income of a fund donated by Mrs. Edith Ripley in 1928.

The **James M. and Sarah Wade Rockwell Scholarships** were established by a fund donated in 1958 in memory of the founders of the Rockwell Fund, Inc. The number of awards and the students to receive each scholarship are determined by a committee of the faculty appointed by the President of the Institute.

The **Benjamin E. and Catharine W. Roper Memorial Scholarships** were

established through the will of their daughter, Miss Mary Withers Roper, to assist worthy students of the Rice Institute.

The **Sarah Lane Literary Society Scholarship** is provided for by the membership of the Society to be awarded to an undergraduate student on recommendation of the officers of the Society.

The **Schlumberger Collegiate Award** is given by the Schlumberger Foundation for an advanced student with high standing in Physics, Geology or Electrical or Mechanical Engineering.

The **Sara Stratford Scholarship** for women students of the Rice Institute commemorates the late Mrs. Sara Stratford, first Adviser to Women.

The **Superior Oil Company Scholarships** are provided for through a gift from the Superior Oil Company to assist worthy entering students who are planning to study geology.

The **Texaco Scholarships**, made possible by Texaco, Inc., are awarded to Junior and Senior students of proven scholastic ability who have demonstrated qualities of leadership.

The **Union Carbide Scholarships** at the Rice Institute are a part of a national scholarship program supported by the Union Carbide Corporation.

The **University Women's Alliance of Houston** awards a scholarship, based primarily on need of financial assistance to a young woman in the Junior or Senior class. The recipient of the award is determined after consideration of scholarship, character and personality.

The **Walsh Prize in Architecture** is awarded by the Faculty in Architecture, on the basis of a competition, to an architecture student completing his fourth year of study.

The **Weingarten Scholarship** was endowed by the Weingarten Welfare Corporation in 1957 to assist a worthy scholar of good character.

The **Western Electric Company Scholarship** is maintained by the Western Electric Company for a student in engineering who has demonstrated exceptional promise and ability in his chosen field. Selection of the recipient is made by a committee of the faculty.

The **Westinghouse Achievement Scholarship** is given to the Rice Institute to be awarded to a fifth-year student in Electrical or Mechanical Engineering who has achieved high scholastic standing and demonstrated qualities of leadership.

The **Blanche White Scholarships** are open to students of the Rice Institute who have completed at least one year in residence .

The **Woman's Club of Houston** provides an annual award for an entering student, based upon scholarship and financial need.

LOANS AND SELF-HELP

Besides the stipends of graduate and undergraduate awards, there are, on the campus and in the city, opportunities in considerable variety for worthy and deserving students to earn a part of their living expenses while attending the Institute. Information concerning such openings may be obtained from the Placement Service.

Thanks to the generosity of a number of persons, there are available several student loan funds. Students who wish to make inquiries about loans should see the Bursar, who is Chairman of the Loan Fund Committee. Entering students, or those not currently enrolled, may address inquiries to the Bursar, Room 102 Lovett Hall.

Loans are available to assist students in payment of fees, room and board charges, or other necessary academic expenses. Terms of repayment are arranged individually at the time a loan is made.

CURRICULA AND DEGREES

The Rice Institute offers baccalaureate degrees in arts and sciences, physical education, engineering, and architecture. Students completing the requirements for the Bachelor of Arts degree with outstanding records are given recognition with a designation of *summa cum laude, magna cum laude,* or *cum laude* when the degree is awarded. Curricula leading to the Bachelor of Science degree in Engineering require five years for completion; the Bachelor of Arts degree is awarded on successful completion of four years in these courses of study. The course of study in Architecture is of five years duration, leading to the degree of Bachelor of Science in Architecture. The degree of Bachelor of Science in Physical Education is awarded after four years of successful study in that curriculum.

Graduate study is offered in the arts and sciences, architecture and engineering. In the arts and sciences, programs leading to the Master of Arts and Doctor of Philosophy degrees are offered. In engineering, programs may lead to the Master of Science and Doctor of Philosophy degrees. The graduate program in architecture may lead to the degree of Master in Architecture. Application for admission to graduate work is made through the department concerned to the Committee on Graduate Instruction. Applicants will be required to submit evidence of suitable preparation and of ability to do work of the quality expected.

For further information about graduate study and for detailed description of the requirements for advanced degrees, see the *Graduate Announcements.*

Undergraduate Programs

During the first two years, students are registered in the four basic curricula (academic, science-engineering, architecture, physical education), in which a considerable part of the work is prescribed. During the second two years, wider choice of majors and individual courses is given. Throughout the entire four-year period, however, each student pursues a broad program of the

fundamental sciences and humanities, rather than a narrow course of specialization.

Fifth-year programs are offered in architecture and engineering, leading to the Bachelor of Science degree in the department of specialization (B.S. in Arch., B.S. in Ch.E., B.S. in C.E., B.S. in E.E., B.S. in M.E.). Students enrolled in these fifth-year courses are classified *Class II.*

In the majority of courses, the formal instruction offered consists of three lectures a week throughout the academic year, together with concurrent laboratory in certain subjects.

The schedule of every student must be approved by his department of specialization in each of the last two years. Special arrangements may be made through the appropriate dean's office for modification of any curriculum leading to a bachelor's degree in order that courses in naval or military science may be taken, or that premedical, prelegal, or teacher training requirements may be met.

To assure that students will distribute choices of electives over an adequate range of subjects, courses are divided into three groups and certain minimum requirements specified in each group.

Group A—languages, literature, and music

Group B—business administration, economics, education, history, philosophy, and sociology

Group C—biology, chemistry, engineering, geology, mathematics, and physics

Academic

First Year

(1) Mathematics 100
(2) Laboratory Science
(3) English 100
(4) French or German[1]
(5) History 100 or 110
(6) Physical Training 100
(7) R.O.T.C., if elected (see pp. 153–159)

[1] Students having two or more high school units in a foreign language are not permitted to enroll in a beginning course in that language.

Second Year

(1) Mathematics 200 or 210, or a laboratory science
(2) English or general literature elective
(3) French or German (continuation of language elected in first year)
(4) Elective in Group B
(5) Elective in Group A, B or C
(6) R.O.T.C., if elected (see pp. 153–159)

Third and Fourth Years

Academic majors are offered in biology, economics and business administration, English, German, history, mathematics, philosophy, psychology, and Romance languages. A major in biology or mathematics may be taken in either an academic or science curriculum.

Ten courses are required, including two in Group A, two in Group B, and one in Group C (or an advanced course in psychology). At least seven of the ten courses must be advanced (numbered 300 or higher). Not less than three nor more than five of the third and fourth year courses and not more than six of the total courses offered in fulfillment of the requirements for the degree may fall within a student's major field.

At the discretion of his major department a student in R.O.T.C. may substitute military science or naval science courses for one of the requirements in each of the last two years, except that substitution may not be made in the same elective group both years, for example, a student is not permitted to substitute military science or naval science for both Group A electives.

Science-Engineering

First Year

(1) Mathematics 100
(2) Physics 100
(3) Chemistry 120
(4) History 100 or 110
(5) English 100
(6) Physical Training
(7) R.O.T.C., if elected (see pp. 153–159)

Second Year

(1) Mathematics 200 or 210
(2) Physics 200a (first semester)
Physics 200b or engineering elective (second semester)
(3) German, French, or Russian[1]
(4) English or general literature elective
(5) Elective in Group A, B or C (except Accounting)
(6) Elective in Group A, B or C, or R.O.T.C.

Science: Third and Fourth Years

Biology, Chemistry, Geology, Mathematics, and Physics

Ten courses are required, including at least four in the major field of study, two in Group C outside the major field, one in the language started in the sophomore year, and of the remaining three courses two must be chosen from Groups A or B. Seven of these ten courses must be advanced (numbered 300 or higher). Not more than six of the total courses offered in fulfillment of the requirements for the Bachelor of Arts degree may fall within the major field.

At the discretion of his major department a student in R.O.T.C. may substitute military science or naval science courses for one of the requirements in each of the last two years.

Engineering: Third and Fourth Years

Chemical, Civil, Electrical, and Mechanical Engineering

Eleven courses are required for completion of the Bachelor of Arts degree, eight to be in Group C and two chosen from Groups A or B. The other is an undesignated elective. At least seven courses must be advanced (numbered 300 or higher).

At the discretion of his major department a student in R.O.T.C. may substitute military or naval science courses for one of the requirements in each of the last two years, except that these substitutions may not be made in Groups A or B.

[1] Students having two or more high school units in a foreign language are not permitted to enroll in a beginning course in that language.

Engineering: Fifth Year

Chemical, Civil, Electrical, and Mechanical Engineering

Admission to fifth-year courses is accomplished through application to the Committee on Examinations and Standing. Interested applicants for admission to fifth-year courses, who have not completed work equivalent to the first four years of the Rice Institute engineering curriculum, should also submit transcripts of previous work to the Dean of Engineering for evaluation. An applicant is accepted or rejected on the basis of his past academic performance and the recommendation of the department concerned. To complete the requirements of the Bachelor of Science degree in each branch of engineering students must follow the programs described below.

Chemical Engineering. Five advanced courses approved by the major department in Engineering, Science, and Economics, plus a departmental seminar and Unit Operations Laboratory. For particularly qualified students with directed interests, flexibility in course planning may permit some specialization during this year in nuclear, petroleum, or process engineering.

Civil Engineering. Five advanced courses in Civil Engineering numbered 500 or higher, approved by the major department, plus a departmental seminar. For particularly qualified students with directed interests, flexibility in course offerings may permit some specialization in structural or sanitary engineering.

Electrical Engineering. Five advanced courses in Electrical Engineering numbered 500 or higher approved by the major department, plus a departmental seminar.

Mechanical Engineering. Four advanced courses numbered 500 or higher in Mechanical Engineering and one elective in engineering or science approved by the major department plus associated laboratories and departmental seminar. For properly qualified and prepared students, flexibility in courses offered may permit specialization in Engineering Mechanics, Thermodynamics and Heat Transfer, or Physical Metallurgy.

Architecture

First Year

(1) Mathematics 100
(2) Physics 100
(3) English 100
(4) History 100 or 110
(5) Architecture 100
(6) Physical Training

Second Year

(1) Mathematics 200 or 210, English, or Philosophy
(2) French or German
(3) History of Art 215 or elective in Group B
(4) Elective
(5) Architecture 200
(6) Drawing 225

(Students who take History 100 in the First Year will be required to take the Group B elective in the Second Year, in place of History of Art 215)

Third and Fourth Years

Architectural students will be required to take their major work in Principles of Architecture in each of the third and fourth years. In addition, they will be required to take two courses in History of Art and two electives chosen from Group A, Group B, or Group C, except that both electives may not be chosen from the same group. Students who have already completed History of Art 215 will register for only one course in History of Art and will take an additional elective. Advanced students in Architecture will also be required to take one course in Drawing.

Fifth Year

Class II graduate students registered in Architecture will be required to take their major departmental work in Principles of Architecture and two electives in Group A, B, or C. Beginning in June 1965, candidates for the degree of Bachelor of Science in Architecture will be required to complete a minimum of twelve weeks of training in the office of a registered architect, and four weeks of travel directed toward architectural study. A report of such employment and travel will be required by the Department of Architecture.

Physical Education

First Year

(1) English 100
(2) Biology 100
(3) Physical Education 100 and 125
(4) Physical Science 150
(5) French, German or Spanish, or R.O.T.C.[1]

Second Year

(1) Physical Education 200 and 225
(2) English or general literature elective
(3) French, German or Spanish (continuation of language elected in first year)
(4) Elective
(5) Elective, or R.O.T.C.

Third and Fourth Years

At least ten courses are required, including at least three in the major, one in psychology and one in anatomy and public health. A minimum of seven of the ten courses must be advanced (number 300 or higher).

Students planning to enter educational work must elect one course in American History, Political Science 210, and two courses in Education.

[1] Students having two or more high school units in a foreign language are not permitted to enroll in a beginning course in that language. Students in R.O.T.C. take History 110 and military science or naval science in the first year, completing the required foreign language requirements in the Junior and Senior years.

RULES OF EXAMINATIONS AND STANDING FOR UNDERGRADUATE AND PROFESSIONAL STUDENTS

STUDENTS working toward any bachelor's degree, or not working toward a degree, are under the jurisdiction of the Committee on Examinations and Standing. Students working toward a master's or doctor's degree are under the jurisdiction of the Committee on Graduate Instruction.

Grade Symbols have the following meanings: 1, very high standing; 2, high standing; 3, satisfactory standing; 4, poor standing; 5, failure. Most courses require two consecutive semesters for completion. Grades are recorded for the first term in February; in June grades are recorded for the second term and for the year. The yearly grade determines the student's final standing in the course.

Registration. All undergraduate students, except those entering for the first time, register in May for the following academic year. Students entering are sent registration materials during the latter half of the summer.

The registration card of each student must be signed by an adviser. The Registrar approves registrations of all entering freshmen; the members of the Committee on Examinations and Standing approve registrations of sophomore students; others are approved by an adviser appointed by the head of the department of the student's major field of study. No student can be registered in or allowed to enter any course or section later than two weeks after the date of opening of courses as given in the Academic Calendar (p. vii). A student who makes a change of course or section within the first two weeks of the term is charged a fee of $10.00 per course. This fee is not charged whenever a change in a students' registration is a result of modification of the course offerings or class schedules of the Institute. However, any stipulation of this paragraph may be

waived at the discretion of the Committee on Examinations and Standing.

Schedules. The regular schedules for all undergraduate students are described on pp. 68–74. Irregular schedules are arranged at the time of registration, and must be approved by the Committee on Examinations and Standing. A student of the Institute who has had four full years of college is permitted to complete a first baccalaureate degree by registering for only those courses actually needed for graduation, provided he is not on probation.

No student shall reduce the program for which he is registered without approval of the Committee on Examinations and Standing.

Examinations. Written three-hour examinations are given to all students at midyear, and at the close of the academic year in May. Late examinations are given only by permission of the Committee on Examinations and Standing; they carry a fee of $10.00 each, which may be waived when an excuse of illness is accepted. Other tests and examinations are given from time to time at periods decided by the instructors. Tests and examinations are conducted under a student honor system. (See page 53.) In determining the standing of a student in each class, both his work during the term and the record of his examinations are taken into account.

Probation. Every student at the Rice Institute is expected to do academic work of high quality at all times. When his work does not meet the expected standards, the Committee on Examinations and Standing places him on academic probation. A student is placed on probation:

(1) If he fails to earn passing grades in at least 75 percent of his full schedule in any semester.

(2) If he does not earn grades of 3 or higher in at least 50 per cent of his full schedule in any semester.

The period of probation is the next semester in which the student is enrolled in the Institute. *A student is not placed on probation more than twice during his residence, but instead of*

a third probation is required to withdraw from the Institute.

A student on probation is not permitted to be a candidate for or to hold any elective or appointive office; or to serve as editor, assistant editor, business manager, or assistant business manager of any college publication.

Special Probation. At its discretion, the Committee on Examinations and Standing may grant the privilege of special probation to an individual student who otherwise would not be permitted to continue at the Rice Institute in his desired program. Special probation requires that a student shall refrain from the extracurricular activities closed to other students on probation (see immediately above) and shall have no grade less than 3 during the period of his special probation, and, further, that he must remain off probation thereafter.

Enforced Withdrawal. A student shall be required to withdraw from the Institute:

(1) If he fails to earn passing grades in at least 50 per cent of his full schedule in any semester, or for any academic year. This clause does not apply to an undergraduate student at the end of his first semester at the Institute.

(2) If he has already been placed on probation twice and his semester grades, at any subsequent time, are such as would result in a third probation.

(3) If he fails to fulfill all the terms of special probation, as outlined above.

Voluntary Withdrawal and Readmission. Any student desiring to withdraw voluntarily from the Institute must do so in person or by letter at the Registrar's Office. A student who withdraws voluntarily while not on probation or special probation will ordinarily be readmitted within three years. However, if the withdrawal occurs within five weeks of the beginning of any semester examination period, his grades as of the date of withdrawal may be used to determine his eligibility for readmission.

Removal of Deficiencies. With the approval, *in advance,* of the Committee on Examinations and Standing, deficiencies may be removed by work of high quality in an approved summer school,

but *future courses of a student's schedule may not be anticipated* by work done in summer school.

Change of Curriculum. Following the completion of a student's work in each of his first two years, the Committee on Examinations and Standing, at its discretion, may require a change of curriculum if, in the judgment of the Committee, the student's work in essential basic courses is such as to render him unsuited for further training in his originally chosen field of study.

Any proposed change of curriculum, whether or not the result of Committee action as mentioned above, is subject to the approval of the Committee on Examinations and Standing.

Approval of Major. In the second semester of the Sophomore year, each student is required to submit to the Committee on Examinations and Standing his choice of major. In determining whether this choice can be approved, the Committee will be guided by (1) aptitude shown in the individual record during the first two years of the curriculum which the applicant has been pursuing, and (2) limitations of departmental facilities for receiving students in the various major programs. Until a student's choice of major has been approved by the Committee on Examinations and Standing, he can not enter the Junior courses of that curriculum.

Graduation. To be recommended for any bachelor's or professional degree, a student must have earned grades of 3 or better in at least 50 per cent of work prescribed for that degree, and also, grades of 3 or better in at least 50 per cent of the work undertaken in his major field after completion of the sophomore year. He must not go on probation at the end of the year in which he is a candidate. A student who goes on probation at the end of this year but who is eligible to reregister may obtain his degree by earning grades, in a program of at least four additional courses, that remove him from probation.

COURSES OF INSTRUCTION

Course numbers below 200 designate beginning courses. Courses numbered from 200 to 299 are considered second-year courses, and are not normally open to freshmen. Courses numbered from 300 to 499 are advanced courses, not open to freshmen or sophomores except by permission. Courses numbered 500 and above are graduate level courses, open to undergraduates only on special recommendation of the department concerned.

The letters "a" and "b" after course numbers indicate first-semester and second-semester courses respectively. *Engineering* courses with numbers ending in 1 are first-semester courses; with 2, second-semester courses; with 3, two-semester (year) courses. If the number of an *engineering* course ends in zero, it is a one-semester course but may be available in both the fall and spring semesters.

Figures entered in parentheses at the left below the description of each course signify the number of class hours per week, the number of laboratory hours per week, and the semester-hours credit for the completed course, in that order. Thus, the entry (3–3–8) below Physics 100 means that the course meets three hours per week, has three hours of laboratory work per week and is evaluated at eight-semester-hours credit upon completion of the full year's work.

Architecture

Major work in Architecture is included with courses entitled, "Principles of Architecture." These are organized into five basic parts as indicated, but all five areas of instruction are carefully integrated into a single unit with material presented at the appropriate point of use, and with each staff member contributing to the student's development in every aspect of the course.

In addition to the courses listed, auxiliary programs provide further student contacts outside the Institute. Among these are weekly visiting speakers, field trip programs, and visiting critics. These contacts broaden and supplement the experience and training offered in the Department of Architecture.

Architecture 100. *Principles of Architecture*

a. Theory and Philosophy: An elementary study of the place of History in Architecture.
b. Architectural Design: Problems introducing basic design elements through actual elementary architectural problems with a brief introduction to building types.
c. Architectural Communication: Introduction to basic media, and the representation of materials by color and texture. Preparation of oral and written expression.
d. Architectural Construction: Awareness of materials of elementary structures, and the existence of building equipment. Introduction to statics.
e. Profession and Practice: The basic organization of the practice of Architecture is introduced along with an awareness of the importance of cost in Architecture. Laboratory fee required.

(0–10–6) *Mr. Ransom and Staff*

Architecture 200. *Principles of Architecture*

a. Theory and Philosophy: A beginning knowledge of History, Theory and Philosophy of Architecture through a study of the relation of the past architecture to past society. An elementary study of people and their reaction to the arts.
b. Architectural Design: Beginning standards of skill in architectural design, and an elementary knowledge of building types through actual architectural problems.
c. Architectural Communication: Continued use of the pencil with beginning competence in the use of basic media for representation of color and texture of materials.
d. Architectural Construction: Elementary knowledge of basic materials, their characteristics, and basic structural systems. Statics and strength of materials. An awareness of types of building equipment.
e. Profession and Practice: The organization of the architect's office. The position and responsibilities of the architect. Elementary cost studies. Laboratory fee required.

(1½–14–12) *Mr. Dunaway and Staff*

History of Art 215. See p. 126.

(3–0–6) *Mr. Chillman*

Drawing 225. *Freehand Drawing and Painting*

Open to all students. Laboratory fee required.

(0–4–2) *Mr. Parsons*

Architecture 300. *Principles of Architecture*

a. Theory and Philosophy: A continuation of the study and understanding of the relation of history and society to architecture as demonstrated in

specific civilizations. Group reaction to society and architecture. A study of the temporary and permanent values in today's society. The origins of structural systems.

b. Architectural Design: Development of greater breadth in architectural design through problems involving small building types. Elementary principles of planning.

c. Architectural Communication: Continued experience in the use of the pencil, and development of skill in several basic media. Practice in the use of oral and written explanation and criticism.

d. Architectural Construction: Principles of steel and concrete structural theory. Basic materials and structural principles. Basic requirements of building equipment.

e. Profession and Practice: The pressures upon the practice of Architecture. Public relations obligations. The operation of the large firm and the place of the individual in the office. The economic background of the small office. Building costs of small structures. Laboratory fee required.

(6–18–24) *Mr. Lent and Staff*

History of Art 315. See p. 126.

(3–0–6) *Mr. DeZurko*

Drawing 325. *Freehand Drawing and Painting*

Open to all students. Laboratory fee required.

(0–4–2) *Mr. Parsons*

Architecture 400: *Principles of Architecture*

a. Theory and Philosophy: Instruction in the origin and development of concepts. Social problems and their solution in the Modern World, with instruction in the social forces in effect today; their strengths, weaknesses, and duration.

b. Architectural Design: Problems involving greater depth in design through a breadth in building types of moderate scope. Advanced principles of planning and housing.

c. Architectural Communication: Continued development in the use of all basic visual media, with examples showing skill in the handling of color and texture of materials. Oral and written presentations.

d. Architectural Construction: Application of materials, structural principles and building equipment of all types, with special studies in acoustics.

e. Profession and Praetice: Financing and Promotion, working in professional collaboration. The procedures in producing complete drawings and specifications. Professional leadership. Laboratory fee required.

(6–18–24) *Mr. Todd and Staff*

History of Art 415. See p. 126.

(3–0–6) *Mr. DeZurko*

Drawing 425. *Life Drawing and Painting*

Laboratory fee required
(0–2–1) *Mr. Parsons*

History of Art 450. See p. 126.
(3–0–6) *Mr. Chillman*

History of Art 455. See p. 127.
(3–0–6) *Mr. Chillman*

Architecture 500. *Principles of Architecture*

a. Theory and Philosophy: Developing a philosophy, convictions, and standards. Analysis of the student's own philosophy, ideals, convictions.
b. Architectural Design: Problems showing a thorough understanding of building types. Demonstration of advanced facility and versatility. During the second semester the student will develop a thesis showing ability to research, question and probe, as well as evidencing depth of convictions.
c. Architectural Communication: Advanced use and facility in several media, with a complete understanding of color as demonstrated through design. Continued exercises in oral and written expression.
d. Architectural Construction: A summary of the principles, basic properties and limitations of all building materials with methods of evaluating new materials. Problems showing a sound understanding of all present systems of structures, with research and study into new areas.
e. Profession and Practice: Establishment of a strong set of professional principles and standards, and assurance in professional contacts. Professional problems in today's society and the place and responsibility of the architect in the local and world community. Laboratory fee required.

(7–18–26) *Mr. Barthelme and Staff*

Architecture 600. *Principles of Architecture*

Advanced work in Architectural Design involving both building types, planning and theory. Instruction is through a series of problems designed to determine the student's ability to derive and present new values in a complete and comprehensive manner in problems of today's architecture and today's society. Candidates will continue in this course until approved for the Master's degree. Two problems in the first semester and one in the second semester will be required. This course is required of all candidates for the Master in Architecture and runs concurrently with Architecture 610 or Architecture 620.
(2–18–16) *Mr. Barthelme and Staff*

Architecture 610. *Research in Architecture*

A course devoted to research in a particular problem or area in the field of architecture, under the joint direction of a Staff Specialist and a member of the departmental faculty. Staff Specialists available are William W.

Caudill, Architect; Paul Baker, Director of the Dallas Theater Center, Dallas, and the Baylor Theatre, Waco. Areas in which research may be undertaken are:

1. Building Types.
2. Group Reaction and Architecture
3. Structures
4. Product Development
5. Basic and Applied Sciences
6. Surveys and Documentation
7. Building Equipment
8. Professional Practice
9. Housing

(1–12–10) *Staff Specialists and Department Staff*

Architecture 620. *The Teaching of Architecture*

A course intended to stimulate interest in the development of new methods of teaching of architecture. Areas wherein special training is available are:

1. Graphics
2. Structures
3. Theory of Architecture
4. Profession and Practice

(1–12–10) *Staff*

Biology

Biology 100. *General Biology*

An introductory course in biology covering the general principles underlying living things. A general vertebrate type is considered first, and this is used as a basis for an introduction to physiology, immunology, embryology, cytology, genetics, ecology, and classification. Structure and function are, when possible, considered together; emphasis is placed on the former in the laboratory, and the more dynamic aspects are presented in lecture with the aid of demonstrations and motion pictures. The latter part of the course deals with various animal forms and their evolution, with emphasis on progressive differentiation of structure and adaptation to environment. Laboratory fee required.

(3–3–8) *Mr. Davies*

Biology 210a. *Comparative Zoology*

A phylogenetic study of the invertebrate phyla, including the prochordates. Prerequisite: Biology 100. Laboratory fee required.

(3–3–4) *Mr. Pulley*

Biology 215b. *Botany*

A comparative study of the plant kingdom with emphasis on phylogenetic relationships. Prerequisite: Biology 100. Laboratory fee required.

(3–3–4) *Mr. Pulley*

Biology 300b. *Comparative Anatomy*

The structure of the vertebrates is studied. The lecture material emphasizes the evolutionary patterns in the development of structures and the nature of homologous and analogous structures in various taxonomic groups. The laboratory is primarily devoted to learning the structure of the shark and cat in sufficient detail that references to homology and function may be meaningful. Prerequisites: Biology 100 and 210a. Laboratory fee required.
(3–6–5) *Mr. Enders*

Biology 310b. *Genetics*

This course is devoted to a study of heredity with frequent references to human material. Prerequisite: Biology 100. Laboratory fee required.
(3–3–4)

Biology 320a. *Parasitism and Symbiosis*

An introduction to the biology of symbiosis, with special emphasis on parasitism. The life histories, morphology, and physiology of parasites and hosts will be discussed with considerable emphasis on the evolution of parasitism. Illustrative examples demonstrating principles will be drawn from the plant or animal kingdom. Some attention will be given to the parasitic worms and protozoans responsible for human and animal disease. Prerequisites: Biology 100, Chemistry 120, Laboratory fee required.
(3–3–4) *Mr. Read*

Biology 340a. *General Physiology*

The fundamental processes of living systems are considered at the cellular level. The cellular environment is examined and some of the homeostatic mechanisms whereby the cell maintains a steady state are studied. The structure of the cell in terms of its chemical composition and physiochemical and functional organization is taken up. Certain aspects of cellular metabolism are considered. These include permeability, respiration and energy metabolism, synthesis, and growth and differentiation. Specialized cellular functions such as excitation and contraction are also studied. Prerequistes: Biology 100, Chemistry 120. Laboratory fee required.
(3–3–4) *Mr. Campbell*

Biology 350b. *Embryology*

Early developmental stages from fertilization to germ layer formation are studied. Reference is made to determination, differentiation, organizers, and other ontogenetic phenomena. Implantation, placentation, and organogenesis of mammals are studied. The laboratory work is primarily concerned with the development of organs and systems of vertebrates. Prerequisite: Biology 300 (can be taken concurrently). Laboratory fee required.
(3–3–4) *Mr. Enders*

Biology 370a. *Histology*

Cells, tissues, and organs are studied microscopically. Much of the material studied is mammalian, but whenever desirable and feasible, com-

parable materials from other animals are presented. Laboratory work includes observation, drawings, and an introduction to histological technique. Prerequisite: Biology 100. Laboratory fee required.
(3–3–4) *Mr. Enders*

Biology 390. *Anatomy and Public Health*

A course of lectures and laboratory work for students of physical education. The first term is devoted to the study of human anatomy and physiology and the physiology of exercise. The second term covers health legislation, social problems, vital statistics, epidemiology, care of water, milk, and other foods, sewage disposal, housing, and ventilation, including trips to study the health practices and conditions of public utilities. Laboratory fee required.
(3–3–8) *Dr. Welsh*

Biology 400 (a and b). *Special problems*

Open only to Senior biology majors, and with special permission of the chairman of the department. Laboratory fee required.
(2–6–4) or (2–6–8) *Staff*

Biology 440b. *Comparative Physiology*

The specialized physiology of the different animal phyla is considered. This includes a study of feeding and digestion, circulation and oxygen transport, respiration and intermediary metabolism, excretion and nitrogen metabolism, behavior, and the hormonal control of growth and development as these processes occur in the different animal groups. Prerequisite: Biology 340a. Laboratory fee required.
(3–3–4) *Mr. Campbell*

Biology 460a. *Introduction to Biochemistry*

The chemistry of proteins, nucleo-proteins, lipids, carbohydrates and growth factors. The application of some physico-chemical laws to living systems. Prerequisite: Biology 340a. Laboratory fee required.
(3–3–4) *Mr. Awapara*

Biology 465b. *Advanced Biochemistry*

A study of enzymes, and their function. Intermediary metabolism and biosynthesis of cell components. Prerequisite: Biology 460a or by permission of the instructor. Laboratory fee required.
(3–2–3) *Mr. Awapara*

Biology 480b. *Endocrinology*

A study of the primary endocrine glands of mammals and their relationships to the physiological homeostasis of the mammal. While emphasis is placed on the function, morphology, and inter-relationships of the glands of internal secretion of mammals, the comparative anatomy and evolution of these glands in the vertebrates is discussed. Laboratory work is restricted

primarily to histological study of the glands, surgical procedures, and simple experiments demonstrating hyposecretion. Prerequisites: Biology 300 and Biology 340a. Laboratory fee required.
(3–3–4) *Mr. Talmage*

Biology 510. *Special Topics in Biochemistry*

Readings, conferences and laboratory work in current developments in biochemistry. Prerequisites: Biology 460 and 465.

Biology 520. *Cytology*

The course consists of student reports and discussions concerning the anatomical and chemical properties of the cell, its formed constituents, and inclusions. Morphological and cytochemical indications of specific activity are emphasized. Prerequisites: Biology 300a and 370b. Open to senior majors by permission of instructor.
(2–6–4) *Mr. Enders*

Biology 525. *Special Cytology*

An analysis of the methods of investigating cellular organization and activity. Particular emphasis is placed on cytochemical studies of parenchymal cells. Prerequisites: Biology 460a.
(2–6–4) *Mr. Enders*

Biology 530. *Advanced Endocrinology A*

The thyroid, pancreas, adrenals, and the relationships of hormones to carbohydrate metabolism are studied. Seminar on current literature in endocrinology.
(3–4–8) *Mr. Talmage*

Biology 540. *Advanced Endocrinology B*

The parathyroids, the pituitary, and the physiology of reproduction. Readings, conferences, and laboratory work. Includes also a weekly seminar on current literature in endocrinology.
(3–4–8) *Mr. Talmage*

Biology 550. *Advanced General Physiology*

Readings, conferences, and laboratory work in current fields of investigation in cellular physiology and biochemistry.
(2–6–8) *Mr. Campbell*

Biology 560a. *Medical Entomology*

Conferences and laboratory study of the arthropods involved in the transmission of infectious agents. Attention will be given to morphology, classification, life histories, in relation to the ecology of viruses, rickettsias, bacteria, and helminths. Some consideration will be given to parasitic arthropods. Control of the medically important arthropods will be discussed.
(2–6–4) *Mr. Read*

Biology 565b. *Protozoology*

Conferences and laboratory study of the protozoan parasites of vertebrates. Attention will be given to the morphology, classification, life histories, and ecology of parasitic protozoa, with some consideration of related free-living species. Laboratory study will include methods of cultivation and husbandry, preparation for study, and specific diagnosis, but emphasis will be placed on the experimental study of protozoan biology.
(2–6–4) *Mr. Read*

Biology 570. *Helminthology*

Conferences and laboratory work on the morphology, classification, life histories, and evolution of the helminth parasites of vertebrates. Emphasis will be placed on study of original literature.
(2–6–8) *Mr. Read*

Biology 580a. *Physiology of Parasitism*

Conferences, student reports, and laboratory work on the physiology of parasites and the functional relationships of hosts and parasites. Attention will be given to growth, metabolism, nutrition, and physiological evolution of parasites, with emphasis on comparative aspects. The basis of pathology and disease will be treated as a series of physiological problems, with examples drawn from the animal and plant kingdoms.
(2–6–4) *Mr. Read*

Biology 585b. *Advanced Comparative Physiology*

Conferences and laboratory work on the physiology of invertebrate animals. Reading in the literature dealing with ionic and osmotic regulation, permeability, respiration, nutrition, nitrogen metabolism, excretion, energy metabolism, neurosecretion, and muscle-nerve physiology. Prerequisite: Permission of the instructor.
(2–6–4) *Mr. Campbell and Mr. Read*

Biology 591. *Research in Vertebrate Anatomy*

Mr. Davies

Biology 592. *Research in Histochemistry and Microanatomy*

Mr. Enders

Biology 593. *Research in Molecular or Comparative Physiology*

Mr. Campbell

Biology 594. *Research in Biochemistry*

Mr. Awapara

Biology 595. *Research in Endocrinology*

Mr. Talmage

Biology 596. *Research in Parasitology or Comparative Physiology*

Mr. Read

Biology 599. *Biology Seminar*

The Biology Seminar is held weekly for the purpose of hearing papers on current research by members of the staff, visiting investigators, and graduate students. Graduate students in biology are required to attend, and the seminar is open to visitors from on and off the campus. Undergraduate biology majors are invited.
(1–0–2) *Staff*

Biology 700. *Summer Graduate Research*

Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Chemical Engineering

Chemical Engineering 303. *Chemical Engineering Fundamentals*

A first course in the application of the principles of mathematics, chemistry and physics to the more important chemical processes. Subjects considered are: stoichiometric and equilibrium concepts, material balances, energy relationships for both chemical and physical changes and mechanical equipment, and the thermodynamic properties of fluids and energy.
(3–0–6) *Mr. Andersen*

Chemical Engineering 403. *Unit Operations*

This course deals with the principles upon which the mechanical operations involved in the chemical manufacturing industries depend, and with the types of equipment available for such operations and the kind of work for which each is best adapted. The application of the principles is illustrated both by discussion in the classroom and by the solution of typical problems. Among the subjects considered are: evaporation, humidification and dehumidification, air conditioning, drying, distillation and fractionation, filtration, absorption and adsorption, extraction, crystallization, crushing, grinding, separation, agitation, and transportation of solids, liquids, and gases. Prerequisite: Chemical Engineering 303.
(3–0–6) *Mr. Hartsook*

Chemical Engineering 421. *Plant Inspection*

The work consists of: (1) a critical examination, in conference of processes, equipment, and problems of each industrial plant to be visited; (2) the inspection of the plant supplemented by discussions by plant officials; (3) a comprehensive report, by squads, consisting of flowsheets, individual unit descriptions, and general specifications of interest. Types of industries inspected are: sewage, sugar, petroleum refining, cement, brewing and malting, steel pouring, plastics, heavy chemicals, fertilizers, etc. Prerequisite: Chemical Engineering 403 or registration in 403.
(1–3–2) *Mr. Kobayashi*

Chemical Engineering 422. *Chemical Engineering Literature*

Sources of information on chemical engineering. Presentation of information in written and oral reports.
(2–0–2) *Mr. Andersen*

Chemical Engineering 443. *Fuels and Combustion Laboratory*

The work consists of the testing and analysis of gas, oil, coal, and water, and the measurement of fundamental physical quantities; and the application of these methods in developing stoichiometric relations and energy balances. Prerequisites: Chemical Engineering 303 and full fourth-year standing. Laboratory fee required.
(0–3–2) *Mr. Davis*

Chemical Engineering 471. *Applied Mathematics for Chemical Engineers I*

The use of mathematical principles for the solution of problems in fluid dynamics, heat and mass transfer, and thermodynamics.
(3–0–3) *Mr. Denny*

Chemical Engineering 472. *Applied Mathematics II*

A continuation of Chemical Engineering 471. Particular emphasis is placed on numerical solutions of differential equations and on the use of analog and digital computer for the solution of complex problems.
(3–0–3) *Mr. Denny*

Chemical Engineering 501. *Rate Processes I*

An advanced study of the important rate processes in chemical engineering with particular emphasis on the rate of transfer of heat, momentum and mass, and on chemical kinetics.
(3–0–3) *Mr. Davis*

Chemical Engineering 502. *Rate Process II*

A continuation of Chemical Engineering 501.
(3–0–3) *Mr. Davis*

Chemical Engineering 511. *Thermodynamics I*

The course considers quantitative applications of the first and second laws; thermodynamics properties of pure fluids; the concepts of equilibrium, chemical potential, fugacity, activity and their application; thermodynamic properties of ideal solutions; equilibrium in systems involving a chemical reaction.
(3–0–3) *Mr. Leland*

Chemical Engineering 512. *Thermodynamics II*

A continuation of Chemical Engineering 511. Topic discussed are: Equilibrium in systems involving many chemical reactions and several phases.

Non-ideal solutions. Azeotropes. Critical phenomena. Equations of state. An introduction to statistical thermodynamics.
(3–0–3) *Mr. Leland*

Chemical Engineering 522. *Plant Design*

The lectures consider the development of chemical manufacturing processes and the design of chemical manufacturing plants from the point of view of location, building, equipment, economics, and organization. The laboratory work consists of calculating and drawing up fundamental data, qualitative and quantitative flowsheets, specifications, plant layout, and cost estimates for typical processes. Prequisite: Chemical Engineering 403.
(2–3–3) *Mr. Akers*

Chemical Engineering 531. *Nuclear Engineering*

An introductory course in: Nuclear properties, nuclear reactions, radioactive decay, the fission reaction. Theory and design of nuclear reactors using the one-group model, Fermi Age Treatment, neutron diffusion theory. The principles of reactor control, shielding, nuclear fuels and their processing, waste disposal, and health physics.
(3–0–3) *Mr. Leland*

Chemical Engineering 532. *Nuclear Engineering*

A continuation of Chemical Engineering 531 with a more advanced treatment of nuclear reactor theory using two group and multi-group methods, neutron transport theory. Calculations for time-dependent reactor operation, temperature and heat transfer effects in a reactor, reactors with reflectors, breeder reactors. A more detailed consideration of related topics of fuel cycles, isotope separation, and shielding.
(3–0–3) *Mr. Leland*

Chemical Engineering 541. *Nuclear Chemistry*

An introductory course in nuclear physics from the chemical viewpoint. Atomic structure, nuclear structure, nuclear stability, nuclear emissions, nuclear reactions, nuclear reaction generators, nuclear emission characteristics, interactions of radiations with matter, health physics, radiation detection and measurement. The laboratory provides a thorough training in the techniques and instruments used for radiation detection, measurement, and personnel protection.
(2–4–3) *Mr. Andersen*

Chemical Engineering 542. *Radiochemistry*

Lecture and laboratory covering the following topics: The physical and chemical manipulations of radioisotopes. Application of radioisotopic techniques to research problems in science and engineering. Utilization of radioactive byproducts from nuclear reactors. Research projects in individual fields. Experimentation with a nuclear reactor for qualified students in this field of interest.
(2–4–3) *Messrs. Andersen and Leland*

Chemical Engineering 543. *Unit Operations Laboratory*

Laboratory work in unit operations as follows: crushing, grinding and screening, hydraulic separation, thickening, flotation, filtration, flow of gases, flow of liquids, flow of heat, humidification, water cooling, adsorption, absorption, liquid-liquid extraction, evaporation, drying, distillation, and rectification. Prerequisite: Chemical Engineering 403. Laboratory fee required.
(0–6–4) *Mr. Hartsook*

Chemical Engineering 550. *Petroleum Production Problems*

Physical properties of hydrocarbons at elevated pressures and temperatures, flow of fluids through porous media, estimating size of petroleum reservoirs, and optimum production procedures.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 551. *Separation Processes*

A systematic approach to the separation of matter based on differences in physical properties. Particular attention is devoted to the equilibrium stage concept.
(3–0–3) *Mr. Akers*

Chemical Engineering 560. *Physical Equilibrium in Fluid Systems*

A development, from thermodynamic principles, of the volume and phase equilibrium behavior of binary and multicomponent systems, including both ideal and nonideal systems and behavior at both low and high pressures.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 561. *General Seminar*

A course for training chemical engineering students in the preparation and oral presentation of formal papers and discussions on topics of engineering interest. The papers and discussions are given by the students, using acceptable material secured from technical publications. This course is required of all fifth-year chemical engineers.
(1–0–1) *Mr. Denny*

Chemical Engineering 590. *Chemical Reaction Kinetics*

A study of the principal facts and theories relating to the rates at which chemical reactions take place, including a study both of elementary reactions and of the way in which over-all rates of complex reactions are related to the rates of the individual steps.
(3–0–3) *Mr. Akers*

Chemical Engineering 620. *Chemical Process Design*

The application of thermodynamics and unit operations to the design of chemical equipment and plants. Prerequisites: Chemical Engineering 403, 411, and 512.
(3–0–3) *Mr. Akers*

Chemical Engineering 662. *Graduate Seminar*

Similar to Chemical Engineering 561 except that the course applies to graduate students above the fifth year.
(2–0–2) *Mr. Denny*

Chemical Engineering 675. *Process Control*

A mathematical approach to the problem of process control with particular emphasis on the analysis of response to process variations.
(3–0–6) *Mr. Davis*

Chemical Engineering 680. *Summer Graduate Research*

Open to students already admitted as candidates for the degree of Master of Science. At least forty hours of laboratory work per week

Chemical Engineering 683. *M.S. Research and Thesis*

At least nine hours of work weekly under the direction of a member of the staff on a problem of chemical engineering importance. Four copies of the accepted report will be required: two for deposit in the Institute library and two for the chemical engineering department.

Chemical Engineering 685. *Transport Properties of Fluids*

A consideration of both the classical and statistical approach to the evaluation of the transport properties of fluids. Special consideration will be given to very dense fluids.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 720. *Advanced Topics in Chemical Engineering III*

A theoretical treatment of advanced phases of chemical engineering with special emphasis upon the development of individual abilities. Prerequisite: full graduate standing and consent of department. *Mr. Deans*

Chemical Engineering 780. *Summer Graduate Research*

Open to students already admitted as candidates for the degree of Doctor of Philosophy. At least forty hours of laboratory work per week.

Chemical Engineering 783. *Ph.D. Research and Thesis*

At least twenty hours of work weekly under the direction of a member of the staff on a problem of chemical engineering importance. Four copies of the accepted report will be required: two for deposit in the Institute library and two for the chemical engineering department.

Chemistry

Chemistry 120. *General Inorganic Chemistry and Qualitative Analysis*

A general introductory course dealing with the fundamental phenomena and principles of the science. During the second half-year the laboratory ex-

ercises are arranged to verify and illustrate the principles and facts which are discussed in the lectures. During the first half-year the laboratory work deals with the general principles and methods of qualitative analysis. This course is required of science-engineering students, and is also open to academic students who may wish to proceed beyond the Sophomore year in chemistry. Chemistry 120 is one of the prerequisites for Chemistry 220. Prerequisite: High School Chemistry. Laboratory fee required.
(3–4–8) *Mr. Brackett and Mr. Sass*

Chemistry 220. *Quantitative Analysis*

The course aims to familiarize the student with the fundamental principles of analytical chemistry and, by laboratory and problem work, with the application of these principles to a variety of representative analytical processes. Special emphasis is placed on chemical mathematics and stoichiometry, and throughout the work attention is given to general analytical technique. Prerequisites: Chemistry 120 and Physics 100. Laboratory fee required.
(3–4–8) *Mr. Curl*

Chemistry 230. *Analytical Chemistry*

A laboratory course required of and open only to Junior chemistry majors. This course is designed to supplement and extend the previous work in analytical chemistry in order to meet certain professional requirements. During the first semester four hours of laboratory work each week will be devoted to qualitative analysis. The second semester will require two four-hour laboratory periods weekly directed to the study of quantitative analysis.
(0–6–4) *Mr. Curl*

Chemistry 300a. *Organic Chemistry*

The course is designed to give a thorough survey of aliphatic and aromatic chemistry with an introduction to the heterocyclic compounds, and to present the theories relating to their structure and reactions. Prerequisite: Chemistry 220.
(3–4–8) *Mr. Richter*

Chemistry 300b. *Organic Chemistry*

A course arranged primarily for premedical students and academic students not specializing in chemistry. This course differs from Chemistry 300a only in the type of laboratory preparations. The laboratory work is devoted chiefly to the synthesis of typical examples of general and local anesthetics, disinfectants, analgesics, biological preparations, alkaloids, and dyes. Prerequisite: Chemistry 220 or special permission from the department of chemistry.
(3–4–8) *Mr. Richter*

Chemistry 310. *Physical Chemistry*

A quantitative study of theoretical and physical chemistry dealing with the forms of matter, changes of state and energy, kinetics, equilibria, electrochemistry, photochemistry, and atomic structure. Prerequisites: Chemistry 220 and Physics 200. Laboratory fee required.
(3–4–8) *Mr. Salsburg*

Chemistry 400a. *Advanced Organic Chemistry*

Introduction to theoretical organic chemistry with emphasis on reactions of general synthetic importance.
(3–0–3) *Mr. Ettlinger*

Chemistry 410a. *Colloid Chemistry*

An introductory course dealing with the theories of colloid chemistry and their applications. Prerequisites: Chemistry 300 and 310. Laboratory fee required.
(3–4–4) *Mr. Milligan*

Chemistry 420b. *Structural Chemistry*

Modern concepts of structural chemistry based on the principles of quantum mechanics, including a discussion of current methods of structure determination.
(3–0–3) *Mr. Brackett*

Chemistry 430a. *Special Topics in Physical Chemistry*

Problems in Chemical Kinetics and Statistical Transport Theory.
(3–0–3) *Mr. Salsburg*

Chemistry 440b. *Advanced Organic Chemistry and Qualitative Analysis*

This course embodies a systematic procedure for the separation and identification of pure organic compounds. It aims to review, by actual laboratory contact, many important reactions of the main series of organic substances. (Owing to limitations of space, enrollment will be limited to thirty-five students.) Laboratory fee required.
(2–6–4) *Mr. Lewis*

Chemistry 450a. *Thermodynamics*

Relation of heat and work to chemical and physical systems. A consideration of free energy, entropy, and fugacity as applied to equilibria. Especial attention to the treatment of solutions.
(3–0–3) *Mr. Kilpatrick*

Chemistry 480b. *Chemistry of Natural Products*

A study of important types of natural products of current interest to biology and chemistry.
(3–0–3) *Mr. Turner*

Chemistry 500. *M.A. Thesis*

Graduate students who are working toward the M.A. degree in chemistry are expected to elect at least nine hours a week in research under the direction of some member of the staff of instruction.

Staff

Chemistry 510. *Chemistry of the Steroids*

A theoretical consideration of the reactions and stereochemistry of the steroids, including a discussion of the physiological importance of these compounds.
(3–0–6) *Mr. Turner*

Chemistry 520b. *Theory of Adsorption of Gases*

An advanced treatment of modern theories of adsorption of gases on solids.
(3–0–3) *Mr. Milligan*

Chemistry 540b. *Special Topics in Organic Chemistry*

(3–0–3) *Mr. Ettlinger*

Chemistry 545a. *Physical-organic Chemistry*

The application of physical methods to the determination of the structure of organic compounds.
(3–0–3) *Mr. Lewis*

Chemistry 545b. *Physical-organic Chemistry*

A study of the mechanisms of various important organic reactions.
(3–0–3) *Mr. Lewis*

Chemistry 550a. *Reaction Kinetics*

A consideration of the rates of reactions with emphasis on homogeneous kinetics as a tool in the study of reaction mechanisms. Prerequisite: Chemistry 400a.
(3–0–3) *Mr. Lewis*

Chemistry 560b. *Electrochemistry*

The application of thermodynamics to the study of electrolytic cells. Prerequisite: Chemistry 450a.
(3–0–3) *Mr. Kilpatrick*

Chemistry 570. *Absorption Spectra of Organic Compounds*

The application of ultraviolet and infrared absorption spectra to the study of molecular structure.
(3–0–6) *Mr. Ettlinger*

Chemistry 580a. *Special Topics in Alkaloid Chemistry*

A consideration of the chemistry of selected groups of alkaloids.
(3–0–3) *Mr. Turner*

Chemistry 590.

Advanced topics in theoretical chemistry.
Mr. Salsburg

Chemistry 600. *Ph.D. Thesis*

Graduate students who are working toward the Ph.D. degree in chemistry are expected to elect at least twelve hours a week in research under the direction of some member of the staff of instruction.

Staff

Chemistry 610. *Application of X-ray Diffraction Methods*

Application of X-ray diffraction methods to inorganic and physical chemistry. Identification of solid phases, determination of crystal size, X-ray analysis of simple types of structures. Electron diffraction. Principles and operation of modern X-ray apparatus. This course alternates with Chemistry 660.

(3–0–6) *Mr. Milligan*

Chemistry 620. *Molecular Structure Determination*

Theory and practice of various physical methods of molecular structure determination. Theory of the chemical bond.

(3–0–6)

Chemistry 630b. *Statistical Thermodynamics*

A development of the principles of thermodynamics from the standpoint of statistical mechanics. The relation of the structure of molecules to their thermodynamic properties. Prerequisites: Chemistry 450a and Mathematics 300 or 310.

(3–0–3) *Mr. Kilpatrick*

Chemistry 640a. *Chemistry of the Terpenes*

(3–0–3) *Mr. Turner*

Chemistry 650. *Quantum Mechanics*

A study of simple mechanical systems from the point of view of wave mechanics. The application of these concepts to the chemical bond. The energy states of polyatomic molecules. Prerequisite: Mathematics 300 or 310.

(3–0–6) *Mr. Kilpatrick*

Chemistry 660. *X-ray Crystal Structure Analysis*

X-rays, and their interaction. Experimental methods. Symmetry and space groups. Fourier methods. Dynamic theory of X-ray diffraction. This course alternates with Chemistry 610.

(3–0–6) *Mr. Sass*

Chemistry 680. *Modern Methods in Crystal Structure*

Fourier and Patterson methods, modification functions, inequalities, and order-disorder phenomena.

(3–0–6) *Mr. Sass*

Chemistry 700. *Summer Graduate Research*

Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Civil Engineering

Civil Engineering 332. *Materials Testing for Architects*

A series of standard tests of common building materials for architectural students registered in Architecture 330. Laboratory fortnightly. Laboratory fee required.

Civil Engineering 355. *Plane Surveying*

The development and study of the principles and theory fundamental to engineering measurements. Field and office work to familiarize the student with tape, compass, level, transit and plane table. Comprehensive studies of directional measurements, linear observations, engineering leveling and topographic operations. Laboratory fee required.
(2–3–3)

Civil Engineering 401. *Mechanics of Materials*

Stress and deformation due to tensile, compressive, and shearing forces; bending moments, deflections, torsional stresses, and combined stresses. Theory of beams, columns, and shafts. Laboratory tests of steel, aluminum, cast iron, wood, and concrete. Prerequisites: Mathematics 200 or 210 and Engineering 301–2. Laboratory fortnightly. Laboratory fee required.
(3–1½–3)

Civil Engineering 402. *Mechanics of Liquids*

Principles of hydrostatics and hydrodynamics; the flow of liquids through orifices, pipes and nozzles, in open channels and over notches and weirs. Flow measurement and simple hydraulic machinery. Prerequisites: Mathematics 200 or 210 and Engineering 302. Laboratory fortnightly. Laboratory fee required.
(3–1½–3)

Civil Engineering 421. *Route Surveying and Highway Design*

Simple and compound horizontal and vertical curves for highway and railway use. Problems in earthwork. Leveling. Error theory. Geometrical and structural design of highways. Prerequisites: Civil Engineering 355. Laboratory fee required.
(3–3–4)

Civil Engineering 422. *Elementary Structural Analysis*

Analytical and graphical methods of determining stresses in statically determinate beams, frames, and trusses due to fixed and moving loads. Analysis of space frameworks. Approximate analysis of indeterminate structures. De-

flections of beams and trusses. Prerequisites: Engineering 301–2, Civil Engineering 401.
(3–3–4)

Civil Engineering 431. *Hydrology*

A study of precipitation, evaporation, transpiration, climate and drainage-basin characteristics with emphasis on the relationship of these elements to surface-water and ground-water runoff. The collection and analysis of hydrological data for engineering design is emphasized.
(3–0–3)

Civil Engineering 432. *Environmental Sanitation*

A presentation of the principles and techniques fundamental to basic sanitation. The study of communicable disease, water supply, waste disposal, refuse collection and disposal, pest and rodent control, milk and food sanitation, swimming pool and housing problems.
(3–0–3)

Civil Engineering 441. *Civil Engineering Analysis*

A study of certain mathematical methods useful in the field of engineering. Formulation of problems of interest to Civil Engineers, mathematical methods of solution, interpretation of results, physical analogies. Prerequisites: Mathematics 300 or 310 and registration in or completion of Civil Engineering 401.
(3–0–3)

Civil Engineering 442. *Special Topics in Civil Engineering Analysis*

A continuation of Civil Engineering 441. Mathematical methods of analysis applied to such topics as Theory of Elasticity, Elastic Stability, Static and Dynamic analysis of structures. Prerequisite: Civil Engineering 441.
(3–0–3)

Civil Engineering 503. *Experimental Problems in Civil Engineering*

Direct and indirect methods of model stress analysis. Strain measurement and stress determination. Photoelastic stress analysis. Prerequisite: Civil Engineering 401 or equivalent.
(0–3–2)

Civil Engineering 521. *Water Supply and Treatment*

Study of the engineering aspects of hydrology pertinent to collection of surface and ground waters. Principles and design of water transmission and distribution systems. Water quality characteristics. Study of unit operations and the synthesis of water treatment processes. Prerequisites: Civil Engineering 402 or equivalent and fifth-year standing. Laboratory fee required.
(3–3–4)

Civil Engineering 522. *Waste Treatment and Water Pollution Control*

Study of the sources and characteristics of waste waters. Principles and design of collection systems. Study of unit operations and the synthesis of waste treatment processes. Concepts of water pollution control as related to waste treatment. Prerequisite: Civil Engineering 521. Laboratory fee required.
(3–3–4)

Civil Engineering 541. *Theory of Concrete Structures*

Properties of concrete. Theory of reinforced concrete. An analytical study of behavior of concrete members in relation to present design codes. Prerequisite: Civil Engineering 401. Laboratory fee required.
(3–3–4)

Civil Engineering 542. *Design of Reinforced Concrete Structures*

Design of structural members and frameworks of reinforced concrete. Elastic and ultimate-strength design. Prestressed concrete. Design of typical parts of buildings, bridges, and foundations. Prerequisites: Civil Engineering 401, 422 and 541. Laboratory fee required.
(3–3–4)

Civil Engineering 561. *Advanced Mechanics of Materials*

Advanced topics in stress analysis. Shear center; unsymmetrical bending; curved beams; torsion of non-circular sections; column theory; local buckling; lateral buckling; stress-concentration; strength under combined loading; plastic analysis. Properties of steel, aluminum, and timber. Prerequisite: Civil Engineering 401.
(3–3–4)

Civil Engineering 562. *Design of Steel, Aluminum, and Timber Structures*

Design of tension members, compression members, beams, and connections. Design of plate girders, roof trusses, simple bridge trusses, and building frames. Working drawings, shop drawings, estimates of weight and cost. Introduction to plastic design of steel. Prerequisites: Civil Engineering 401, 422 and 561. Laboratory fee required.
(3–3–4)

Civil Engineering 581. *Introduction to Statically Indeterminate Structures*

A study of the stresses and deflections of such structures as continuous spans and rigid frames, by the methods of angle changes and moment distribution. Analysis of trussed structures with redundant members, analysis of secondary stresses in trusses. Williot-Mohr diagrams. Prerequisites: Civil Engineering 401 and 422.
(3–3–4)

Civil Engineering 582. *Elementary Soil Mechanics and Foundations*

A study of the physical characteristics of soils and of the mechanics of soil masses subjected to loads. Earth pressures and stability. Design of foundations for buildings, bridges, and other major structures. Laboratory fee required.
(3–3–4)

Civil Engineering 605. *Graduate Seminar*

(1–0–2)

Civil Engineering 611. *Advanced Problems in Soil Mechanics and Foundations*

Stress conditions for failure in soils, plastic equilibrium, arching in ideal soils. Application to retaining wall problems and stability of slopes. Earth pressure on supports in cuts, tunnels, and shafts, anchored bulkheads. Theory of consolidation, mechanics of drainage. Problems involving subgrade soil or pile reaction. Vibration problems. A study of foundation design and construction procedures. Site investigation, methods of soil exploration. Footing, raft, and pile foundations. Settlement due to exceptional causes. Cofferdams and other aids for open excavations, caissons. Bridge piers and abutments. Underpinning. Prerequisites: Civil Engineering 582 or an equivalent course.
(3–3–4)

Civil Engineering 612. *Design of Dynamically Loaded Structures*

Design and analysis of structures subjected to impulsive loading such as blast, earthquake, wind and wave forces. Prerequisites: Mathematics 300, Civil Engineering 541–2, 561–2 and 581 or their equivalent.
(3–0–3)

Civil Engineering 623. *Numerical and Approximate Methods of Structural Analysis*

Methods of successive approximations. Numerical procedures for the solution of complex problems with applications to bridges, buildings, and aircraft structures. Method of successive relaxation of constraints; energy methods; difference equations; numerical integration procedures. Vibrations of structures including earthquake effects. Action of simple structural elements and of more complex structures subjected to dynamic loads. Elastic and inelastic instability of bars, plates, and stiffened plates.
(3–0–6)

Civil Engineering 631. *The Application of Electronic Computers to Structural Problems*

Introduction to computer programming. Matrix methods of structural analysis. Optimization of structures. Prerequisites: Mathematics 300 or 310, Civil Engineering 542, 562 and 581, or their equivalents.
(3–3–4)

Civil Engineering 632. *Buckling of Structures*

Buckling of axially and eccentrically loaded colums. Torsional buckling of columns. Lateral buckling of beams. Stability of frameworks. Local buckling. Prerequisites: Mathematics 300 or 310, Civil Engineering 401 or the equivalent.
(3–0–3)

Civil Engineering 641. *Introduction to the Mathematical Theory of Elasticity*

Fundamental concepts of the theory of elasticity. The differential equations of equilibrium and the equations of strain compatibility. Solution of two-dimensional problems in rectangular and polar coordinates. Strain energy methods. Analysis of stress and strain in three dimensions. Torsion and bending of prismatic bars. Analogies: the photoelastic analogy, the membrane analogy, the electric analogy. Propagation of waves in elastic medium. Bending of laterally loaded plates with various boundary conditions. Elastic stability of plates. Membrane theory of shells. General theory of shells. Prerequisites: Mathematics 300 or the equivalent.
(3–0–3)

Civil Engineering 642. *Analytical Study of Experimental Work in Reinforced Concrete*

Critical reviews of experimental and analytical investigations. Behavior of reinforced concrete structural members; beams and columns subjected to flexure, axial compression, combined axial compression and flexure, and combined flexure and shear. Behavior of reinforced concrete structures; frames, floor slabs, column footings, and highway bridge floors. Prerequisites: Undergraduate courses in structures and reinforced concrete design.
(3–0–3)

Civil Engineering 661. *Steel Design*

Design of steel members; codes and specifications for buildings; riveted and welded construction; evolution of bridge specifications; loads and working stresses; economic proportions. Prerequisite: Civil Engineering 561–2 or equivalent.
(3–0–3)

Civil Engineering 662. *Design of Lightweight Structures*

Analysis and design of structures and structural members of minimum weight. Prerequisites: Civil Engineering 561–2 and 581, or their equivalents.
(3–0–3)

Civil Engineering 671. *Advanced Sanitary Engineering I*

The theory of the chemical and physical principles utilized in water and waste treatment operations. Unit operations such as sedimentation, gas transfer, chemical treatment, filtration and sludge treatment are presented. The

synthesis of these operations into water and waste treatment processes is developed.
(3–0–3)

Civil Engineering 672. *Advanced Sanitary Engineering II*

The theory of the biological and biochemical principles utilized in water and waste treatment operations. Unit operations such as biological oxidation, aerobic and anaerobic, and disinfection are presented. The synthesis of these operations into water and waste treatment processes is developed.
(3–0–3)

Civil Engineering 681. *Sanitary Chemistry*

The chemistry of water and waste treatment processes. Laboratory practice in the various chemical, physical and biochemical analytical procedures applicable to process design and evaluation.
(3–3–4)

Civil Engineering 682. *Industrial Waste Treatment*

A study of the chemistry and processes applicable to analysis and treatment of industrial wastes.
(3–3–4)

Civil Engineering 691. *Advanced Statically Indeterminate Structures*

Classical and modern methods of analysis applied to a study of stresses and deflections in structures such as rigid frames, trusses, continuous beams and arches. Methods to be applied include Real Work, Virtual Work, Castigliano's Theorem and Least Work, Slope Deflection and Column Analogy. Prerequisite: Civil Engineering 581 or its equivalent.
(3–0–3)

Civil Engineering 692. *A Critical Review of Codes for Steel and Concrete Structures*

A study of experimental and analytical investigations which form the basis for design codes. Behavior of steel and reinforced concrete structural members and the behavior of steel and reinforced concrete structures. Prerequisites: Civil Engineering 561–2 and Civil Engineering 541–2 or their equivalents.
(3–0–3)

Civil Engineering 703. *Research and Thesis*

This will consist of an original investigation along some approved line of civil engineering work, an original design, or a critical review of existing work. In every case three complete typewritten or printed reports will be required; two for deposit in the Institute library and one for the civil engineering department.

Economics, Business Administration, and Sociology

Requirements for departmental majors: Students majoring in the department must take six courses in economics and business administration. These courses must include Business Administration 200, Economics 200, and Economics 350a. Only in special cases will exceptions to these requirements be considered.

Recommendations to prospective majors: (1) Students primarily interested in accounting are advised to take Business Administration 200 in their sophomore year. (2) Students primarily interested in economics are advised to take Economics 200 in their sophomore year.

Economics 200. *Principles of Economics*

The principles of modern economics and the history of economic thought and controversy. The first part of the course is concerned with the theory of national income determination, price and distribution theory, and the theory of trade. In the second part of the course great economic ideas and issues are studied, with emphasis on those ideas and policy issues of continuing influence in national and international economic affairs.
(3–0–6) *Staff*

Economics 304b. *Junior Independent Work*

Each student is required to undertake research and to write (and rewrite) a short paper on a topic approved by his adviser. He is required also to select and obtain faculty approval for a senior thesis topic. A limited number of students will be selected for this course on the basis of interviews with those who apply. Those selected are required to take Economics 400 in their senior year. Open to students having a principal interest in economics.
(0–0–3) *Staff*

Economics 350a. *Elements of Statistical Method*

Collection, classification, and presentation of data; use of graphic methods; analysis of frequency distributions; introduction to the theory of sampling and statistical inference; analysis of time series; index numbers; correlation.
(3–2–3) *Mr. J. Hodges*

Economics 355b. *Money and Banking*

The theory of money and credit and the theory and practice of commercial and central banking. Treasury debt management policy and the nature of the money market are also examined. Prerequisite: Economics 200 or approval of the instructor.
(3–0–3) *Mr. Brothers*

Economics 370a. *Economic Analysis I*

A course in intermediate theory, devoted to the study of economic equilibrium and market relationships. The theories of income distribution and of

general equilibrium are developed, and a brief survey of comparative economic systems is presented. Prerequisite: Economics 200.
(3–0–3) *Mr. Edwards*

Economics 375b. *Economic Analysis II*

The theory of national income determination and growth; a critical consideration of selected theories of income fluctuations; some applications of theory to policy questions. Prerequisite: Economics 200.
(3–0–3) *Mr. Edwards*

Economics 404. *Senior Independent Work*

The student is required to undertake intensive research on the senior thesis topic approved in Economics 304b. The results of his research will be presented in the form of a scholarly paper. Prerequisite: Economics 304b.
(0–0–6) *Staff*

Economics 410b. *The Economics of Labor Relations*

A survey of the history and current status of the labor movement in the United States; organization and structure of labor unions; trends in labor legislation; collective bargaining and the settlement of labor disputes; wage and employment theory; social insurance; current labor problems and issues. Prerequisite: Economics 200 or approval of the instructor.
(3–0–3) *Mr. Giles*

Economics 420a. *International Economics*

A study of the economic relationships between separate countries in the international economy and between separate regions within the national economy. Prerequisite: Economics 200a.
(3–0–3) *Mr. Auten*

Economics 430a. *Comparative Economic Systems*

Various theoretical models of economic systems are presented as a basis for analyzing the economic operation and the institutional characteristics of several countries. Particular attention is given to the U.S.S.R. and such undeveloped countries as India and China. Prerequisite: Economics 200.
(3–0–3) *Mr. Rimlinger*

Economics 435b. *Government Regulation of Industry*

A study of the nature, enforcement, and economic impact of the federal statute laws regulating monopoly and competition in the United States. Particular emphasis is placed upon the development of legal interpretation of the antitrust laws through precedents established in important cases.
(3–0–3) *Mr. Steele*

Economics 455a. *Financial Policies and Institutions*

The financial policies of large-scale business organizations and the nature and functions of various financial institutions which serve as intermediaries

in the saving-investing process. Both theoretical analysis and empirical data are employed to convey an understanding of the influence of these policies and institutions on the functioning of the economy. Prerequisites: Business Administration 200 and Economics 200a.
(3–0–3) *Mr. Brothers*

Economics 460a. *Management I*

Introduction to personnel management and employee relations; personnel policies; job analysis; wage and salary administration; employee services; labor legislation.
(3–0–3) *Mr. J. Hodges*

Economics 465b. *Management II*

Financial structure of enterprise; principles of internal organization; plant location; control of production and sales; managerial uses of accounting data.
(3–0–3) *Mr. J. Hodges*

Economics 475b. *Taxation and Fiscal Policy*

An analysis of the financial operations of governmental units at the national, state, and local level, chief emphasis being placed upon operations at the federal level. Theoretical analysis of monetary and fiscal policies to promote economic stability is combined with an economic appraisal of the United States tax structure. Special attention is given to the incentive effects of taxation and the prospects for long-run economic growth and development. Prerequisite: Economics 200a.
(3–0–3) *Mr. Steele*

Economics 490a. *The Development of Economic Institutions*

A seminar devoted to the analysis of the impact of technological change and political and social developments upon the evolution of economic institutions. Investigation will be made of economic forces which lie beyond supply-and-demand factors in the market economy. The course will survey the works of leading institutional economists and social anthropologists as a point of departure for research and discussion.
(3–0–3) *Mr. Giles*

Business Administration 200. *Introduction to Business*

Accounting principles; financial statements; business organization and procedures; financial structure, internal organization, and accounting problems of partnerships and corporations; negotiable instruments; manufacturing costs; analysis and interpretation of financial reports.
(3–0–6) *Messrs. Simons and Mackey*

Business Administration 391a. *Cost Accounting*

The methods of accounting for the various elements of manufacturing costs are treated with special emphasis on the use of cost information in

administration and control. Job order, process, and standard cost procedures. Prerequisite: Business Administration 200.
(3–0–3) *Mr. Mackey*

Business Administration 392b. *Principles of Accounting—Intermediate*

Further development of accounting principles. Construction of financial and operating statements; interpretation of financial and operating statements; corporations; valuation of assets and liabilities; funds and reserves; application of funds. Prerequisite: Business Administration 200.
(3–0–3) *Mr. Simons*

Business Administration 411a. *Advanced Accounting and Federal Taxation*

Partnerships; consignment and installment sales; insurance; statement of affairs; receiverships; actuarial science; estates and trusts; home office and branch accounting; parent and subsidiary accounting; consolidations, mergers, and financing; foreign exchange. Laboratory hours devoted to the study of federal taxation of the income of individuals. Prerequisite: Business Administration 392b.
(3–3–4) *Mssrs. Simons and Mackey*

Business Administration 412b. *Auditing and Federal Taxation*

Financial examination theory and procedure as practiced by the independent certified public accountant; internal control; working papers and reports. Largely based on integrated case study. Laboratory hours devoted to a study of federal taxation of the income of fiduciaries, partnerships, and corporations; estate and gift taxation; oil and gas taxation. Prerequisites: Business Administration 391a, 392b, and 411a.
(3–3–4) *Mr. Mackey*

Sociology 200. *An Introduction to Sociology*

The course includes an analysis of the geographical and biological factors in social evolution, social psychology, and a study of the functions of citizenship. The subject matter involves a survey of modern social problems and their relation to a changing technological and institutional framework.
(3–0–6) *Mr. Giles*

Education

Education 310. *The History of Education*

A survey of the development of education in theory, organization, and practice from ancient times to the present.
(3–0–6)

Education 410. *Professional Education*

By means of group preparation and presentation, lectures, and reading notes, the prospective teacher acquires knowledge required of a member of the teaching profession.
(3–0–6)

Education 420. *Methods, Observation, and Student Teaching, Grades 7–12*

Required of students who plan to teach in the secondary schools. Meets three hours per week on the campus during the instruction period in methods of teaching and in preparation for the actual teaching. Observation and supervised student teaching off the campus in the schools for half-day placement for a period of sixteen weeks. Open only to Senior students and Class C graduate students who have the approval of the instructor, as an additional course not to be counted in the degree program.
(Credit: 9 semester hours)

In planning his courses, the student who wishes to receive a recommendation for a teacher's certificate should:

(1) Take History 110 and Political Science 210, preferably during the Freshman and Sophomore years; Psychology 300, either the Junior or Senior year; Education 310, the Junior year; and Education 410 and Education 420, the Senior year.
(2) Consult early with the chairman of the department in which he plans to major.

Electrical Engineering

Electrical Engineering 340. *Elementary Electronics and Circuits*

Fundamental principles of vacuum tubes, gaseous conduction tubes, transistors, and their associated circuits. General circuit theory. For students of chemical, civil, and mechanical engineering. Prerequisites: Physics 200a and Mathematics 200 or 210. Laboratory fee required.
(4–3–5)

Electrical Engineering 342. *Elementary Electronics and Circuits*

Fundamental principles of vacuum tubes, gaseous conduction tubes, transistors, and their associated circuits. General circuit theory. For students of electrical engineering. Prerequisites: Physics 200 and Mathematics 200 or 210.
(4–3–5)

Electrical Engineering 403. *Electrical Machinery and Circuits*

Fundamental principles of electrical engineering for civil and mechanical engineering students. Prerequisites: Electrical Engineering 340 and Mathematics 300 or 310. Laboratory fortnightly. Laboratory fee required.
(3–1½–7)

Electrical Engineering 412. *Introduction to Electrical Machinery and Controls.*

Fundamental principles of electrical machinery and controls for chemical engineering students. Prerequisites: Electrical Engineering 340 and Mathematics 300 or 310. Laboratory fortnightly. Laboratory fee required.
(3–1½–3)

Electrical Engineering 413. *Electrical Machinery and Transmission Lines*

Theory of d-c machinery, transformers, a-c machinery, and transmission lines. Prerequisites: Electrical Engineering 342 and Mathematics 300 or 310. Laboratory fortnightly.
(3–1½–7)

Electrical Engineering 443. *Electrical Engineering Devices*

An introduction to principles of design. Electrical engineering materials and components. Electronic circuits (a one semester continuation of Electrical Engineering 342). Prerequisites: Registration in or completion of Electrical Engineering 413. Laboratory fee required.
(3–3–8)

Electrical Engineering 473. *Electrical Engineering Analysis I*

Introduction to and application of selected mathematical methods useful in the solution of engineering problems. Mathematical formulation of engineering problems; methods of solution; physical interpretation of results. Field theory; matrix algebra; transform methods; some classical partial differential equations. Prerequisite: Mathematics 300 or 310.
(3–0–6)

Electrical Engineering 503. *Advanced Circuit Theory. Field Theory*

Mathematical theory of time-invariant linear circuits, including selected topics on transmission line theory. Applications of electromagnetic field theory. Prerequisites: Electrical Engineering 413 and 473.
(3–0–6)

Electrical Engineering 505. *Seminar*

(1–0–2)

Electrical Engineering 513. *Advanced Electrical Machinery and Controls. Servomechanisms*

Theory of electrical machinery and controls; calculation of characteristics; application of electronic and magnetic controls and circuits; symmetrical components; the machine as a circuit element; electrical system stability; servomechanisms; power rectifiers. Prerequisites: Electrical Engineering 413; registration in or completion of Electrical Engineering 503 and 573; registration in Electrical Engineering 553.
(3–0–6)

Electrical Engineering 523. *Electrical Design*

The application of fundamental theory to the design of electrical apparatus. Prerequisites: Registration in or completion of Electrical Engineering 503 and 513. Laboratory fee required.
(3–4–8)

Electrical Engineering 543. *Electronics and Communications Engineering*

Electronic devices and circuits and their applications in communication engineering and related fields. Systems at audio, radio, and microwave frequencies. Prerequisites: Registration in or completion of Electrical Engineering 503. Laboratory fee required.
(4–4–10)

Electrical Engineering 553. *Advanced Laboratory Measurements*

Laboratory studies of electrical machinery and circuits, power rectifiers, electronic and magnetic control devices and circuits, and servomechanisms; electrical measurements, electronic computer studies. Prerequisite: Registration in Electrical Engineering 513. Laboratory fee required.
(1–8–7)

Electrical Engineering 573. *Electrical Engineering Analysis II*

Continuation of Electrical Engineering 473. Electronic differential analyzer; functions of a complex variable; Boolean algebra; probability. Prerequisite: Electrical Engineering 473.
(3–0–6)

Electrical Engineering 593. *Electrical Engineering Problems*

Under certain conditions, an electrical engineering major with advanced standing may carry out an investigation of selected electrical engineering problems under the direction of a member of the electrical engineering staff. Laboratory fee required.
(1–9–8)

Electrical Engineering 603. *Advanced Circuit Analysis*

Advanced topics in the dynamics of time-invariant linear systems; foundations of statistical communication theory; selected topics in related fields of interest.
(3–4–8)

Electrical Engineering 605. *Graduate Seminar*

(1–0–2)

Electrical Engineering 607. *Nonlinear Circuit Analysis*

Consideration of various electronic circuits whose performance depends on nonlinear phenomena. Physical circuits are examined and the pertinent approximate equations are formulated. This is followed by an analytical treatment of these equations.
(3–0–6)

Electrical Engineering 613. *Advanced Servomechanisms*

Mathematical formulation of the control problem; linear servo analysis and synthesis; design criteria and optimum synthesis; sampled-data systems;

nonlinear systems. Prerequisite: Registration in or completion of Electrical Engineering 603.
(3–4–8)

Electrical Engineering 643. *Advanced Electronics and Communications Engineering*

Electromagnetic theory and wave propagation; angle modulation; frequency analysis; electroacoustical systems; selected topics in related fields of interest.
(3–4–8)

Electrical Engineering 645. *Electronic Circuit Synthesis*

It is assumed that the student is familiar with the analysis of electronic circuits. Performance specifications are considered and circuits are synthesized to meet these requirements. Certain of these are constructed and tested. Particular attention is given to second order effects on the operation of these circuits.
(3–0–6)

Electrical Engineering 653. *Theory of Electrical Machinery*

Treatment of electrical machinery from concepts of generalized circuit theory and energy flow.
(3–4–8)

Electrical Engineering 690. *Research and Thesis*

Engineering

Courses listed as *Engineering*, are basic courses for students majoring in the several branches of engineering. More advanced courses are described under the names of the four engineering departments: chemical (p. 88), civil (p. 97), electrical (p. 107) and mechanical (p. 133).

Engineering 201. *Engineering Mechanics—Statics*

Coplanar and noncoplanar static force systems analyzed by algebraic and graphical methods. Controids and moments of inertia of areas and bodies. Friction. Prerequisites: Mathematics 100, Physics 100.
(3–0–3)

Engineering 205. *Engineering Graphics*

An engineering course which develops graphics as a method of exchanging ideas. Included are orthogonal projection, sketching, dimensioning. ASA and SAE standards, pictorial projection and lettering. Staff approval of all drawing instruments is required. Laboratory fee required.
(0–6–2)

Engineering 215. *Engineering Graphics*

Emphasis on the graphical method of solving technical problems. Included are graphical arithmetic, graphical calculus, nomography, and relationships of algebraic and graphical solutions of problems in space. Prerequisite: Engineering 205 and completion or registration in Mathematics 200 or 210. Laboratory fee required.
(0–6–2)

Engineering 302. *Engineering Mechanics—Dynamics*

Application of Newton's second law to problems of translation, rotation, and plane motion of rigid bodies. Work and energy methods. Impulse and momentum. Prerequisites: Engineering 301.
(3–0–3)

Engineering 360. *Kinematics*

The study of kinematics of the motion of particles and rigid bodies, the relative motion of machine parts, instant centers, and gearing. Prerequisites: Physics 100, Mathematics 100, registration in Mathematics 200.
(3–3–4)

English

English 100. *Introduction to Critical Reading, Thinking, and Writing*

Special attention will be given to expository writing and to the study of literary forms.
(3–0–6) *Messrs. Conner, Dowden, Gallegly, Cope, Parish, Pickard, G. Williams, and others*

English 210. *Argumentation and Public Speaking*

Practical training in the fundamentals of effective speech, written argument, and debate. Designed to prepare the student for the ordinary demands of business life. Platform speaking, themes, conferences. This course is planned for students of physical education.
(3–0–6) *Mr. Gallegly*

English 230. *Selected Great Books of European Literature*

Readings, lectures, discussions, and reports.
(3–0–6) *Mr. McKillop*

English 240. *Modern and Ancient Narrative in Prose, Verse, and Drama*

Through readings, lectures, discussions, and reports, a study will be made of prose fiction, poetic fiction, and drama. Specific forms to be treated are the fable, the tale, the epic, the romance, the dramatic monologue, the short story, the novel, comedy, and tragedy.
(3–0–6) *Messrs. Conner, Marsh, Parish, Pickard, and Thomas*

English 250. *Masters of English Literature*
(3–0–6) *Mr. A. Williams*

English 300. *English Drama from Its Beginnings to 1642*

The development of the drama will be traced from the miracle plays and the moralities through the plays of Shakespeare and his contemporaries to the closing of the theaters. Some emphasis will be placed upon the development of Shakespeare as a dramatist, and upon the indebtedness of Shakespeare to the earlier drama.
(3–0–6) *Mr. Camden*

English 310. *Modern British Poetry*

A survey of British poetry from 1890 to date, with special emphasis on major intellectual developments of the period as they have been reflected in the poetry.
(3–0–6) *Mr. G. Williams*

English 320. *Modern Drama*

A study of representative English, American, and Continental plays and dramatic movements since Ibsen against the background of antecedent theatrical traditions of the nineteenth century. Lectures and class discussions will be supplemented by reports on collateral reading.
(3–0–6) *Mr. Thomas*

English 325. *Greek and Latin Literature.*

A study of Greek and Latin classics in the best available translations. Some emphasis will be placed on the debt of modern civilization and literature to classical antiquity. Not open to students who have credit for English 230 or English 240.
(3–0–6) *Mr. Marsh*

English 330. *Advanced Writing*

The writing of essays, stories, plays, and novels. Time is given also to problems of marketing manuscripts. Stories will be read and analyzed, and critical theories are discussed. Frequent conferences.
(3–0–6) *Mr. G. Williams*

English 340. *The English Novel*

Major novelists of the nineteenth and early twentieth centuries.
(3–0–6) *Mr. McKillop*

English 350. *Poetry and Prose of the Romantic Period*

Study of the poetry from Blake to Keats; reading of selected prose from Lamb to Carlyle.
(3–0–6) *Mr. Dowden*

English 355. *Victorian Literature*

The main procedure is close reading and class discussion of assigned texts from the major writers of poetry and nonfictional prose. Connections with other literature of the period, and with the social and political background, will be made through lectures, collateral reading, and reports.
(3–0–6) *Mr. Thomas*

English 360. *English Drama from 1660 to 1900*

This course begins with the opening of the theaters after the Puritan Revolution and covers the drama of the Restoration, the eighteenth century, and the nineteenth century.
(3–0–6) *Mr. A. Williams*

English 375b. *James Joyce and the Modern English Novel*
(3–0–3) *Mr. Cope*

English 380. *Poetry of the English Renaissance*

Major poets of the period and their relation to the political, religious, and scientific issues.
(3–0–6) *Mr. Parish*

English 390. *American Literature from the Beginnings to 1880*

A survey of American literature from Colonial times to the genteel tradition of post Civil War days and the beginnings of naturalism. Particular emphasis is placed on major nineteenth century figures like Poe, Hawthorne, Melville, Emerson, Whitman, Twain, and James.
(3–0–6) *Mr. Pickard*

English 393. *American Literature from 1880 to the Present*

A survey of modern trends in American Literature, beginning with the naturalist writers. Major figures like Dreiser, Eliot, Hemingway, Faulkner, and O'Neill will receive special emphasis.
(3–0–6) *Mr. Pickard*

English 395. *Life and Literature of the West and Southwest*
(3–0–6) *Mr. Gallegly*

English 400. *Shakespeare*

A close study of certain of the comedies, histories, and tragedies, with lectures on the interpretation of these plays in the light of the Elizabethan mind.
(3–0–6) *Mr. Camden*

English 404. *Directed Reading and Independent Work in English Literature*

Open to students of high standing having a principal interest in English or other modern literatures. Opportunity for independent reading and re-

search will be provided for a selected group who wish to develop individual abilities and significant interests. Papers embodying the results of research will be written. Students will be selected for participation after consultation with the instructor in charge.
(0–0–6) *Mr. Cope*

English 440. *History of the English Language, and Modern English Grammar*
(3–0–6) *Mr. Conner*

English 450. *Literary Allegory in the Sixteenth, Seventeenth, and Eighteenth Centuries.*

A study particularly of *The Faerie Queene, The Winter's Tale, The Tempest, Paradise Lost, Pilgrim's Progress, Absalom and Achitophel,* and *A Tale of a Tub.*
(3–0–6) *Mr. Cope*

English 460. *Sixteenth Century Literature*

A survey of nondramatic literature from Malory to the death of Elizabeth, with special emphasis upon *The Faerie Queene* and *Arcadia.*
(3–0–6) *Mr. Marsh*

English 500. *Topics in English Literary History*

Graduate research and thesis for the degree of Master of Arts.

English 505. *Chaucer*
(3–0–6) *Mr. G. Williams*

English 510. *Old English: "Beowulf"*
(3–0–6) *Mr. Conner*

English 515. *Directed Reading in English Linguistics*
(3–0–6) *Mr. Conner*

English 520. *Seminar in the Romantic Period*
(3–0–6) *Mr. Dowden*

English 530a. *Bibliography and Methodology*

This course is designed to acquaint students with the bibliographical guides and aids to literary research. Attention will also be given to methods of preparing papers, theses, and dissertations.
(3–0–3) *Mr. Thomas*

English 535. *Literary Criticism*

A study of the principles of classical, romantic, and realistic literature as formulated by the major critics from Plato to the present day.
(3–0–6) *Mr. Dowden*

English 540. *Seventeenth Century Prose and Poetry*
(3–0–6) *Mr. Cope*

English 550. *Shakespeare Seminar*
(3–0–3) *Mr. Camden*

English 555. *Seminar in Elizabethan and Jacobean Drama*
(3–0–3) *Mr. Camden*

English 560. *Eighteenth Century Prose and Poetry.*
(3–0–6) *Mr. McKillop*

English 570. *Milton Seminar*
(3–0–6) *Mr. Cope*

English 575b. *Seminar in Seventeenth Century Literature*
(3–0–3) *Mr. Cope*

English 580. *Directed Reading in English Literature*
(3–0–6) *Staff*

English 595. *Pope and Dryden*
(3–0–6) *Mr. A. Williams*

English 600. *Topics in English Literary History*
Graduate research and thesis for the degree of Doctor of Philosophy.

English 700. *Summer Graduate Research.*
Open only to graduate students already admitted to study for an advanced degree. At least forty hours of library study and research per week.

French: *see* Romance Languages

Geology

Geology 200a. *Physical Geology*
An introduction to the study of the physical, chemical and geological processes that produce rocks, economic deposits, and landforms. The laboratory includes map and structure interpretation in addition to the identification of hand specimens of rocks and minerals. Prerequisite: Consent of the Department. Prospective majors in geology are expected to have had Chemistry 120, Physics 100, and Mathematics 100. Laboratory fee required.
(3–3–4) *Messrs. Adams and Rogers*

Geology 201b. *Historical Geology*

An introduction to the study of the physical events of the ancient past from the birth of the earth through the most recent ice age, together with a synopsis of the concurrent changing patterns of life. The laboratory includes the analysis of geological maps with emphasis on the structure of the stratified rocks and their organic remains. Prerequisite: Geology 200a or consent of the Department. Laboratory fee required.
(3–3–4) *Mr. Purdy*

Geology 310. *Mineralogy and Petrology*

Basic introduction to the following topics: crystallography, crystal structure, hand specimen mineralogy, optical mineralogy, petrology and petrography of igneous and metamorphic rocks, and X-ray mineralogy. Laboratory includes work with crystal model, mineral hand specimens, optical techniques such as identification of minerals in immersion oils, hand specimen and thin section petrography, and X-ray technique. Prerequisites: Mathematics 200, Physics 200, or consent of the Department. First term: ((3–4); second term: (3–6); credit: 9. Laboratory fee required.
Messrs. Donnelly and Rogers

Geology 321b. *Mineral Resources*

An introduction to the study of the geology, origin, and general economics of mineral and fuel deposits. Topics for study include the analysis of significant occurrences and methods of exploration. Prerequisite: Consent of the Department. Laboratory fee required.
(3–0–3) *Mr. Adams*

Geology 330a. *Structural Geology*

Introduction to structural geology and field methods. Topics covered include description of faults, folds, and other structural features, field methods for recognizing and interpreting structures, mechanics of rock deformation, and elementary tectonics. Laboratory work involves descriptive geometry, plane table surveying, aerial photograph interpretation, and preparation of geologic maps. Prerequisites: Geology 200a and 201b. Laboratory fee required.
(3–4–4) *Mr. Rogers*

Geology 331b. *Sedimentary Petrology*

Introduction to the study of sedimentary rocks. Emphasis is placed on the processes of weathering, transportation, and deposition and on the petrographic attributes of the more important types of sedimentary rocks. Laboratory work is concerned largely with sedimentation analyses and the description of hand specimens and thin sections. Prerequisite: First semester of Geology 310. Laboratory fee required.
(3–4–4) *Messrs. Purdy and Rogers*

Geology 390. *Field Geology*

In addition to the various shorter field trips conducted in connection with a number of the geology courses taken in residence, a summer field course of

not less than six weeks (ordinarily eight weeks) is required of all majors. The work may be taken at any one of several approved university field stations during the summer prior to the senior year. Credit variable. Laboratory fee required.

Geology 400a. *Geobiology*

The morphology, geological record and geographic distribution of the major invertebrate groups characterized by significant fossil representation. Prerequisites: Geology 201b and consent of the Department. Laboratory fee required.
(3–4–4) *Mr. Purdy*

Geology 401b. *Stratigraphy and Index Fossils*

The principles of stratigraphy and stratigraphic analysis. Problems of correlation, standard sections and paleogeography. Prerequisite: Geology 400a. Laboratory fee required.
(3–4–4) *Mr. Croneis*

Geology 405a. *Micropaleontology*

A microscopic study of the plant and animal remains commonly recoverable from drill cuttings. Principles underlying the use of such fossils in local and worldwide correlations. Prerequisite: Geology 401b or consent of the Department. Laboratory fee required.
(2–6–4) *Mr. Croneis*

Geology 411a. *Igneous and Metamorphic Petrology*

Study of the origin and mode of formation of igneous and metamorphic rocks. Emphasis is placed on the application of experimental petrology to field and petrographic evidence concerning major petrologic problems. Laboratory work involves petrographic study of selected suites of important rocks. Prerequisite: Geology 310. Laboratory fee required.
(3–4–4) *Mr. Donnelly*

Geology 455. *Geochemistry*

A study of the geological and chemical processes that produced the observed distribution and abundances of the elements. The age, formation, and heat balance of the earth are some of the topics discussed from a geochemical viewpoint. Prerequisites: Geology 310a and consent of the Department. Laboratory fee required.
(3–4–8) *Mr. Adams*

Geology 460. *Geophysics*

Theory of wave propagation, rays, and wave guides; earthquake and exploration seismology; potential theory; gravity and terrestrial magnetism; heat flow; present knowledge of the earth through geophysics; tectonophysics; contribution of physics to theories of the origin and development of the earth through geologic time. Prerequisite: Consent of the Department. Laboratory fee required.
(3–3–8) *Mr. DeBremaecker*

Geology 480. *Research in Geology*

Advanced work adapted to the needs of the individual student. Credit variable. Laboratory fee required.

Geology 490. *Recent Advances in Geology*

A study of recent research in specific fields under the guidance of a member of the staff. Credit variable. Laboratory fee required.

Geology 500. *Special Studies*

Advanced work in certain phases of geology, adapted to the needs of individual graduate students. Registration permitted only with consent of the department. Credit variable.

Geology 505a. *Biostratigraphy*

A consideration of the paleoecologic principles and porcesses used to reconstruct the life relationships and habitats of fossil organisms. Concepts of community ecology and biogeography will be discussed and statistical methods of analysis will be emphasized. Prerequisites: Geology 400a and 540a (may be taken concurrently).
(3–3–4) *Mr. Purdy*

Geology 506a. *Advanced Paleontology*

A study of the major features of evolution as exemplified by fossil invertebrates. Topics considered include rates of evolution, adaptation, and extinction. Prerequisite: Geology 505a (may be taken concurrently).
(3–3–4) *Mr. Purdy*

Geology 510-517. *Seminars in Geology*

Courses covering the subjects listed in sequence under Research Courses numbered 590–597. Individual seminars may cover different topics in different years and may be taken more than once.
All seminars three units per semester.

Geology 518a. *Marine Geology*

Geology and geophysics of oceanic areas. Topics covered include the basic structure of oceanic parts of the crust, marine geologic processes, and the origin and development of submarine geomorphologic features. The course will be handled largely in seminar fashion.
(3–3–4) *Mr. Officer*

Geology 519b. *Geotechnics*

Basic problems of engineering geology and application of geologic and geophysical methods to their solution. The course will be handled largely in seminar fashion.
(3–3–4) *Mr. Officer*

Geology 530b. *Advanced Sedimentary Petrology*

A survey of sedimentary processes (weathering, transportation, deposition, and diagenesis) and sedimentary rocks. Selected topics will be studied in the fields of sedimentary mineralogy, lithofacies analysis and environmental interpretation, and tectonic sedimentation. Laboratory work includes sedimentation analysis and thin section study of sedimentary rocks.
(3–4–4) *Messrs. Rogers and Purdy*

Geology 535b. *Optical Mineralogy and X-ray Techniques*

The course is devoted largely to the techniques of making optical measurements on minerals. Universal stage techniques are studied in detail. Rock-forming minerals will also be studied by X-ray powder diffraction methods.
(3–6–5) *Mr. Donnelly*

Geology 540a. *Statistical Geology*

Fundamentals of statistical analysis and their application to geologic problems. Topics covered include sampling distributions, comparison of means and variances, correlaton and regression, chi-square analysis, variance analysis, and handling of multiple sets of data.
(3–3–4) *Mr. Rogers*

Geology 550. *Chemical Geology*

Survey of physical chemistry and its applications to geologic studies. Topics covered include basic thermodynamics, phase equilibria and solution chemistry, reaction kinetics, crystal chemistry and crystal growth.
(3–3–8) *Mr. Rogers*

Geology 560. *Advanced Topics in Geophysics*

Study of selected topics in geophysics, including seismology, gravitation, and geomagetism.
(3–3–8) *Mr. De Bremaecker*

Geology 590. *Research in Physical and Structural Geology*
(0–9–3) *Messrs. Rogers and De Bremaecker*

Geology 591. *Research in Mineralogy*
(0–9–3) *Messrs. Adams and Donnelly*

Geology 592. *Research in Petrography and Petrology*
(0–9–3) *Messrs. Donnelly and Rogers*

Geology 593. *Research in Geochemistry*
(0–9–3) *Messrs. Adams and Rogers*

Geology 594. *Research in Geophysics and Oceanography*
(0–9–3) *Messrs. De Bremaecker and Officer*

Geology 595. *Research in Geobiology and Stratigraphy*
(0–9–3) *Messrs. Croneis and Purdy*

Geology 596. *Research in Economic and Petroleum Geology*
(0–9–3) *Staff*

Geology 597. *Research in Regional Geology*
(0–9–3) *Staff*

German

German 100. *Elementary German*

Grammar, conversation, and extensive reading.
(3–0–6)

German 200. *Intermediate German: Literary*

Reading of several works of literary excellence. Outside reading.
(3–0–6)

German 201. *Intermediate German: Scientific*

The work of the first semester is identical with that in German 200. May be offered as prerequisite for advanced courses.
(3–0–6)

German 205. *Intermediate German: Literary and Scientific*

The work of the first semester is identical with that in German 200. May be offered as prerequisite for advanced courses. Outside reading second semester in field of major study.
(3–0–6)

German 305. *Writing, Speaking, Translation*
(3–0–6)

German 307. *Philosophical Ideas in German Literature*

Readings in the original will be required.
(3–0–6)

German 309. *History of German Literature*

A comprehensive survey of German literature from its beginnings to the present.
(3–0–6)

German 330. *Romanticism and Realism in German Literature*
(3–0–6)

German 360. *Lessing and Schiller*

Given in alternate years.
(3–0–6)

German 380. *German Literature since 1880*

Given in alternate years.
(3–0–6)

German 390. *Goethe*

Including the study of *Faust*. Given in alternate years.
(3–0–6)

German 405. *Special Topics in German Literature*

(3–0–6)

German 460. *German Literature, 1400–1750*

Given in alternate years.
(3–0–6)

German 505. *Graduate Research*

(3–0–6)

German 520. *Germanic Philology*

An introduction to the study of Gothic, Old Norse, Old Saxon, Old High German, and the history of the German language. For advanced students in English and German. Given in alternate years.
(3–0–6)

German 530. *Middle High German*

Given in alternate years.
(3–0–6)

History, History of Art, Anthropology and Political Science

History 100. *Foundations of Western Civilization*

This course is intended to provide an historical background for the various humanistic branches of study. It includes a survey of human achievement from the prehistoric times through antiquity and the middle Ages to the eighteenth century.
(3–0–6) *Mrs. Drew*

History 110. *American History*

A survey of the growth of the American nation, with considerable attention to its European background. Recommended as fulfilling the requirements of

prelegal and premedical students and constituting a basic course in history for Freshmen.
(3–0–6) *Mr. Masterson*

History 200. *Modern European History*

This course surveys the history of Europe since 1500, and is intended to serve as background for advanced work in European and American history, literature, and philosophy.
(3–0–6) *Mrs. Drew and Mr. Nelson*

History 300. *Cultural History of the United States*

This course deals with the primary trends in the social and intellectual life of the American people from colonial times to the Civil War, and seeks to interpret them as expressions of the American national spirit. Prerequisite: History 110.
(3–0–6) *Mr. Lear*

History 304b. *Junior Independent Work*

All Juniors majoring in the Department are required to write one or more historical essays, under the supervision of a member of the Department.
(0–0–3) *Staff*

History 310. *American Social History*

Social inheritance of the American people with emphasis on the evolution of social institutions, the arts, education, and similar areas from the beginning of English colonization. Prerequisite: History 110.
(3–0–6) *Mr. Vandiver*

History 315. *Greek and Roman History*

A survey in some detail of the main political, social and economic events of the Greek and Roman world.
(3–0–6) *Mr. Craig*

History 320. *Trends in European Culture during Antiquity and the Middle Ages*

This course traces selected aspects of European thought from Periclean Athens to the later Middle Ages, with special reference to Hellenistic and Greco-Roman influences. Religious, philosophical, and scientific implications are examined in some detail. Prerequisite: History 100.
(3–0–6) *Mr. Lear*

History 350. *Modern Europe, 1715–1870*

The first half of this course contains a study of the Old Regime, the French Revolution, and Napoleon. The second half deals with the rise of liberalism, socialism, and nationalism from 1815 to 1871.
(3–0–6) *Mr. Loewenheim*

History 355. *British History*

This course deals mainly with the period since 1485, although it includes a survey of the constitutional development of the earlier period.
(3–0–6) *Mr. Nelson*

History 370. *Naval and Military History*

The course includes a survey, from ancient times, of war as an instrument of national policy.
(3–0–6) *Mr. Craig*

History 380. *American Economic History*

A study of the economic history of the United States from the colonial period through the Second World War. Examination of broad economic trends will be supplemented by histories of individual firms and business leaders. Prerequisite: History 110.
(3–0–6) *Mr. Galambos*

History 385. *American Political and Social History since the Civil War*

This course examines basic political, social, and intellectual developments in the United States from 1876 to the present. Prerequisite: History 110.
(3–0–6) *Mr. Galambos*

History 390b. *History of the American West*

This course traces the westward movement from its beginnings on the Atlantic seaboard to its culmination on the Pacific. Most attention is given to the history, institutions, and problems of the Trans-Mississippi West, with special emphasis on Texas and the Great Plains. Prerequisite: History 110.
(3–0–3) *Mr. Muir*

History 395. *A History of the South*

A study of the life and economy of the Southern people from the colonial period. Attention is given to such topics as the frontier, the plantation, slavery, sectionalism, and agrarian, social, and industrial problems. Primary emphasis is placed on the institutions and history of the ante-bellum period. Prerequisite: History 110.
(3–0–6) *Mr. Vandiver*

History 404. *Senior Thesis*

All Seniors majoring in the Department are required to write a thesis of 15–25,000 words on a subject to be approved in advance by their departmental adviser. Prerequisite: History 304.
(0–0–6) *Staff*

History 420. *Medieval Sources*

Survey and translation of typical medieval Latin sources. The selections are studied from the point of view of historical significance and of literary

appreciation. This course is intended for students of history and the modern languages who desire some familiarity with ordinary medieval Latin texts. Prerequisite: three or four years of high school Latin.
(3–0–6) *Mr. Lear*

History 430. *Topics in Ancient and Medieval Intellectual History*

This course deals with selective phases of classical and medieval thought based on the cultural monuments of antiquity and the Middle Ages. Intensive reading and reports on special aspects of the field. Prerequisite: History 100.
(3–0–6) *Mr. Lear*

History 440. *Social and Economic History of Europe in the Middle Ages*

The work of this course begins with social and economic conditions in the late Roman Empire, traces their gradual evolution into the "stagnant" conditions of the early Middle Ages, and then considers the important economic changes associated with the eleventh century and their influence on the social and economic institutions of early modern Europe. Open only to advanced students after consultation with the instructor.
(3–0–6) *Mrs. Drew*

History 450. *Contemporary History*

A survey of current world affairs, with lectures and readings on the background of present-day policies and events.
(3–0–6) *Mr. Craig*

History 455. *Modern Europe since 1871*

The subject of this course is the political, diplomatic, and cultural history of Europe from the proclamation of the German Empire to the present.
(3–0–6) *Mr. Loewenheim*

History 460. *English Constitutional History*

A survey of the development of the English constitution with particular attention to the period since 1485.
(3–0–6) *Mr. Nelson*

History 465. *American Colonial History*

A study of American society in the colonial period. Particular attention is given to the social and intellectual background of the Revolution.
(3–0–6) *Mr. Nelson*

History 470. *Foreign Relations of the United States*

This course is primarily a study of American diplomatic history, with some emphasis as well on our political, economic, social, and cultural relations with other nations.
(3–0–6)

History 480. *American Politics*

An advanced survey of American political history. Emphasis is placed on the relationship of politics to economic and social events. Prerequisite: History 110.
(3–0–6) *Mr. Masterson*

History 490. *Topics in American Constitutional and Political History*

Research in the fields of American political history and constitutional development. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Masterson*

History 495. *Civil War and Reconstruction*

A study of the rise of sectionalism, the abolition crusade, the secession crisis, United States versus Confederate States, aftermath of the war, reconstruction, economic and social consequences of the war, and emergence of a New South. Emphasis is placed on social, economic and military events during the years 1861–1865. Prerequisite: History 110.
(3–0–6) *Mr. Vandiver*

History 500. *Historical Research*

Master's thesis.
(3–0–6) *Staff*

History 510. *Directed Reading in American History*
(3–0–6) *Staff*

History 520. *Directed Reading in Medieval History*
(3–0–6) *Staff*

History 530. *Directed Reading in Modern History*
(3–0–6) *Staff*

History 545. *Historiography*

Graduate Seminar.
(3–0–6) *Staff*

History 550. *Studies in the History of the Atlantic Community*

A systematic study of the origins and development of the Atlantic Community from the 1750's to the 1950's. The first semester is devoted to a study of the intellectual and cultural history of the Atlantic Community; the second semester to its diplomatic and military history. Qualified seniors may be admitted by special permission.
(3–0–6) *Mr. Loewenheim*

History 570. *The First World War*

A study of the causes of World War I, the course of the war itself, and the peace settlement of Versailles. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Craig*

History 590. *Seminar in Western American History*

This course includes a study of the leading authorities in Western American history, training in the critical examination of source material, and original research in selected topics of Western history. Open to graduate students, and to Seniors who show a proficiency in history, after consultation with the instructor.
(3–0–6)

History 595. *Topics in Confederate History*

This seminar is devoted to original research in various phases of the history of the Southern Confederacy, 1861–1865. Open to properly qualified students after consultantion with the instructor.
(3–0–6) *Mr. Vandiver*

History 600. *Historical Research*

Doctoral dissertation. *Staff*

History of Art 215. *History of the Architecture, Sculpture, and Painting of the Ancient World*

Emphasis is placed upon the correlation of the arts and their reflection in Renaissance and contemporary developments. Open to students in all divisions.
(3–0–6) *Mr. Chillman*

History of Art 315. *History of the Architecture, Sculpture, and Painting of the Middle Ages*

A study of outstanding examples of western sacred and secular art. Open to students in all divisions.
(3–0–6) *Mr. DeZurko*

History of Art 415. *History of the Architecture, Sculpture, and Painting of the Renaissance and the Subsequent Developments to the Present Time.*

Open to students in all divisions. A general knowledge of ancient and medieval art is desirable for students entering this course.
(3–0–6) *Mr. DeZurko*

History of Art 450. *Great Works of Architecture and Its Related Arts*

A history of art from 500 B.C. to modern times. Masterpieces of architectural composition which combine sculpture and painting. Examples: the

Acropolis at Athens and the cathedral at Chartres. Lectures, discussion, and papers. Open to students in all divisions.
(3–0–6) *Mr. Chillman*

History of Art. 455. *The Art of the Fourteenth and Fifteenth Centuries in Italy*

Open to students in all divisions.
(3–0–6) *Mr. Chillman*

Anthropology 200. (a) *General Anthropology I*

Physical anthropology and archeology. Human evolution, fossil man, human genetics, races of man and problems of race; major outlines of the ancient prehistory of the Old and New Worlds.

(b) *General Anthropology II*

Cultural and social factors. Late prehistory of man and cultural growth; major aspects of culture (social organization, economics, religion); cultural patterns and sociocultural change.
(3–0–6)

Anthropology 300. (a) *Primitive Religion*

Comparative survey of religion and magic; the relationship of religion and magic to other aspects of culture, and their roles with respect to society and and the individual.

(b) *The Nature of Culture*

The nature and basic processes of cultural behavior; cultural and social change; dynamics of cultural life. Illustrative data taken from primitive and modern societies.
(3–0–6)

Political Science 210. *American Government*

A study of the history and operation of constitutional government in the United States with special emphasis on the historical background of the Federal government, the structure of the government, the formation of public policy, and the conduct of public business. For additional background and for contrast, reference is made to English constitutional history and to the present structure of the English government. This year course in American government, planned for the general student of government, is also designed to enable prospective lawyers, physicians, and teachers to meet the state requirement of a course in "Constitutions."
(3–0–6) *Mr. Hudspeth*

Political Science 310. *Law and Society*

The study of law as a part of cultural anthropology and the history of organized society. Emphasis is placed upon the sources of legal doctrine,

specifically illustrated by case law and legislation in the field of contracts, torts, commercial transactions, and domestic relations.
(3–0–6) *Mr. Hudspeth*

Political Science 340. *Foundations of National Power*

A study of the basic factors in political geography and international politics, stressing such elements of national power as geographical location, population, resources, technology, ideology, military strategy, and geopolitical theory.
(3–0–6)

Political Science 410. *Ancient and Medieval Political Theory*

A survey of the main trends in politics and law from antiquity into the later Middle Ages. Open only to advanced students after consultation with the instructor.
(3–0–6) *Mr. Lear*

Political Science 520. *Topics in Legal History and Political Theory*

Much attention is given to methods, materials, and the recent literature in this field. Instruction is based on the translation of several primary sources in Roman and Germanic law, as well as reports on such topics as sovereignty and allegiance. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Lear*

Mathematics

Mathematics 100. *Elementary Analysis*

Calculus and analytic geometry. The idea of the calculus are introduced by considering the rate and area problems. The course includes the differentiation of the elementary function and some of the simpler integration formulae, with applications. Analytic geometry, through a study of the conic sections and the reduction of the general equation of second degree, is treated. This course is required of all freshmen because it forms a necessary introduction to work in mathematics and pure and applied science, and assists the student in developing habits of self criticism in thinking and writing. As one of the most modern of the sciences and at the same time, one of the most ancient of the humanities, mathematics is regarded as an integral part of any general education. Science-engineering sections meet four hours per week.
(3–0–6) or (4–0–8) *Staff*

Mathematics 101. *Fundamental Concepts of Mathematics*

A course designed expressly for students in the academic division and intended to convey an appreciation of the edifice of mathematical ideas, the topics treated being largely chosen for the light they shed on the nature and role of mathematics. The elements of algebraic theory of ruler and compass constructions. The ideas of the calculus are introduced in connection

with the analysis of planetary motion. An important part of the program consists of a critical study of the number systems. The course begins with a brief introduction to the concepts and notation of logic.
(3–0–6) *Staff*

Mathematics 200. *Differential and Integral Calculus*

Systematic integration, definite integral, improper integrals, infinite series, analytic geometry in three dimensions, algebra of vectors and multiple integrals. Applications of physical problems. Prescribed for all science-engineering majors who do not take Mathematics 210. Students who have considerable facility in mathematical reasoning should register in Mathematics 210.
(3–0–6) *Staff*

Mathematics 210. *Differential and Integral Calculus*

This course has the same scope as Mathematics 200 but is more complete and rigorous. It is open to students who have passed Mathematics 100 with high standing, or otherwise satisfy the instructor of their fitness to take the course.
(3–0–6) *Staff*

Mathematics 300. *Advanced Calculus and Differential Equations*

Partial differentiation with applications to geometry of three dimensions, vector analysis and differential equations. This course, or Mathematics 310, is prescribed for all science-engineering students. Open also to other students who have passed Mathematics 200 or 210, or otherwise satisfy the instructor of their fitness to take the course.

Mathematics 310. *Advanced Calculus and Differential Equations*

This course is designed for students with considerable facility in mathematical reasoning. The scope is essentially that of Mathematics 300 but the development is more systematic and rigorous. It is open to students who have passed Mathematics 200 or 210 with high standing or otherwise satisfy the instructor of their fitness to take the course.
(3–0–6) *Staff*

Mathematics 320. *Analytical Mechanics*

Vector analysis, reduction of systems of forces and conditions for equilibrium, dynamics of systems of particles, rigid bodies. Prerequisites: Mathematics 200 and 300. (The latter may be taken concurrently.)
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 330. *Introduction to Higher Algebra*

Properties of determinants and matrices, theory of linear dependence, bilinear and quadratic form, polynomials, invariants, lambda matrices and applications.
(3–0–6) *Staff*

Mathematics 360. *An Introduction to Mathematical Probability and Statistics*

Topics covered will include: conditional probability, Bernoulli's Theorem, law of large numbers, distributions, central limit theorem, correlation, large and small sample theory, goodness of fit, testing statistical hypotheses, and the design of experiments. Insofar as possible, the mathematical foundations will be emphasized. Prerequisite: Mathematics 300 (may be taken concurrently). Enrollment with permission of instructor.
(3–0–6) *Mr. Douglas*

Mathematics 400. *Theory of Functions of a Complex Variable*

This course is fundamental in analysis. Besides giving an introduction to basic concepts of analysis, it includes the study of analytic functions of a complex variable, the Cauchy-Riemann equations, Cauchy's Integral Theorem, Taylor's series, calculus of residues, and conformal mapping.
(3–0–6) *Mr. Ulrich*

Mathematics 410. *Differential Equations and an Introduction to the Calculus of Variations*

Geometry of the integral curves and the classification of the singularities of equations of first order, existence theorems, theory of integrating factors and integration by elementary means, general theory of second order linear equations, oscillation and comparison theorems, fuchsian theory of regular singular points, Eigenvalue problems, general partial differential equations of first order, boundary value problems for certain second order linear systems, and as much calculus of variations as time permits.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 420. *Differential Geometry*

Theory of curves and surfaces, geodesics, mapping of surfaces, the absolute geometry of a surface.
(3–0–6)

Mathematics 430. *Introduction to Modern Geometry*

Synthetic and algebraic geometry, the group of projective transformations and certain subgroups of the group of projective transformations, the geometries defined by these groups, projective correspondences, projective theory of conics.
(3–0–6)

Mathematics 440. *Algebra and Topology*

Groups, rings, fields, vector spaces, topological spaces, fundamentals of homology theory, homotopy, and covering spaces, classification of surfaces, Riemann surfaces.
(3–0–6) *Mr. Brown or Mr. MacLane*

Mathematics 450. *Number Theory*

The fundamental theorem of arithmetic, residue class rings and congruences, quadratic residues and reciprocity law. Numerical functions. Algebraic number fields, factorization and ideals.
(3–0–6) *Mr. Durst*

Mathematics 460. *Numerical Analysis*

Approximate integration and differentiation by finite differences, interpolation, functional approximation, linear and non-linear algebraic equations, eigenvalues, approximate solution of ordinary differential equations and of some simple partial differential equations. A digital computer is available for laboratory use. Prerequisite: Mathematics 300 or 310.
(3–0–6) *Mr. Douglas*

Mathematics 500. *Theory of Normal Families of Functions*

Equicontinuity and Ascoli's Lemma, limiting oscillation of Ostrowski and Caratheodory's continuous convergence, Orsove's theorem on normal families of potential functions, theorems of Vitali and Montel and Mandelbrojt's theory of kernals, location and description of singularities of families of analytic functions.
(3–0–6) *Mr. Johnson*

Mathematics 501. *Theory of Functions of a Complex Variable*

A study of special analytic functions of importance in mathematical physics. The course is usually given as a seminar.
(3–0–6) *Mr. Ulrich*

Mathematics 505a. *Selected Topics from the Theory of Functions of a Complex Variable*

The subject matter of this course varies from year to year. In past years the following topics have been among those presented: singularities of a function defined by a Taylor series, elementary theory of Dirichlet series, approximation theory, and constructive theory of functions.
(3–0–3) *Mr. Mandelbrojt*

Mathematics 510. *Theory of Functions of a Real Variable*

Theory of real numbers, limits and continuity, Lebesgue and Stieljes integrals, general integrals, the theory of differentiation, Fourier series, function spaces, selected topics. The student should be familiar with some of the material of Mathematics 440. These courses could be taken concurrently.
(3–0–6) *Mr. Brown*

Mathematics 520. *Trigonometric Series and Related Topics*

Series expansions in terms of orthogonal systems of functions. Trigonometric series. Fourier transforms and integrals. The course is based upon Mathematics 510.
(3–0–6) *Mr. Bray*

Mathematics 525. *Modern Theory of Meromorphic Functions*

Riemann surfaces and covering surfaces, harmonic measure and logarithmic capacity, the Nevanlinna theory of meromorphic functions and the defect relation, boundary behavior and the theory of cluster sets.
(3–0–6) *Mr. Lohwater*

Mathematics 530. *Laplace Transformations*

Theory of the Laplace transformation with particular reference to the properties of the transform as a function of a complex variable. Applications to the solution of difference equations, integral equations of the convolution type, and ordinary differential systems. Boundary value problems. Certain Sturm-Liouville systems. Abelian and Tauberian theorems. Asymptotic representations.
(3–0–6) *Mr. Ulrich*

Mathematics 535. *Partial Differential Equations*

Theorems of Couchy-Kowalewski and Holmgren, classification of partial differential equations. Cauchy problem for first order hyperbolic systems and the wave equation, boundary value problems for second order hyperbolic, elliptic and parabolic equations, numerical solution of partial differential equations and systems. Prerequisites: Mathematics 410 or 400; preferably both.
(3–0–6) *Mr. Douglas*

Mathematics 540. *Topological Linear Algebra*

Vector spaces. The elementary geometric and algebraic properties of Banach and Hilbert spaces. Normed rings. Operators and spectral theory. Applications and topics of related interest. Prerequisite: Mathematics 510.
(3–0–6) *Mr. Brown*

Mathematics 545. *Theory of Algebraic Functions*

Theory of elliptic functions. Properly discontinuous groups of linear transformations. Automorphic functions. Uniformization of algebraic functions.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 550. *Advanced Theory of Riemann Surfaces*

Topological properties, theory of entire and meromorphic functions, problem of type.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 555. *Recent Developments in the Theory of Riemann Surfaces*

(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 560. *Potential Theory*

Integral theorems of potential theory, Riesz's theorem on potentials of negative mass and subharmonic functions, a flux integral for functions which

have harmonic support, boundary value problems, Piosson Integral and Green's function, exceptional points of the boundary, theorems of Kellogg and Evans, recent researches on boundary topologies.
(3–0–6) *Mr. Johnson or Mr. Lohwater*

Mathematics 570a. *Selected Topics from Advanced Analysis*

The subject matter of this course varies from year to year. In past years the following topics have been among those presented: Fourier transforms in the complex domain, analytic continuation and infinitely differentiable functions, theory of composition, general Tauberian theorems, general problem of moments, closure theorems, general asymptotic representations, zeta-function of Riemann, and analytic theory of numbers, ergodic theory, and monogenic and isogenic functionals and harmonic analysis.
(3–0–3) *Mr. Mandelbrojt*

Mathematics 600. *Thesis*

Mathematical Colloquim

The colloquium usually meets one afternoon every other week in order to allow the exposition of original investigations by its members.

Mechanical Engineering

Mechanical Engineering 350. *Mechanical Processes*

Class and laboratory instruction dealing with welding, heat-treating, foundry and machine shop practice, and their effects on machine design. Practice with a variety of bench and machine tools, carefully selected for their fitness in affording actual contact with machine work and in developing a certain degree of skill and resourcefulness in the student. Plant inspection trips. One semester. Laboratory fee required.
(3–6–5) *Mr. Burghard*

Mechanical Engineering 380. *Process Metallurgy*

Instruction in the mechanical and metallurgical aspects of processes utilized to form metals into machine and structural components. The principles of flow and solidification of liquid metals, plastic deformation, and solid state transformations are considered in the description and analysis of casting, forming, welding, machining and heat treating processes. The laboratory instruction includes practice in the operation of basic machine tools and in foundry and welding techniques. One semester. Laboratory fee required.
(3–3–4) *Mr. Burghard*

Mechanical Engineering 390. *Production Metallurgy*

Class and laboratory instruction in the processes utilized in the production of metals. A study is made of the chemistry and thermodynamics of the reactions involved in ore concentration and in the extraction, refining and alloying of metals. One semester. Laboratory fee required.
(3–3–4) *Mr. Burghard*

Mechanical Engineering 403. *Thermodynamics and Heat Engines*

A general course of lectures, recitations from the text, and laboratory. A detailed exposition of the laws of classical thermodynamics is followed by their application to systems of practical importance. Other topics included are: properties of liquids, gases, and vapors, the thermodynamics of high velocity flow, psychometric principles, and the thermodynamics of gas or vapor power systems and of refrigeration systems. Prerequisite: Full fourth-year standing. Laboratory fortnightly. Two semesters. Laboratory fee required.
(3–1½–7) *Messrs. Chapman and Beckmann*

Mechanical Engineering 423. *Engineering Analysis*

The analysis of engineering problems, with emphasis on the interpretation of results and analogies among the problems of different fields. Undergraduate and graduate credit. Two semesters.
(3–0–6) *Mr. Wilhoit*

Mechanical Engineering 483. *Introduction to Mechanical Design*

A study of those machine elements that require elementary mechanics and stress theory for their design. Attention is directed toward the manufacture of machine elements and their assembly into a working machine. Two semesters.
(½–3–3) *Mr. Burghard*

Mechanical Engineering 505. *Seminar*

A course devoted to the purpose of training engineering students in collecting and presenting orally formal papers on topics of engineering interest. The papers are given by the students, using acceptable material secured from technical periodicals. The course meets weekly and is conducted in the form of a professional society meeting. Required of all mechanical engineering students in the year they are candidates for the bachelor's degree in mechanical engineering.
(1–0–2) *Staff*

Mechanical Engineering 511. *Design of Machine Elements*

The design of components of machines including shafting, beams, springs, clutches, and brakes. A study of stress and strain at a point and strain energy methods. Analysis of curved beams and thick walled cylinders. One semester.
(3–0–3) *Mr. Jacobson*

Mechanical Engineering 512. *Advanced Strength of Materials*

Bending of beams on elastic foundations, elastic stability problems, torsional problems with non-circular cross-sections, thin plates and shells, deformations beyond the elastic limit. One semester.
(3–0–3) *Mr. Jacobson*

Mechanical Engineering 515. *Machine Design Laboratory*

Investigation and design of problems in the field of machine design. One semester. Laboratory fee required.
(0–6–2) *Mr. Jacobson*

Mechanical Engineering 521. *Applied Thermodynamics and Heat Power*

Application of thermodynamics and related fields of study to the solution of problems encountered in mechanical engineering. Emphasis is placed on energy converting systems. Prerequisite: Mechanical Engineering 403. One semester.
(3–0–3) *Mr. Plapp*

Mechanical Engineering 522. *Applied Fluid Mechanics and Fluid Machinery*

Applications of fluid mechanics in mechanical engineering. Particular emphasis is placed on hydraulic machinery, the basic principles of aircraft and missile propulsion, and incompressible and compressible flow in pipes. Prerequisites: Mechanical Engineering 403 and Civil Engineering 402. One semester.
(3–0–3) *Mr. Plapp*

Mechanical Engineering 525. *Advanced Thermodynamics and Heat Power Laboratory*

Advanced laboratory work in thermodynamics, heat transfer, and fluid mechanics consisting of at least one small research project in addition to a number of tests of common items of equipment. This course is ordinarily taken concurrently with Mechanical Engineering 521. One semester. Laboratory fee required.
(0–6–2) *Mr. Plapp*

Mechanical Engineering 532. *Internal-combustion Engines and Fuels*

A study of the theory, characteristics, and operation of gasoline, gas, and oil-burning engines for automotive, stationary, and marine service, including the production and characteristics of the fuels used. Prerequisite: Mechanical Engineering 403. One semester. Laboratory fee required.
(3–3–4)

Mechanical Engineering 541. *Physical Metallurgy I*

A study of the fundamentals of alloying and heat treatment. Mechanical and non-mechanical properties of metallic systems. Analysis of various basic types of metal forming processes. An introduction to oxidation and corrosion of metals. One semester. Laboratory fee required.
(3–3–4) *Mr. Brotzen*

Mechanical Engineering 542. *Physical Metallurgy II*

Introduction to X-ray metallography. Thermodynamics of alloy systems. Mechanism and kinetics of transformations. A fundamental study of the mechanical behavior of metals and alloys. Prerequisite: Mechanical Engineering 541 or equivalent. One semester. Laboratory fee required.
(3–3–4) *Mr. Brotzen*

Mechanical Engineering 555. *Chemical Metallurgy*

Metals are considered from the standpoint of their chemical properties. The fundamental aspects of corrosion and oxidation of metallic materials are given primary consideration. Solubility and diffusion of gases in metals are also discussed. One semester.
(3–0–3) *Mr. Masson*

Mechanical Engineering 563. *Advanced Metallurgical Laboratory*

Students whose interest lies primarily in the fields of materials and metallurgy are given the opportunity for research in these fields. The student will be able to work on problems of a basic nature. Two semesters.
(0–4–2) *Staff*

Mechanical Engineering 570. *Mechanical Vibrations*

Theory of harmonic vibrations with several degrees of freedom. Applications to balancing of rotating machinery, vibration isolation, and the calculation of critical speeds of rotating shafts. Prerequisite: Mechanical Engineering 423. One semester.
(3–0–3) *Mr. Paslay*

Mechanical Engineering 590. *Heat Transfer*

A general course of lectures and recitations from text covering a basic study of the laws of heat transfer by conduction, convection, and radiation. Prerequisites: Mechanical Engineering 403 and 423. One semester.
(3–0–3) *Mr. Chapman*

Mechanical Engineering 593. *Mechanical Engineering Problems*

If conditions are favorable, mechanical engineering students may elect at least nine hours a week in approved investigations or designs under the direction of a member of the staff.

Mechanical Engineering 605. *Graduate Seminar*

(1–0–2) *Staff*

Mechanical Engineering 615. *Advanced Dynamics*

Dynamics of a particle, dynamics of a system of particles, Hamilton's principle, and LeGrange's equations. Applications to advanced engineering problems including gyroscopic motion and the vibration of elastic bodies. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 623. *Advanced Engineering Analysis I*

An introduction to the theory of the complex variable and to vector analysis with particular emphasis on engineering applications in the fields of fluid dynamics, heat conduction and elasticity. One semester.
(3–0–3) *Messrs. Plapp, Wilhoit, Chapman*

Mechanical Engineering 625. *Advanced Engineering Analysis II*

Advanced topics in engineering analysis. The subject matter may vary from year to year depending on the background of those enrolled. Among topics which may be considered are: the calculus of variations, integral equations, matrix methods, tensor analysis, partial differential equations, statistics and probability, numerical methods, and their engineering applications. One semester.
(3–0–3) *Staff*

Mechanical Engineering 631. *Plasticity*

Formulation of stress-strain relations and methods of solution for plastic flow. Specific topics covered include axially symmetric two-dimensional problems, two-dimensional slipline theory for non work-hardening materials and corresponding problems, limit analysis with applications and anistotropic flow. One semester.
(3–0–3) *Mr. Paslay*

Mechanical Engineering 634. *Thermodynamics of Alloys*

Discussion of equilibrium conditions in liquid and solid metallic solutions. Analysis of thermodynamic quantities from the classical and statistical points of view. Specific heat, thermal expansion coefficient and compressibility of metallic systems are studied. One semester.
(3–0–3)

Mechanical Engineering 635. *Transformations in Alloys*

Diffusion and nucleation in the solid state. Order-disorder reactions. The kinetics and mechanisms of allotropic transformations, including diffusionless processes. One semester.
(3–0–3)

Mechanical Engineering 636. *X-ray Metallography*

A study of the diffraction of X-rays by crystals. Application of single crystal and powder techniques to physical metallurgy. Stress measurements, particle size determination, and the effects of crystalline defects on diffraction. One semester.
(3–0–3)

Mechanical Engineering 644. *Lattice Imperfection Theory*

Dislocations in otherwise perfect media: the geometry of dislocations in a continuum, their stress fields and interactions. Dislocations in real crystals: (dislocation reactions, dislocation interaction with other crystal imperfec-

tions) and theories concerning the origin of dislocations. The presence and behavior of lattice vacancies and intertestials of solids. Production of these defects by different methods including irradiation. One semester.
(3–0–3) *Mr. Roberts*

Mechanical Engineering 645. *Mechanical Metallurgy*

Elastic, plastic, and viscous behavior of metallic solids. The interpretation of mechanical behavior in terms of lattice imperfection theory. Discussion of fracture, fatigue, creep, and damping in metals. One semester. Prerequisite: Mechanical Engineering 644.
(3–0–3) *Mr. Roberts*

Mechanical Engineering 646. *Theory of Metallic Structures*

Electron theory of metals, starting with the Free-electron model and leading to Brillouin Zones and Band Theory. Metallic structures and solid solubilities are interpreted in the light of these theories. One semester.
(3–0–3) *Mr. Brotzen*

Mechanical Engineering 647. *Physical Properties of Solids*

Based on the electron theory of metals, the electrical and thermal conductivities of metals are studied. The origin and behavior of diamagnetic, paramagnetic and ferromagnetic materials are considered. A discussion of semiconductors will be included. Prerequisite: Mechanical Engineering 646 or equivalent. One semester.
(3–0–3) *Mr. Brotzen*

Mechanical Engineering 653. *Research and Thesis*

A report on an engineering investigation carried out by the individual student under the direction of a member of the staff in mechanical engineering. Nine hours of research weekly. Three copies of the accepted report will be required: two for deposit in the Institute library and one for the mechanical engineering department.

Mechanical Engineering 661. *Theory of Elasticity*

State of stress at a point, state of strain at a point, and stress-strain relations. The general equations of three-dimensional theory of elasticity are considered. A treatment of the two-dimensional theory, including plane stress and plane strain is included. Also discussed are the states of stress in rectangular, circular and ring shaped plates, and the torsion and flexure of uniform bars of any cross-section. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 662. *Additional Topics in the Theory of Elasticity*

The use of complex variables is applied to two-dimensional elasto-static problems. Three-dimensional problems in the theory of elasticity are considered. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 663. *Special Topics in Applied Mechanics*

A collection of several topics not currently included in other courses. The topics include engineering applications of variational calculus methods, thermodynamic conditions imposed on the formulation of stress-strain equations, stress wave propagation and nonlinear elasticity and vibration problems. One semester.
(3–0–3) *Messrs. Wilhoit and Paslay*

Mechanical Engineering 665. *Theory of Plates and Shells*

The bending of rectangular and circular flat plates with various edge conditions is discussed. An introduction to plate buckling and vibration is given. The membrane theory of shells and the general theory of cylindrical shells is treated. One semester.
(3–0–3) *Mr. Paslay*

Mechanical Engineering 670. *Advanced Thermodynamics*

A continuation of the study of the principles of thermodynamics. Primarily a thorough course in the fundamental concepts of thermodynamics not usually covered in undergraduate courses. A detailed consideration of energy and its transformations, the laws of thermodynamics, reversibility, entropy, and examples of applications to various fields. One semester.
(3–0–3) *Mr. Plapp*

Mechanical Engineering 673. *Advanced Fluid Dynamics*

A course emphasizing topics in classical fluid dynamics. The material consists of the fundamentals of frictionless flow, airfoil theory, and ducted flow. Equal time is devoted to the flow of viscous fluids. Primary attention is given to boundary layer flow and to turbulent flow. Two semesters.
(3–0–6) *Mr. Beckmann*

Mechanical Engineering 675. *Special Applications of Fluid. Dynamic Theories*

Special topics of greater interest are emphasized, comprising the hydrodynamic theory of lubrication, cavitation, flow through porous materials, admixtures of solid particles to flowing fluids, flow of two non-mixing liquids of different densities, the fluid dynamics of meteorology, and others. Two semesters.
(3–0–6) *Mr. Beckmann*

Mechanical Engineering 680. *Advanced Heat Conduction*

Advanced work in the field of heat conduction. The course consists of a presentation of the general conduction equation and methods of solution in one-, two-, and three-dimensional problems and in the transient state. An examination is made of the problems of extended surfaces and internal heat sources. One semester.
(3–0–3) *Mr. Chapman*

Mechanical Engineering 682. *Theory of Convective Heat Transfer*

A basic examination of the processes of forced and free convection in laminar and turbulent flow. Development of the basic flow equations and a presentation of the more important cases for which they have been solved. One semester.
(3–0–3) *Mr. Plapp*

Mechanical Engineering 693. *Advanced Gas Dynamics*

Analysis of the general equations of fluid flow. Properties of compressible fluids. Subsonic and supersonic flow in the steady and non-steady states and in one, two, and three dimensions. Shock waves and other phenomena connected with high-velocity flow. Analysis of the general properties of quasi-linear hyperbolic differential equations. Two semesters.
(3–0–6) *Mr. Chapman*

Mechanical Engineering 695. *Special Research Topics in Mechanical Engineering*

Individual laboratory or library research investigations under the direction of a member of the mechanical engineering staff.

Music

(The Shepherd School of Music)

Music 300. *Orientation and Analysis*

An investigation into the technical, psychological, and social aspects of music. Prerequisite: Junior standing.
(3–0–6) *Mr. Hall*

Music 400. *Medieval and Renaissance Music contrasted with Modern Music*

A comparison of the techniques of the periods showing the development and expansion of basic principles of composition. Prerequisite: Music 300 or its equivalent and instructor's permission.
Mr. Hall

Philosophy

Philosophy 100. *An Introduction to Responsible Thinking*

The theory of responsible thinking, or logic; responsible thinking about human nature, or moral philosophy, with extensive reading and discussion of philosophical classics.
(3–0–6) *Mr. Fulton*

Philosophy 210. *Introduction to Philosophy*

Ethics: an introductory study of the development of moral ideas and of the problems of morality in our civilization. Logic: the principles according

to which evidence is weighed and right conclusions are drawn in everyday thought as well as in the systematic thinking of science and philosophy.
(3–0–6) *Mr. Black*

Philosophy 220. *Philosophical Classics*

Reading of philosophical works which have helped to mold the mind of Western man, and discussion of problems in philosophical method, ethics, social and political philosophy, and esthetics.
(3–0–6) *Mr. Kolenda*

Philosophy 300. *History of Philosophy*

An historical survey of the essential features and main currents of philosophical thought, ancient, medieval, and modern.
(3–0–6) *Mr. Fulton*

Philosophy 310. *History of Religions*

An introductory study of the historical development of he principle religions.
(3–0–6) *Mr. Nielsen*

Philosophy 340. *Foundations of Knowledge and Valuation*

Investigation of knowledge-yielding procedures in science and in other types of inquiry, with special emphasis on ethics.
(3–0–6) *Mr. Kolenda*

Philosophy 350. *Philosophical Ideas in Literature*

Reading and discussion of literary works which reflect the movement of thought from the time of the Enlightenment to the present. German literature, in original and translation, will be studied. The course is also listed as German 307.
(3–0–6) *Mr. Kolenda*

Philosophy 360. *Aesthetics*

A systematic study of the nature of the art object, the meaning of the aesthetic experience, and the nature of the creative process. Reading and discussion of philosophical writings on aesthetics, with constant reference to the arts, particularly literature and music.
(3–0–6) *Mr. Mackey*

Philosophy 410. *Philosophy of Religion*

An examination of the basic ideas and problems of religious thought.
(3–0–6) *Mr. Nielsen*

Philosophy 420. *Types of Philosophical Theory*

First semester: Types of logic. Second semester: Trends in contemporary ethical theory.
(3–0–6)

Philosophy 430. *Modern Philosophical Classics*

Reading and discussion of selected masterpieces of modern philosophy.
(3–0–6) *Messrs. Fulton and Kolenda*

Philosophy 440. *Philosophy Since 1900*

Critical reading of major philosophical works.
(3–0–6)

Philosophy 450. *Seminar in Religious Philosophy*

A critical study of the major religious traditions through analysis and discussion of selected theological problems.
(3–0–6) *Mr. Nielsen*

Philosophy 460. *Social and Political Philosophy*

A survey of fundamental problems of social ethics and political theory.
(3–0–6) *Mr. Nielsen*

Philosophy 500. *Problems in Systematic Philosophy*

Thorough critical examination of selected topics. For graduate students and specially qualified seniors.
(3–0–6)

Philosophy 510. *Graduate Philosophical Research and Thesis*

Physical Training and Physical Education

Physical Training 100.

This course is designed to familiarize the students with the physical education and equipment available to them at the Rice Institute, to discuss the place and importance of health and physical education in our modern society and to teach the skills and knowledge of physical education activities, including recreational games and sports. Required of all Freshmen. Two two-hour periods each week.
(0–4–0) *Staff*

Physical Education 100. *Introduction to Health, Physical Education, and Recreation*

An introductory course to the professional study of health, physical education, recreation, and camping. Units of instruction include orientation, vocational analysis, educational and scientific foundations, and personal hygiene.
(3–0–6) *Messrs. Hermance and LeBar*

Physical Education 125. *Laboratory Experiences in Team and Group Activities*

Activities covered are soccer, speedball, tennis, gymnastics, touch football, swimming, diving, Senior Red Cross Life Saving, and water safety. For each

of the activities the history, specific values, court and field construction, activity skills and game formations, techniques and methods of teaching and coaching, audio-visual aids, and officiating are studied. Laboratory fee required.
(0–6–4) *Mr. Weston*

Physical Education 150. *Physical Science*

An introduction to the study of physiography, chemistry, and physics for students preparing to enter the field of health education and physical education. The course covers the fundamental principles of chemistry including matter, elements, gases, acids and bases, metals and alloys, biochemistry, and the science of nutrition. The physics unit includes the fundamental principles of mechanics, heat, magnetism, electricity, sound and light as they apply to movements in physical education activities. Laboratory fee required.
(3–0–6) *Mr. Weston*

Physical Education 200. *Fundamentals of Health Education and Physical Education*

The first semester is a study of the principles, organization, administration, materials and methods of community recreation programs, intramural sports, and safety education, physical education, recreation, and camping. Current problems and research form an integral part of the work during the second semester.
(3–0–6) *Messrs. Barker and Weston*

Physical Education 225. *Laboratory Experiences in Individual Recreational Activities*

Activities covered are archery, casting, handball, squash, volleyball, badminton, fencing, and apparatus. For each of the activities the history, specific values, court and field construction, activity skills and game formations, techniques and methods of teaching and coaching, audio-visual aids, and officiating are studied. Laboratory fee required.
(0–6–4) *Mr. Barker*

Physical Education 300. *Scientific Foundations of Health Education and Physical Education*

This course includes a systematic study of tests and measurements, physiology of exercise, kinesiology, and adaptive physical education in the fields of health education, physical education, recreation and camping.
(3–0–6) *Mr. Bearden*

Physical Education 325. *Laboratory Experiences in Developmental, Recreational, and Sports Activities*

Activities covered are lead-up games, indoor and outdoor recreational games, basic rhythms, golf, boxing and wrestling. For each of the activities the history, specific values, facilities, equipment, activity skills, techniques

and methods of teaching and coaching, audio-visual aids, officiating, and tournaments are studied. Laboratory fee required.
(0–6–4) *Mr. Bearden*

Physical Education 400. *The Program of Physical Education for Elementary and Secondary Schools*

The principles, organization, administration, materials, methods and supervision of the programs of physical education in elementary and secondary schools.
(3–0–6) *Mr. Hermance*

Physical Education 410. *Health and Physical Education for Teachers of Elementary and Secondary Schools*

This course is designed for prospective teachers who desire to increase their proficiency to teach health and physical education. The course includes a study of the purpose, content, and method of instruction of health and physical education in the elementary and secondary schools.
(3–3–8) *Staff*

Physical Education 425. *Laboratory Experiences in Team Sports, Training Room Procedure, and Student Teaching*

Activities covered are football, basketball, baseball, and track. In addition to the history, specific values, court-field-diamond construction, activity skills, game formations, audio-visual aids, officiation, and scouting, emphasis is placed on the psychology and techniques of teaching and coaching physical education activities, including interscholastic athletics. Also included is a unit on training room procedure and one semester of student teaching. Laboratory fee required.
(0–6–4) *Messrs. Bland, Weston, and Wojecki*

Physical Education 430. *The Program of Health Education in Elementary and Secondary Schools*

The organization, administration, principles, materials, methods, and supervision of the program of health education in elementary and secondary schools. The historical developments in health education and medicine are studied as a foundation for building effective health education programs.
(3–0–6) *Mr. Weston*

Physics

Physics 100. *Mechanics, Heat, Sound and Light*

An introductory course consisting of two lecture hours, one problem hour and three hours of laboratory work per week. This course is the first half of the introductory physics course required of all science-engineering students. In addition this course satisfies one of the laboratory science requirements for academic students. Topics of study include: geometrical optics; statics and dynamics of solids and liquids based on Newton's three laws of

motion; thermal properties of materials and introductory thermodynamics based on the first and second laws of thermodynamics; wave motion and sound; interference. Students taking Physics 100 must have taken or be enrolled in Mathematics 100. Laboratory fee required.
(3–3–8) *Messrs. Bryan and Rorschach*

Physics 200. *Electricity, Magnetism, and Atomic Physics*

A course of three lectures and three hours of laboratory work per week. This course with Physics 100 makes up a complete course on the principles of physics which is required of science-engineering students. In this second course the fundamental principles of electrical theory are explained and illustrated, including the elementary theory of direct and alternating currents, electronics, and electrical theory of matter. The topics of the last fourteen weeks are atomic physics, solid state physics, and nuclear physics. In the laboratory the students make measurements of all the important electrical quantities such as current, resistance, potential, capacity, inductance, magnetic induction, magnetic properties of iron and steel, electro-chemical equivalents, characteristics of triodes; other experiments include measurements of radiations from radioactive elements. Students taking Physics 200 must have completed Mathematics 100 and must take Mathematics 200 or 210 at the same time as Physics 200. Laboratory fee required.
(3–3–8) *Messrs. Bonner, Class, G. Phillips*

Physics 210. *Electricity, Magnetism, and Atomic Physics*

Covers the material of Physics 200 but is more rigorous and mathematical in approach. Open to students with high grades in Physics 100.
(3–3–8) *Mr. Class*

Physics 310. *Atomic and Nuclear Physics*

Outline of the principal experiments upon which the quantum theory is based. Particle-like properties of light and other electromagnetic radiation. Wave-like and particle-like properties of the electron. Optical spectra and energy levels. X-rays. Radioactivity. Properties and spectra of alpha, beta, and gamma rays. Elementary facts of nuclear structure. Three hours of laboratory weekly. Laboratory fee required.
(3–3–8) *Mr. Risser*

Physics 400. *Introduction to Mathematical Physics*

A systematic review of the principal subjects in mechanics and electrodynamics. Mathematical methods, including differential equations and vector analysis, will be applied to the solution of problems in particle dynamics, vibrating systems, dynamics of rigid bodies, electrostatics, magnetostatics, and the electromagnetic field. Three class hours and two problem hours per week.
(3–2–7) *Messrs. Rorschach and Houston*

Physics 415. (a) *Electronics*

The physical principles of electron devices including vacuum tubes and semiconductors, linear circuit theory, electronic circuits. Laboratory exercises cover many practical circuits. Laboratory fee required.

(b) *Vibration and Sound*

Wave motion in one, two, and three dimensions, acoustic and electromagnetic transmission lines, scattering of sound waves.
(3–1½–7) *Mr. Donoho*

Physics 425. (a) *Thermodynamics and Elements of Statistical Mechanics*

Basic concepts of temperature, entropy, enthalpy, free energy, with applications to physical and chemical systems. Kinetic theory of gases. Maxwell-Botzmann distribution, quantum statistics, with applications to gases, liquids, solids.

(b) *Physical Optics*

Electromagnetic waves, boundary conditions at dielectric interface, polarization, refraction, interference, diffraction. Optical instruments. Electromagnetic radiation from a dipole. Heat radiation. Laboratory fee required.
(3–1½–7) *Mr. Squire*

Physics 510. *Advanced Dynamics*

The general principles of analytical dynamics. Orbit theory and the central force problem. The kinematics of rigid bodies, treated from the standpoint of matrix transformations, canonical transformations. Hamilton-Jacobi theory.
(3–0–6) *Mr. Class*

Physics 520. *Principles of Quantum Mechanics*

A deductive presentation of the principles of quantum mechanics with applications to various problems in spectroscopy, collisions of atomic particles, molecular binding, etc.
(3–0–6) *Mr. Phillips*

Physics 530. *Electromagnetic Theory*

Electrostatics, magnetostatics, boundary value problems, stress-energy relations; electromagnetic wave equations, Lienard-Wiechert potentials, multiple fields, radiation; special relativity, radiation from accelerated charges.
(3–0–6) *Mr. Biedenharn*

Physics 540. *Nuclear Physics*

Radiation detectors; interaction of alpha particles, electrons, neutrons and gamma radiation with matter; properties of nuclei; theory of nuclear structure; nuclear shell model, nuclear magnetic moments and spins; beta disintegrations; artificial disintegration of nuclei; nuclear scattering; mesons; fission; cosmic rays.
(3–0–6) *Mr. Bonner*

Physics 550. *Special and General Theories of Relativity*
(2–0–4) *Mr. Wilson*

Physics 560. *Structure of Solids*

A review of the structure and vibration of crystals, and the motions of electrons in them, based on quantum mechanics.
(3–0–6) *Mr. Houston*

Physics 570. *Low-temperature Physics*

Production and measurement of extremely low temperatures. Properties of liquid helium. Superconductivity. Magnetism and low temperatures. Specific heats. Recently published research. Laboratory techniques and participation in research problems (Physics 590).
(3–0–6) *Mr. Squire*

Physics 580. *Physics Colloquium*

One meeting a week at which results of researches in physics will be discussed.
(1–0–2) *Staff*

Physics 590. *Research Work*

Physics 600. *Special Topics in Solid State Physics*
(2–0–4) *Mr. Houston*

Physics 610. *Neutron and Reactor Physics*

Fundamental properties of the neutron: mass, magnetic moment, interaction with the proton, etc. Interaction with nuclei. Sources and detectors. Interaction with matter in bulk: slowing down and diffusion. Nuclear chain reactions. Magnetic scattering and polarization. Neutron diffraction.
(3–0–6) *Mr. Risser*

Physics 620. *Theoretical Nuclear Physics*

General nuclear properties, two-body problems, scattering, nuclear spectroscopy, nuclear reaction, interaction of nuclei with electromagnetic and electron-neutrino fields, nuclear shell theory.
(3–0–6) *Mr. Tobocman*

Physics 630. *Advanced Quantum Mechanics*

Relativistic quantum mechanics of the electron; field quantization for the electron-positron and electromagnetic fields; quantum electrodynamics; scattering matrix theory; radiative corrections.
(3–0–6) *Messrs. Biedenharn and Tobocman*

Physics 640. *Applications of Group Theory to Quantum Mechanics*

An introductory treatment of abstract group theory and the general theory of group representations for finite and compact groups with application to the symmetric, orthogonal, and symplectic groups. Particular emphasis is given to the three dimensional rotation group, including the application of the Wigner and Racah coefficients.
(3–0–6) *Mr. Biedenharn*

Physics 700. *Summer Graduate Research*

Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Psychology

Psychology 210a. *General Psychology*

Psychological studies of human behavior are examined to show the interdependence of theory, method and data in scientific inquiry in the behavioral sciences. (Note that this is a first semester course; it must be followed by Psychology 210b.)
(3–0–3) *Mr. Walker*

Psychology 210b. *Elementary Statistics*

An introduction to the theories and techniques of the statistical method as applied to problems in psychological research. The course will be concerned with means of describing distribution of scores and measures, the normal curve and probabilities, sampling and statistical inference, and correlation.
(3–0–3) *Mr. Wann*

Psychology 300. (a) *General Psychology*

Psychological studies of human behavior are examined to show the interdependence of theory, method, and data in scientific inquiry in the behavioral sciences.

(b) *Culture and the Individual*

The view of science presented in the first semester is elaborated further in a systematic consideration of several alternative conceptions of the relations between the individual and his cultural environment.
(3–0–6) *Mr. Walker*

Psychology 310a. *Adavnced Statistics*

More advanced correlational techniques, frequency comparisons, small sample methods, analysis of variance, and further consideration of sampling and statistical inference. Prerequisite: Psychology 210a and 210b.
(3–0–3) *Mr. Wann*

Psychology 310b. *History and Systems*

This course reviews the history of Western scientific psychology and the development of systems in psychological theory. Prerequisite: Psychology 210a and 210b.
(3–0–3) *Mr. Hudson*

Psychology 320. *Language, Thought, and Communication*

An examination of language, thought, and communication from the perspectives of psychology, linguistics, communication theory, cultural anthro-

pology, and philosophy. Prerequisite: Psychology 210a and 210b, or 300.
(3–0–6) *Mr. Walker*

Psychology 330. (a) *Differential Psychology*

This course is designed to familiarize the student with the techniques for measuring individual differences. Critical reviews will be made of various theories of individual differences in intelligence and personality.

Mr. Wann

(b) *Personality*

Selections from the literature on personality are analyzed and compared. Prerequisite: Psychology 210a and 210b.
(3–0–6) *Mr. Walker*

Psychology 400. *Experimental Psychology*

This course is an introduction to experimental methods in psychological research, presented in the context of its historical antecedents and interpreted in terms of modern psychological theory. In lectures, and in laboratory experiments and demonstrations, psychological concepts and methods will be developed and examined experimentally. Prerequisite: Psychology 210a and 210b. Laboratory fee required.
(2–4–6) *Mr. Hudson*

Psychology 410. (a) *Developmental Psychology*

The year course presents three major topics: adolescence, comparative social psychology, and theories and problems of social psychology. The first semester is designed to acquaint the student, from the point of view of adolescence, with the physical, social, and emotional processes that go into the making of an adult.

Mr. Wann

(b) *Social Psychology*

The second semester is a continuation of the above topics, giving greater emphasis to social processes. These are viewed from the vantage point of comparative social psychology and the wide varieties of behaviors possible for human beings; and from the points of view provided by alternative theories. Prerequisite: Psychology 210a and 210b, or 300.
(3–0–6) *Mr. Wann*

Psychology 450. *Introduction to Research*

An introduction to research for the well-qualified upper-division student in which, under the direction of a member of the staff, a minor research problem will be undertaken. Prerequisites: Psychology 210a and 210b, 310a and 310b, 320, and 330. Hours and credit to be arranged.

Staff

Courses in Romance Languages

French 100. *Beginning French*

A close study of the fundamentals of French grammar and pronunciation. Exercises in written French. Oral practice, dictations and translation of suitable texts.
(3–0–6)

French 200. *Intermediate French*

Emphasis on intensified oral, written and translation practice. An introduction to the main currents in French literature. Readings of significant texts, composition, dictation and conversation.
(3–0–6)

French 300. *French Civilization and Literature, and Advanced Composition*

A thorough review of advanced grammar combined with the study of plays and other literary masterpieces from the period of Molière to the present days, and the reading of selected texts by representative contemporary authors on modern French civilization. Discussions, and oral and written reports in French.
(3–0–6) *Mr. Shelton*

French 330. *The Age of Enlightenment*

Readings from the representative authors of the eighteenth century: Marivaux, Le Sage, Voltaire, Montesquieu, Diderot, Rousseau, and Beaumarchais. Discussion and analysis of texts in French.
(3–0–6) *Mr. Myers*

French 350. *The French Romantic Movement*

Poetry, novel and drama. Special emphasis on the study of Chateaubriand, Constant, Lamartine, Vigny, Hugo, Musset and Mérimée. A thorough study of selected texts with discussions and essays in French.
(3–0–6) *Mr. Bourgeois*

French 380. *Modern French Fiction and Drama*

Study and discussion in French of significant novels and plays of the twentieth century.
(3–0–6)

French 404. *Directed Study and Senior Thesis*

Open only to Senior students selected after application to the Directing Committee of the Department. An extensive program of research is undertaken, after consultation, with approval of the Department. A paper embodying the results of the research must be submitted. At least two advanced courses in French are prerequisites.
(0–0–6)

French 420. *French Classicism*

A study of seventeenth century authors with particular emphasis on the theatre of Corneille, Racine and Molière. Selected readings from Malherbe, Descartes, Pascal, Boileau, La Rochefoucauld, La Fontaine, Madame de Sévigné and others. Discussion and analysis of texts in French.

French 450. *French Realism and Naturalism*

Special emphasis on the Study of Stendhal, Balzac, Flaubert, Maupassant, the de Goncourt brothers and Zola. Discussion and essays in French.
(3–0–6) *Mr. Bourgeois*

French 520. *Racine and Molière*

The element of universality in their presentation of Man. (Offered in 1960–1961).
(3–0–6) *Mr. Bourgeois*

French 542. *Voltaire, Part I*

A chronological study of Voltaire's life and work up to 1750. (Offered in 1960–61).
(3–0–6) *Mr. Myers*

French 543. *Voltaire, Part II*

A chronological study of Voltaire's life and work from 1750 to his death. (Offered in 1961–62).
(3–0–6) *Mr. Myers*

French 550.

The evolution of the dramatic conception in France during the nineteenth century. (Offered in 1961–1962).
(3–0–6) *Mr. Bourgeois*

French 570.

Studies in contemporary French literature. (Offered in 1960–1961).
(3–0–6)

French 600.

Graduate research.
(3–0–6)

Spanish 100. *First Year Spanish*

Oral exercises, grammar, composition, and study of elementary Spanish texts.
(3–0–6)

Spanish 200. *Second Year Spanish*

Oral exercises, dictation, grammar, composition, translation, and study of

modern Spanish texts. Open to students who have had two years of high-school Spanish or Spanish 100.
(3–0–6)

Spanish 300. *Third Year Spanish*

Review of grammar, composition, essays, study of representative authors, collateral readings and reports. Conducted in Spanish.
(3–0–6)

Spanish 400. *Outlines of the History of Spanish Literature*

Collateral reading of major authors representative of the various periods.
(3–0–6)

Russian

Russian 100. *Elementary Russian*

(3–0–6) *Mr. Jitkoff*

Russian 200. *Grammar and Literature*

(3–0–6) *Mr. Jitkoff*

RESERVE OFFICERS' TRAINING CORPS PROGRAMS

The Rice Institute offers two Reserve Officers' Training Corps Programs: (1) Army and (2) Navy. The mission of these programs is to train college students so that they may qualify upon graduation as commissioned officers in a component of the United States Army or Navy. Upon successful completion of one of the ROTC programs and graduation with a baccalaureate degree, the student may be given a commission in the appropriate service. The Navy has two types of memberships, one leading to a reserve commission and the other leading to a regular commission. The Army normally awards reserve commissions, however, certain selected distinguished military students may be offered commissions in the Regular Army.

Any student dropped by the Rice Institute for academic failure or other cause shall be immediately disenrolled from the ROTC programs. Any student performing unsatisfactory work in military or naval science courses, or possessing unsatisfactory officer-like qualities may be disenrolled from the ROTC programs regardless of the quality of his academic work. Students taking five-year courses are considered eligible for enrollment at the beginning of their first or second year. Enrollment in the ROTC programs at the Rice Institute is made at the beginning of the fall term only.

COURSES IN MILITARY SCIENCE

The department of military science was established in the fall of 1951. A U.S. Army officer, designated the Professor of Military Science and Tactics, with assistance by officers and men of the U.S. Army, administers the program. Training in military leadership is emphasized, with instruction being given in subjects common to all branches of the Army and in tactics and techniques of the Corps of Engineers. The course is a four-year program consisting of two main subdivisions: (1) Basic and (2) Advanced. Students electing the AROTC do so for only two years at a time.

The first election is for the two-year Basic Course, after which, if the student is recommended for further training, he may elect the Advanced Course. This training, once entered upon by the student, is, under the terms of his contract, a required part of his course. No contract is executed between the government and student admitted to the Basic Course.

The Basic Course is the course of study normally pursued by the student during his Freshman and Sophomore academic years. The Basic Course consists of a minimum of two hours per week of formal instruction of a general type applicable to the Army as a whole and not specialized by arm or service. Students receive ten hours of instruction in Military History during the first year of the basic course. This is coordinated with History 110.

The Advanced Course consists of a minimum of five hours per week of formal military instruction, specializing in Corps of Engineer subjects. Completion of the Basic Course is a prerequisite to admission to the Advanced Course. Advanced Course students are required to attend one summer camp, which normally comes between the Junior and Senior years. This camp consists of practical and theoretical military instruction principally specializing in Corps of Engineer functions.

The Advanced Course provides a stipend of about a dollar per day during the last two years and affords a draft deferment during these years.

Courses of Instruction

The AROTC course of training consists of those courses, practice periods, and exercises prescribed by the Army Program of Instruction for Military and Civilian Colleges currently in effect, together with such training camps as may be prescribed. Military science courses as described below will be taken in succession.

***Military Science 101** (first half-year). *Orientation, Basic Weapons,* and *Military History*

Military Organization. Introduction to weapons to include Marksmanship. History of land operations.
(1–1–1)

* History 110, American History, must be taken concurrently unless previously completed.

***Military Science 102** (second half-year).

Military Science 101 continued.
(1–1–1)

Military Science 201 (first half-year). *Military Techniques*

Map and Aerial Photograph Interpretation. Introduction to crew served weapons.
(2–2–2)

Military Science 202 (second half-year). *Military Tactics*

Gunnery and Small Unit Tactics.
(2–2–2)

Military Science 301 (first half-year). *Military Engineering Techniques*

Military Leadership, Military Explosives and Mine Warfare. Construction Materials and Elementary Military Construction.
(4–1–4)

Military Science 302 (second half-year). *Military Engineering Techniques*

Military Structures, Field Construction Procedures.
(4–1–4)

Military Science 401 (first half-year). *Military Administration* and *Logistics*

Military Administration, Personnel Management. Supply, Evacuation and Utilities.
(4–1–4)

Military Science 402 (second half-year). *Engineer Operations*

Construction of roads and airfields. Offensive and Denial Operations. River Crossing Operations, etc.
(4–1–4)

COURSES IN NAVAL SCIENCE

The Department of Naval Science at The Rice Institute was established in the fall of 1941 and is an integral part of the organization of the Institute. It is administered by a senior U.S. Naval Officer who is the Professor of Naval Science. He is assisted in his administrative and instructional duties by officers and men of the U.S. Navy and Marine Corps. The purpose of the Naval Reserve Officers' Training Corps is to train highly select young men for

either naval service as commissioned officers of the Regular Navy and Marine Corps (Regular Program) or as reserve officers of the Navy or Marine Corps (Contract Program).

There are, therefore, two categories of NROTC students: (1) Regular; (2) Contract.

Regular Students

A regular NROTC student is appointed a Midshipman, U.S. Naval Reserve, on a nation-wide competitive basis and receives retainer pay at the rate of $50.00 per month for a maximum of four years, with all fees, books and equipment paid for by the government. Required uniforms are furnished. He is required to complete twenty-four semester hours of naval science subjects (one course per term, including those courses taught by the civilian faculty which are a part of the Navy curricula) and other training prescribed during the summer months, and upon graduation with a baccalaureate degree to accept a commission as Ensign in the U.S. Navy or Second Lieutenant in the U.S. Marine Corps.

Contract Students

Contract students are civilian college students who enter into a mutual contract with the Secretary of the Navy in which they obligate themselves to take Naval Science courses and drills and one summer training cruise. In return, the Navy provides the required uniforms, pays them a subsistence allowance (currently about $30.00 per month) during their Junior and Senior years, provides draft deferment and offers a reserve commission in the Navy or Marine Corps upon graduation.

Contract students are *not* selected by the competitive procedure indicated above for Regular students; rather they are selected by the Commanding Officer (Professor of Naval Science) from among those students who apply who are either selected for admission by the Rice Institute or who are already in attendance. Contract students are deferred from the draft.

U.S. Marine Corps

NROTC students, either Regular or Contract, may apply for transfer to the Marine Corps program during the second term of

the Sophomore year. Such selectees are referred to as Marine Corps option students and attend separate classes under a Marine Officer Instructor during their Junior and Senior years.

Courses of Instruction

The NROTC course of training consists of those courses, laboratory periods, and drill, together with such training duty or training cruises as may be prescribed.

Naval Science courses as described will be taken in succession as listed:

Naval Science 100. *History and Naval Orientation*

This course consists of History 110 (American History—taught by the History Department) plus a two hour weekly lab in which traditions, customs, organization, missions and responsibilities of the Navy are presented, together with an introduction to seamanship and naval warships.
(1–2–2)

Naval Science 201 (first half-year).

This course consists of General Psychology 210a plus a two hour laboratory period. The purpose of the course is to further the understanding of sound leadership principles through psychological studies of human behavior. Two hours of laboratory work per week are devoted to practical applications of leadership and to scientific principles and their application to naval weapons systems.
(3–2–3)

Naval Science 202 (second half-year). *Naval Weapons*

Introduction to naval weapons and space technology. Fire control system. Principles of sonar and radar. Guided missiles. Nuclear weapons and radiological defense. Anti-submarine warfare. Amphibious warfare.
(3–2–3)

Naval Science 301 (first half-year). *Naval Engineering*

Basic principles of and problems in thermodynamics are employed in the study of various power cycles of both main propulsion and auxiliary plants. Steam, internal combustion and nuclear plants are studied and their energy transformations analyzed. With the emphasis on fundamental principles employed, the student is familiarized with the entire shipboard engineering plant, including electrical systems, refrigeration, compressed air and hydraulic systems. Principles of ship stability are studied, including evaluations of transverse and longitudinal stability after damage and weight change.
(3–2–3)

Naval Science 302 (Second half-year). *Navigation*

Terrestrial and celestial navigation. Piloting problems, utilizing electronics

and visual navigation aids, are studied. Motions of celestial bodies are determined. The celestial sphere concept is utilized in determining position by the employment of spherical trigonometry.
(3–2–3)

Naval Science 401 (first half-year). *Naval Operations*

The elements of shipboard operations, including the Rules of the Nautical Road, problems in relative motion, maneuvering ships in formation, and employment of the Striking Force. Fleet Communications, with an introduction to Electronics Countermeasures. The effects of weather on Naval Operations.
(3–2–3)

Naval Science 402 (second half-year). *Principles and Problems of Leadership*

Continued discussion and application of the principles of human relations and leadership. Principles of management. Naval administration and Military Justice.
(3–2–3)

NROTC students who desire to be commissioned as Second Lieutenants in the U.S. Marine Corps or Marine Corps Reserve, and whose applications for transfer are accepted, will substitute the following courses during the final two years:

Naval Science 301M (first half-year). *Evolution of the Art of War*

Significance of military power. Classic principles of war, analyzed as a foundation for further understanding of military operations by a study of famous battles.
(3–2–3)

Naval Science 302M (second half-year). *Modern Basic Strategy and Tactics*

Basic strategic concepts and principles of offensive and defensive tactics through the battalion level.
(3–2–3)

Naval Science 401M (first half-year). *Amphibious Warfare*

History of amphibious warfare. Development of amphibious tactics. Gunfire support. Planning. Logistics. Administration.
(3–2–3)

Naval Science 402M (second half-year). *Marine Corps, Leadership and the Uniform Code of Military Justice*

Development of leadership techniques through a study of the basic psychology of leadership. Uniform Code of Military Justice.
(3–2–3)

The Navy prescribes certain course requirements for NROTC students as follows:

1. By the end of the Sophomore year each Regular student must have satisfactorily completed one year of college physics.

2. By the end of the Sophomore year every student must have satisfactorily completed mathematics through trigonometry.

3. Every student must achieve proficiency in written and oral expression. The Rice Institute will prescribe standards of proficiency and determine procedures necessary to achieve them.

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