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University Calendar

1960-1961

1960

January 4, 8:10 a.m. (Mon.) ..... Christmas vacation ends
January 5 (Tues.) ..... Last day for filing applications for degrees to be granted in January
January 9 (Sat.) ..... Last day of classes for arts seniors taking comprehensive examinations
January 13-16 (Wed.-Sat.) ..... Comprehensive examinations for arts seniors
January 16 (Sat.) ..... Last day of classes in fall semester
Janaury 18 (Mon.) ..... Course examinations begin
January 27 (Wed.) ..... Course examinations end
February 2 (Tues.) ..... Registration for spring semester
February 3 (Wed.) ..... Spring semester instruction begins
February 13 (Sat.) ..... Last day on which registration for spring courses will be permitted
March 26, 1 p.m. (Sat.) ..... Spring vacation begins
Mid-semester reports due
April 4, 8:10 a.m. (Mon.) ..... Spring vacation ends
Preregistration begins
April 9 (Sat.) ..... Preregistration ends
April 15 (Fri.) ..... Last day for filing applications for degrees to be conferred in June
May 17 (Tues.) ..... Last day of classes for arts seniors taking comprehensive examinations
May 20-24 (Fri.-Tues.) ..... Comprehensive examinations for arts seniors
May 24 (Tues.) ..... Last day of classes in spring semester
May 25 (Wed.) ..... Course examinations begin
June 3 (Fri.) ..... Course examinations end
June 12 (Sun.) ..... Baccalaureate Sunday
June 13 (Mon.) ..... University Day
June 14 (Tues.) ..... Registration for summer session (1st 6 weeks, undergraduate session)
June 15 (Wed.) ..... Summer session instruction begins (1st 6 weeks, undergraduate session)
July 23 (Sat.) ..... End of summer session (1st 6 weeks, undergraduate session)
July 25 (Mon.) ..... Registration for summer session (2nd 6 weeks, undergraduate session)
July 26 (Tues.) ..... Summer session instruction begins (2nd 6 weeks, undergraduate session)
September 3 (Sat.) ..... End of summer session (2nd 6 weeks, undergraduate session)
September 7 (Wed.) ..... Freshman Week begins
September 10 (Sat.) ..... Last day for filing applications for degrees to be conferred on Founder's Day

Sept. 10-13 (Sat.-Tues.)	Make-up examinations and special examinations
September 14 (Wed.)	Registration for fall semester
September 15 (Thurs.)	Fall semester instruction begins
September 19 (Mon.)	First faculty meeting
September 26 (Mon.)	Last day on which registration for fall courses will be permitted
October 9 (Sun.)	Founder's Day
Oct. 17-19 (Mon.-Wed)	Engineering inspection trips
November 7 (Mon.)	Preregistration begins Mid-semester reports due
November 12 (Sat.)	Preregistration ends
Nov. 23, 10 p.m. (Wed.)	Thanksgiving vacation begins
Nov. 28, 8:10 a.m. (Mon.)	Thanksgiving vacation ends
Dec. 21, 10 p.m. (Wed.)	Christmas vacation begins

1961

January 5, 8:10 a.m. (Thurs.)	Christmas vacation ends Last day for filing applications for degrees to be granted in January
January 7 (Sat.)	Last day of classes for arts seniors taking comprehensive examinations
January 11-14 (Wed.-Sat.)	Comprehensive examinations for arts seniors
January 14 (Sat.)	Last day of classes in fall semester
January 16 (Mon.)	Course examinations begin
January 25 (Wed.)	Course examinations end
January 31 (Tues.)	Registration for spring semester
February 1 (Wed.)	Spring semester instruction begins
February 11 (Sat.)	Last day on which registration for spring courses will be permitted
March 25, 1 p.m. (Sat.)	Spring vacation begins Mid-semester reports due
April 3, 8:10 a.m. (Mon.)	Spring vacation ends Preregistration begins
April 8 (Sat.)	Preregistration ends
April 15 (Sat.)	Last day for filing applications for degrees to be conferred in June
May 16 (Tues.)	Last day of classes for arts seniors taking comprehensive examinations
May 19-23 (Fri.-Tues.)	Comprehensive examinations for arts seniors
May 23 (Tues.)	Last day of classes in spring semester
May 24 (Wed.)	Course examinations begin
June 2 (Fri.)	Course examinations end
June 11 (Sun.)	Baccalaureate Sunday
June 12 (Mon.)	University Day

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B.A., Syracuse, 1914; M.A. (Engl.), 1915; M.A. (Ed.) Michigan, 1922; Ph.D., 1929.

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MICHAEL THOMAS COOLEY (1950) ..... *Instructor in Physical Education, Assistant Varsity Football Coach*
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A.B., St. John's (Annapolis), 1913; A.M., Johns Hopkins, 1916; Ph.D., New York, 1924; Ehrensenator, Heidelberg, 1949.

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PAUL JUSTUS FRANZ, JR. (1944, 1949) ..... *Assistant to the President*
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A.B., DePauw, 1936; M.A., Missouri, 1938; Ph.D., Johns Hopkins, 1942.

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A.B., Idaho, 1903; B.A., Oxford, 1907; M.A., 1951; Ph.D., Yale, 1918; Litt.D., Temple, 1947; L.H.D., Lehigh, 1951; LL.D., Idaho, 1953; L.H.D., Yale, 1955.

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B.A., Toronto, 1949; M.A., Alberta, 1950; Ph.D., Washington, 1959.

ELMER WILLIAM GLICK (1949, 1952) .....*Treasurer*
B.A., Lehigh, 1933.

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Ph.B., Yale, 1895; A.B., Harvard, 1897; M.A., 1898; Ph.D., 1901.

JOSEPH JOHN HAMMEL (1956) ..... *Graduate Assistant in Chemistry*
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E.M., Lehigh, 1927.

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A.B., North Carolina, 1914; M.A., Columbia, 1925; Ph.D., New York, 1926.

KI SUB JOUNG (1959) ..... *Graduate Assistant in Civil Engineering*
B.S., Lafayette, 1959.

CAREY BONTHRON JOYNT (1951, 1956) ..... *Associate Professor of International Relations, Head of the Department of International Relations*
B.A., Western Ontario, 1945; M.A., 1948; Ph.D., Clark, 1951.

GEORGE EUGENE KANE (1950, 1954) ..... *Assistant Professor of Industrial Engineering*
B.S., Pennsylvania State, 1948; M.S., Lehigh, 1954.

JOHN J. KARAKASH (1946, 1956) ..... *Professor of Electrical Engineering, Head of the Department of Electrical Engineering, Director of the Curriculum in Electrical Engineering*
B.S. in E.E., Duke, 1937; M.S. in E.E., Pennsylvania, 1938.

CHETAN LALCHAND KARNA (1957) ..... *Graduate Assistant in Mechanics*
B.E., College of Engineering, Poona (India), 1953.

JOSEPH KASPER, JR. (1957) ..... *Assistant in Military Science*
Sergeant First Class, U.S.A.

JOHN DANIEL KEEFE (1955) ..... *Instructor in Economics*
B.S., Lehigh, 1948; M.A., Miami (Florida), 1955.

WILLIAM WOODING KENAWELL (1955) ..... *Circulation Librarian*
A.B., Franklin & Marshall, 1953; M.A., Lehigh, 1955.

JERRY DEAN KENNEDY (1958) ..... *Graduate Assistant in Physics*
B.S., Oklahoma, 1956; M.S., California, 1959.

HENRY EUGENE KENTOPP (1953) ..... *Part-time Lecturer in Education*
B.A., Midland, 1921; M.A., Wisconsin, 1930; Ed.D., Columbia, 1940.

PAUL ALEXANDER KICSKA (1959) ..... *Graduate Assistant in Physics*
B.S., Muhlenberg, 1958.

RICHARD KING (1958) ..... *Research Assistant in Chemistry*
B.A., Illinois, 1954.

ARTHUR WARNER KLEIN (1904, 1952) ..... *Professor Emeritus of Mechanical Engineering*
M.E., Lehigh, 1899.

CARL JACOB KNAUSS, JR. (1954) ..... *Research Assistant in Chemistry*
B.S., Kansas State, 1952; M.S., 1953.

EARL ALLEN KNIES (1958) ..... *Graduate Assistant in English*
A.B., Muhlenberg, 1958.

JERE KNIGHT (1957) ..... *Research Assistant in History*
B.A., Pennsylvania, 1929; M.A., 1930.

RUTH EVELYN KOBBE (1958) ..... *Research Assistant in Computing Laboratory*
A.B., Indiana, 1958.

ALFRED PAUL KOCH (1946, 1951) ..... *Associate Professor of Accounting*
B.S., Pennsylvania State Teachers (Bloomsburg), 1939; M.S., Bucknell, 1940; C.P.A., Pennsylvania, 1952.

EDWARD HOWARD KOTTCAMP, JR. (1956, 1957) ..... *Instructor in Metallurgical Engineering*
B.S., Lehigh, 1956; M.S., 1957.

THOMAS PAUL KREHNBRINK (1958) ..... *Graduate Assistant in Civil Engineering*
B.C.E., Manhattan, 1958.

JOHN ERNEST KRIZAN (1957) ..... *Research Assistant in Physics*
B.S., Lehigh, 1956; M.S., 1959.

THERON LAMONT KROPP (1958) ..... *Assistant Director of Residence Halls, Assistant Coordinator of Scholarships and Self-Help*
B.A., Lehigh, 1956.

LEON ELWOOD KROUSE (1951, 1958) ..... *Assistant Professor of Finance*
B.A., Susquehanna, 1941; M.S., Bucknell, 1947; Ph.D., New York, 1958.

FRANCIS THOMAS KRUPINSKI (1959) ..... *Assistant in Military Science*
Sergeant, U.S.A.

THOMAS CHARLES KUBELIUS (1948, 1957) ..... *Associate Professor of Business Law*
B.S., Illinois, 1945; LL.B., 1947.

ROBERT HAROLD KUNKEL (1959) ..... *Graduate Assistant in Chemistry*
B.S., Virginia Polytechnic Institute, 1958.

CHANG-YUN KUO (1955) ..... *Research Assistant in Chemistry*
B.S., College of Ordnance Engineering (China), 1945; M.S., Lehigh, 1957.

OWEN ROBERT KURTZ (1946) ..... *Accounting Assistant*

GEORGE WALLACE KYTE (1946, 1951) ..... *Associate Professor of History*
A.B., California, 1940; M.A., 1941; Ph.D., 1943.

KENNETH WORCHESTER LAMSON (1926, 1952) ..... *Associate Professor Emeritus of Mathematics*
A.B., Harvard, 1906; Ph.D., Chicago, 1917.

NICHOLAS LAPARA (1959) ..... *Graduate Assistant in Chemistry*
B.S., Lehigh, 1959.

ARTHUR IRVING LARKY (1954, 1958) ..... *Research Assistant Professor of Electrical Engineering*
B.S., Lehigh, 1952; M.S., Princeton, 1953; Ph.D., Stanford, 1957.

VORIS V. LATSHAW (1931, 1947) ..... *Associate Professor of Mathematics*
B.A., Indiana, 1927; A.M., 1928; Ph.D., 1930.

CORRINGTON R. LAUGHLIN (1957) ..... *Assistant in Air Science*
Senior Master Sergeant, U.S.A.F.

HERBERT CHARLES LEBOVITZ (1959) ..... *Graduate Assistant in Mathematics*
S.B. Physics, Massachusetts Institute of Technology, 1952; S.B. Bus. Adm., 1953.

WILLIAM BADER LECKONBY (1946) ..... *Assistant Professor of Physical Education, Varsity Football Coach, Varsity Golf Coach*
B.S., St. Lawrence, 1939.

GEORGE CHAO-CHI LEE (1957, 1959) ..... *Research Associate in Civil Engineering*
B.S. in C.E., National Taiwan, 1956; M.S., Lehigh, 1958.

HWA-PING LEE (1957) ..... *Graduate Assistant in Mechanical Engineering*
B.S.E., National Taiwan, 1954; M.S., Illinois, 1956.

TI-TA LEE (1958) ..... *Research Assistant in Civil Engineering*
B.S. in C.E., National Taiwan, 1954; M.S., Iowa State, 1958.

GERALD GRANT LEEMAN (1950) ..... *Assistant Professor of Physical Education, Varsity Wrestling Coach, Varsity Tennis Coach, Freshman Soccer Coach*
B.A., Iowa State Teachers, 1948.

JOHN DOUGLAS LEITH (1945, 1958) ..... *Dean of Students*
A.B., North Dakota, 1920; A.M., Columbia, 1924.

ROY JUNIOR LEONARD (1959) ..... *Assistant Professor of Civil Engineering*
B.C.E., Clarkson College of Technology, 1952; M.S., Connecticut, 1954; Ph.D., Iowa State, 1958.

KENNETH DONALD LERCHE (1959) ..... *Graduate Assistant in Mathematics*
B.A., Lehigh, 1959.

MICHAEL STEPHEN LESSER (1958) ..... *Graduate Assistant in Government*
A.B., Franklin and Marshall, 1958.

WILLIAM GERHARD LETZING (1959) ..... *Graduate Assistant in Physics*
B.S., Bucknell, 1958.

VICTOR LEVI (1956, 1958) ..... *Research Instructor in Civil Engineering*
B.S., Panama, 1956; M.S., Lehigh, 1958.

JOSEPH FRANCIS LIBSCH (1946, 1954) ..... *Professor of Metallurgical Engineering*
B.S., M.S., Massachusetts Institute of Technology, 1940; Sc.D., 1941.

JOHN ORTH LIEBIG, JR. (1946, 1955) ..... *Associate Professor of Civil Engineering*
B.S., Lehigh, 1940; M.S., 1949.

HOWARD FRANCOIS LISTON (1957) ..... *Assistant in Military Science*
Master Sergeant, U.S.A.

ANDREW WILLARD LITZENBERGER (1929, 1933) ..... *Superintendent of Buildings and Grounds*
Cert. in Architectural Engineering, Pennsylvania, 1911.

LE WU LU (1957, 1959) ..... *Research Associate in Civil Engineering*
B.S., National Taiwan, 1954; M.S., Iowa State, 1956.

ROBERT ALAN LUCAS (1958, 1959) ..... *Instructor in Mechanical Engineering*
B.S. in M.E., Lehigh, 1957; M.S., 1959.

YIU KWAN LUI (1959) ..... *Research Assistant in Chemistry*
B.S., Chung Chi, 1959.

GEORGE EDWARD MACBRIDE (1959) ..... *Graduate Assistant in Chemistry*
B.S., Lehigh, 1959.

JAMES DECKER MACK (1946, 1950) ..... *Librarian*
B.A., Lehigh, 1938; M.A., 1949.

FRED T. MACKENZIE (1959) ..... *Graduate Assistant in Geology*
B.S., Upsala, 1959.

JOHN ROBERT MAGAN (1959) ..... *Graduate Assistant in Physics*
B.S., Muhlenberg, 1959.

RICHARD GRIFFITH MALSBERGER (1959) ..... *Assistant Professor of Biology*
B.A., Lehigh, 1948; M.S., 1949; Ph.D., 1958.

JAMES CARMEN MANCUSO (1958) ..... *Counselor, Counseling and Testing Service*
A.B., Dickinson, 1951; Ph.D., Rochester, 1958.

ALFREDO LUEJE MARCOS (1959) ..... *Instructor in Romance Languages*
Licenciado en Economia, Madrid, 1954.

IRWIN MURRAY MARCUS (1959) ..... *Graduate Assistant in History*
B.S., Pennsylvania State, 1958; M.A., Lehigh, 1959.

WALTER EDWARD MARGIE, JR. (1956) ..... *University Physician, Part-time*
B.S., Lehigh, 1944; M.D., Temple School of Medicine, 1951.

ROBERT CLINTON MASON (1960) ..... *Assistant in Military Science*
Sergeant First Class, U.S.A.

JAMES PATRICK MATHEWS (1947) ..... *Physiotherapist, University Health Service*

JOSEPH ABELE MAURER (1947, 1956) ..... *Associate Professor of Classical Languages, Head of the Department of Classical Languages*
B.A., Moravian, 1932; M.A., Lehigh, 1936; Ph.D., Pennsylvania, 1948.

JOHN WALTER MAXWELL, JR. (1927, 1946) ..... *Bursar and Purchasing Agent*
B.S., Lehigh, 1926.

ALBERT JOSEPH MAZURKIEWICZ (1955, 1959) ..... *Associate Professor of Education, Supervisor of the Reading and Study Clinic*
B.A., Ursinus, 1950; M.A., Pennsylvania, 1951; Ed.D., Temple, 1957.

AUSTIN VAIL MCCLAIN (1948) ..... *Development Consultant*
B.S., Washington & Jefferson, 1930; M.A., 1933.

FRANCIS MARTIN MCCLARNON (1958) ..... *Research Assistant in Civil Engineering*
B.C.E., Manhattan, 1958.

GEORGE WALTER MCCOY, JR. (1956) ..... *Director, University Health Service*
B.S., Pennsylvania, 1929; M.D., 1932.

LESLIE GUY MCCRACKEN, JR. (1956) ..... *Associate Professor of Electrical Engineering*
B.S., Massachusetts Institute of Technology, 1945; M.S., Lehigh, 1947; Ph.D., Pennsylvania State, 1952.

NEIL OLIVER MCCRAY (1959) ..... *Assistant Professor of Military Science*
B.S., U.S. Military Academy, 1951; Captain, U.S.A.

JOSEPH BRENDAN MCFADDEN (1948, 1955) ..... *Associate Professor of Journalism, Head of the Division of Journalism*
B.A., St. Joseph's (Canada), 1941; M.A., Syracuse, 1948.

GILBERT MCGAIR (1958) ..... *Graduate Assistant in Chemical Engineering*
B.S., Rhode Island, 1956.

JAMES WILLARD MCGEADY (1950, 1959) ..... *Associate Director of Admission*
B.A., Lehigh, 1950.

HOWARD ELWOOD MCKENZIE (1958) ..... *Assistant Professor of Air Science*
B.S., West Chester State Teachers, 1951; Captain, U.S.A.F.

JAMES ALAN MCLENNAN, JR. (1948, 1958) ..... *Associate Professor of Physics*
A.B., Harvard, 1948; M.S., Lehigh, 1950; Ph.D., 1952.

EDWIN WALLACE MCMULLEN (1957) ..... *Assistant Professor of English*
B.A., Florida, 1936; M.A., Columbia, 1939; Ph.D., 1950.

LAURENCE ALOYSIUS MCNELLIS (1958).....*Assistant to the Director of Placement and Counseling Services*
B.S., Lehigh, 1958.

HERBERT EUGENE MEILY (1958).....*Graduate Assistant in Physics*
B.S., Muhlenberg, 1958.

THOMAS CARTWRIGHT MENTZER (1956)....*Graduate Assistant in Geology*
B.A., Williams, 1956; M.S., Lehigh, 1958.

FREDERICK HORSTMANN MIDLIGE, JR. (1958).....*Graduate Assistant in Biology*
B.S., Muhlenberg, 1957; M.S., Lehigh, 1959.

JOSEPH ANTHONY MIHURSKY (1956).....*Research Assistant in Biology*
A.B., Lafayette, 1954; M.S., Lehigh, 1957.

ARCHIE ROSCOE MILLER (1922, 1946) *Professor of Electrical Engineering*
B.S. in E.E., Illinois, 1918; M.S., Lehigh, 1925.

GLEN MILLER (1959).....*Research Assistant in Chemistry*
B.S., Juniata, 1959.

MAUREEN DORIS MILLER (1958).....*Nurse, University Health Service*
R.N., St. Luke's Hospital School of Nursing, 1955.

MYLES L. MILLER (1959).....*Graduate Assistant in Accounting*
B.S., Lebanon Valley, 1959.

RICHARD J. MILLER (1959).....*Graduate Assistant in Chemistry*
B.S., Union, 1959.

WILLIAM BRUNNER MILLER (1959).....*Instructor in Mathematics*
B.S., Lehigh, 1947; M.A., 1955.

THEODORE MILLON (1954) .....*Assistant Professor of Psychology*
B.S., City College of New York, 1950; M.A., 1951; Ph.D., Connecticut, 1954.

HAROLD MINDLIN (1957).....*Graduate Assistant in Civil Engineering*
B.S., Lehigh, 1956.

SAMUEL HAROLD MISSIMER (1950, 1959).....*Associate Director of Admission*
B.A., Lehigh, 1950.

JAMES AYARS MITCHELL, JR. (1958).....*Graduate Assistant in Economics*
B.S., Lebanon Valley, 1958.

MICHAEL FRANCIS MIZIANTY (1959).....*Graduate Assistant in Chemistry*
B.S., Scranton, 1954.

SUTTON MONRO (1959).....*Associate Professor of Industrial Engineering*
B.S., Massachusetts Institute of Technology, 1942.

CARL LELAND MOORE (1948, 1956).....*Associate Professor of Accounting*
A.B., Bucknell, 1943; M.A., Pittsburgh, 1948; C.P.A., Pennsylvania, 1952.

CHARLES JOHN MORAVEC (1937, 1956) .....*Director, Office of Public Information*
B.S., Albright, 1937.

*DOROTHY DEAN MORAVEC (1946, 1958).....*Assistant to the Associate Dean of Students*

ROBERT PATTISON MORE (1916, 1956).....*Dean Emeritus of the College of Arts and Science*
B.A., Lehigh, 1910; M.A., Harvard, 1913.

ALVIN ROBERT MORRIS (1958).....*Research Assistant in Biology*
B.A., Lafayette, 1957; M.S., Lehigh, 1959.

*Resigned, December 31, 1959.

RICHARD DUANE MORRISON (1956, 1959) ..... *Research Assistant in Metallurgical Engineering*
B.S., South Dakota School of Mines and Technology, 1956; M.S., Lehigh, 1957.

JOHN ANTHONY MUELLER (1958) ..... *Research Assistant in Civil Engineering*
B.C.E., Manhattan, 1958.

ROBERT DONALD MUHL (1953) ..... *Graduate Assistant in Physics*
Geophysical Engineer, Colorado School of Mines, 1953; M.S., Lehigh, 1955.

WILLIAM FRANK MUHR (1958) ..... *Graduate Assistant in Accounting*
B.S., Lehigh, 1958.

*FRANK EVANS MYERS (1946) ..... *Professor of Physics*
B.A., Reed, 1927; M.S., New York, 1930; Ph.D., 1934.

RAYMOND REEVER MYERS (1950, 1956) ..... *Research Associate Professor of Chemistry*
B.A., Lehigh, 1941; M.S., Tennessee, 1942; Ph.D., Lehigh, 1952.

HANNA I'D. NASSAR (1956, 1957) ..... *Instructor in Mathematics*
B.A., London, 1952; M.A., Lehigh, 1957.

KARIM WADE NASSER (1956) ..... *Instructor in Civil Engineering*
B.S., American University of Beirut, 1949; M.S., Kansas, 1952.

RODOLFO JORGE NAVEIRO (1959) ..... *Graduate Assistant in Romance Languages*
Ingeniero Industrial, Buenos Aires, 1958.

JOSEPH C. NEUKLIS (1959) ..... *Graduate Assistant in Chemistry*
B.S., Pennsylvania State, 1959.

HARVEY ALEXANDER NEVILLE (1927, 1956) ..... *Vice President and Provost, Director of the Institute of Research*
A.B., Randolph-Macon, 1918; M.A., Princeton, 1920; Ph.D., 1921; LL.D., Randolph-Macon, 1952.

WILLIAM ARTHUR NEVILLE (1949, 1951) ..... *Instructor in English*
A.B., New Hampshire, 1949; M.A., Lehigh, 1952.

AKIRA NITTA (1957, 1959) ..... *Research Associate in Civil Engineering*
B.E., Tokyo, 1953; M.E., 1955.

CLAIR W. NOLL (1959) ..... *Instructor in Accounting*
B.S., Lebanon Valley, 1955; M.B.A., Lehigh, 1957.

ROBERT E. NORWOOD (1959) ..... *Graduate Assistant in Chemistry*
B.S., Lafayette, 1959.

FRANCIS CLYDE OGLESBY (1954, 1957) ..... *Instructor in Mathematics*
A.B., Dickinson, 1954; M.S., Lehigh, 1956.

MORRIS OJALVO (1958) ..... *Research Instructor in Civil Engineering*
B.C.E., Rensselaer Polytechnic Institute, 1944; M.C.E., 1951.

PHILIP OLEAR (1957, 1959) ..... *Instructor in Mechanical Engineering*
B.S.E., Connecticut, 1957; M.S., Lehigh, 1959.

JOHN FRANCIS O'LEARY (1958) ..... *Instructor in Economics*
B.S., Villanova, 1955; M.B.A., Pennsylvania, 1959.

JOHN FURNIFOLD O'NEAL (1959) ..... *Assistant Professor of Education*
B.S., North Carolina, 1950; M.Ed., 1952.

CARL SPADT OPLINGER (1958) ..... *Graduate Assistant in Biology*
B.S., Muhlenberg, 1958.

*On leave of absence 1958-60.

THOMAS JAMES ORSAGH (1957).....*Instructor in Economics and Statistics*
B.S., Pennsylvania, 1954; M.A., 1958.

JOSEPH C. OSBORN (1946, 1955).....*Assistant Professor of Mechanics*
B.S.M.E., Purdue, 1933; M.S., Michigan, 1946.

ALEXIS OSTAPENKO (1957).....*Assistant Professor of Civil Engineering*
Dipl. Ing., Munich Institute of Technology (Germany), 1951; Sc.D. in C.E., Massachusetts Institute of Technology, 1957.

WILLIAM WALLACE OSWALT (1956).....*Part-time Lecturer in Education*
A.B., Muhlenberg, 1949; Ed.M., Temple, 1950.

BRADFORD BRECKENRIDGE OWEN (1945, 1948).....*Associate Professor of Biology*
B.A., Williams, 1934; M.A., 1936; Ph.D., Harvard, 1940.

RUTH ELMINA COSGROVE PACE (1948, 1949).....*Order Librarian*
B.A., Moravian, 1941; B.S. in L.S., Carnegie Library School, 1942; M.A., Lehigh, 1951.

ROBERT WARREN PACKARD (1958).....*Graduate Assistant in Mathematics*
A.B., Bowdoin, 1958.

ANTHONY PACKER (1946).....*Assistant Professor of Physical Education, Varsity Basketball Coach, Varsity Baseball Coach*
B.S., St. Lawrence, 1938.

DAVID HSIEN-CHUNG PAI (1958).....*Graduate Assistant in Civil Engineering*
B.S. in C.E., Virginia Military Institute, 1958.

EUGENE R. PAOLINI (1959).....*Graduate Assistant in Chemistry*
B.S., Albright, 1959.

BERNARD JAY PARIS (1956).....*Instructor in English*
A.B., Johns Hopkins, 1952; Ph.D., 1959.

DAVID MAXWELL PARKE (1952, 1956).....*Assistant Professor of Mechanics*
B.S. in M.E., Lehigh, 1948; M.S. in M.E., 1949; Ph.D., 1956.

BASIL WALDO PARKER (1940, 1954).....*Professor of Biology, Head of the Department of Biology*
S.B., Massachusetts Institute of Technology, 1933; A.M., Harvard, 1935; Ph.D., Massachusetts Institute of Technology, 1939.

PRESTON PARR, JR. (1949, 1956).....*Associate Dean of Students*
B.S. in Ch.E., Lehigh, 1943; M.S., 1944.

FRANKLIN ARTHUR PAUL (1959).....*Physician, University Health Service*
B.S., Moravian, 1954; M.D., Hahnemann Medical, 1958.

HARRY GORDON PAYROW (1916, 1950).....*Associate Professor Emeritus of Sanitary Engineering*
B.S. in C.E., Tufts, 1907.

ALAN WIGGINS PENSE (1957).....*Research Assistant in Metallurgical Engineering*
B.S. in Met.E., Cornell, 1957; M.S., Lehigh, 1959.

ULYSSES JOSEPH PERRY (1958).....*Assistant in Military Science*
Master Sergeant, U.S.A.

ARTHUR EVERETT PITCHER (1938, 1948).....*Professor of Mathematics*
A.B., Western Reserve, 1932; A.M., Harvard, 1933; Ph.D., 1935; D.Sc., Western Reserve, 1957.

PAUL PETER PODGURSKI (1959).....*Research Assistant in Metallurgical Engineering*
B.S., Lehigh, 1959.

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THEODORE JOHN PODOLSKY (1956) ..... *Assistant in Military Science*
Master Sergeant, U.S.A.

JOSEPH GEORGE POMPONIO (1956) ..... *Assistant Director, University Health Service*
B.S., Vermont, 1949; M.D., 1953.

HAYDEN NELSON PRITCHARD (1959) ..... *Research Assistant in Biology*
B.A., Princeton, 1955.

WILLIAM LEROY QUAY (1957) ..... *Graduate Assistant in History and Government*
A.B., Muhlenberg, 1956; M.A., Pennsylvania, 1957.

EDWARD LEO QUEENEY (1959) ..... *Assistant Professor of Military Science*
B.A., Boston, 1952; Captain, U.S.A.

FRANCIS JOSEPH QUIRK (1950, 1953) ..... *Professor of Fine Arts, Head of the Department of Fine Arts*
Dipl., Rhode Island School of Design, 1929.

RICHARD M. RAMER (1959) ..... *Graduate Assistant in Chemistry*
B.S., Lehigh, 1959.

EDWARD GEORGE RANKEY (1954) ..... *Cataloger (Social Sciences)*
B.A. in History, Moravian, 1940; B.S. in Library Science, Syracuse, 1949.

GERHARD RAYNA (1955) ..... *Instructor in Mathematics*
A.B., Harvard, 1952; M.A., Princeton, 1953.

GEORGE EMIL RAYNOR (1931, 1946) ..... *Professor of Mathematics, Head of the Department of Mathematics and Astronomy*
B.S., Washington, 1918; M.A., Princeton, 1920; Ph.D., 1923.

DONALD A. RECCHIO (1958) ..... *Research Assistant in Civil Engineering*
B.C.E., Georgia Institute of Technology, 1958.

RICHARD JAMES REDD (1958) ..... *Instructor in Fine Arts*
B.Ed., Toledo, 1953; M.F.A., Iowa, 1958.

HAROLD SCOTT REEMSNYDER (1959) ..... *Instructor in Civil Engineering*
B.S., Carnegie Institute of Technology, 1954; M.S., 1959.

WADE ALLAN RENN (1958) ..... *Graduate Assistant in Physics*
B.S., Lehigh, 1956.

JOSEPH H. RENO (1947, 1949) ..... *Assistant Professor of Physical Education, Team Physician*
M.D., Temple, 1941.

NICHOLAS RESCHER (1957, 1959) ..... *Associate Professor of Philosophy*
B.S., Queens (New York), 1949; M.A., Princeton, 1950; Ph.D., 1951.

FREDERICK EUGENE RESSLER (1952) ..... *Assistant Registrar*
B.A., Lehigh, 1952.

RODNEY EARL RESSLER (1947, 1952) ..... *Administrative Assistant to Registrar*

RAINERIO OCHANGCO REYES (1957, 1959) ..... *Instructor in Mathematics*
B.S. in C.E., Mapera Institute of Technology, 1954; M.S., Lehigh, 1959.

JOSEPH BENSON REYNOLDS (1907, 1948).....*Professor Emeritus of Mathematics and Theoretical Mechanics*
B.A., Lehigh, 1907; M.A., 1910; Ph.D., Moravian, 1919.

ROBERT MCCULLOCH RHODES (1957).....*Manager, Office of Publications*
B.A., Arkansas, 1949.

JAMES ANDREW RHODY (1959).....*Graduate Assistant in English*
B.A., St. Francis, 1959.

MARGARET IRENE RICE (1932) .....*Accounting Assistant*

WALLACE JAMES RICHARDSON (1952, 1959).....*Professor of Industrial Engineering*
B.S., U.S. Naval Academy, 1941; M.S. in I.E., Purdue, 1948.

ALBERT AUGUSTUS RIGHTS (1933, 1943)....*Assistant Professor of English*
A.B., Maine, 1927; A.M., Harvard, 1931.

EDGAR HEISLER RILEY (1926, 1958).....*Associate Professor Emeritus of English*
A.B., Cornell, 1915; Ph.D., 1925.

DANIEL GOTTSHALL RITTER (1958).....*Assistant to the Director of Admission*
B.A., Lehigh, 1958.

ROY EDWARD ROBERTS, JR. (1958).....*Graduate Assistant in Mathematics*
A.B., Gettysburg, 1958.

GEORGE FULTON ROEMHILD (1957) .....*Graduate Assistant in Physics*
B.A., Reed, 1957; M.S., Lehigh, 1959.

JOSEPH FRANCIS ROGALEWICZ (1958).....*Graduate Assistant in Economics*
B.S., Moravian, 1958.

GUY HARLAN ROOTH (1959).....*Graduate Assistant in Geology*
B.A., New Hampshire, 1958.

JOHN CHRISTOPHER ROSNER (1959).....*Graduate Assistant in Civil Engineering*
B.S., Purdue, 1959.

ROBERT SUMNER ROUSE (1956).....*Assistant Professor of Chemistry*
B.S., Yale, 1951; M.S., 1953; Ph.D., 1957.

JOHN LOUIS RUMPF (1956).....*Research Instructor in Civil Engineering*
B.S., Drexel Institute of Technology, 1943; M.S., Pennsylvania, 1954.

HELEN GENEVIEVE RYAN (1917).....*Secretary to the President*

JOHN DONALD RYAN (1952, 1957).....*Associate Professor of Geology*
B.A., Lehigh, 1943; M.S., 1948; Ph.D., Johns Hopkins, 1952.

SUMAN TRIMBAK SABNIS (1959).....*Graduate Assistant in Chemical Engineering*
B.Sc., Agra (India), 1954; B.S. Ch.E., H. B. Technological Institute (Kanpur, India), 1956.

PAUL SYMONDS SACKS (1958).....*Graduate Assistant in Chemical Engineering*
B.S. in Ch.E., Lehigh, 1958.

BRIAN VICTOR SADERHOLM (1959).....*Graduate Assistant in English*
B.A., Moravian, 1958.

PERCY LEE SADLER (1946).....*Professor of Physical Education, Director of the Division of Athletics and Physical Education*
Brig. Gen., Inf., U.S.A., Ret.

JOHN S. SANDEL (1957).....*Part-time Lecturer in Education*
B.A., Pennsylvania, 1946; M.Ed., 1947; Ed.D., 1955.

JOSEPH SARA (1957).....*Assistant Professor of Air Science*
B.S., Trenton State Teachers, 1936; M.Ed., Rutgers, 1950; Captain, U.S.A.F.

PAUL L. SAVAGE (1959).....*Assistant Professor of Military Science*
B.A., Connecticut, 1949; Captain U.S.A.

RAYMOND BURKERT SAWYER (1946).....*Associate Professor of Physics*
Ph.B., Ripon, 1921; M.S., Wisconsin, 1925; Ph.D., Chicago, 1930.

ELIZAJANE KEMMERER SCHAEFFER (1958).....*Assistant to the Dean of the Graduate School*
B.A., Moravian, 1937; B.S. in L.S., Drexel Institute of Technology, 1938.

WILLIAM DWIGHT SCHAEFFER (1956).....*Assistant Research Director, National Printing Ink Research Institute*
B.S., Lehigh, 1943; M.S., 1947.

ROBERT H. SCHIESSER (1959).....*Research Assistant in Chemistry*
B.Ch.E., Clarkson College of Technology, 1958.

WILLIAM EDWARD SCHIESSER (1960).....*Assistant Professor of Chemical Engineering*
B.S., Lehigh, 1955; M.A., Princeton, 1958.

MELVIN SCHLECHTER (1958).....*Graduate Assistant in Chemistry*
B.S., Queens (New York), 1953; M.S., Virginia Polytechnic Institute, 1958.

DONALD WALTER SCHMOYER (1946, 1949).....*Accountant*
B.S. in Bus. Adm., Lehigh, 1944.

RAYMOND K. SCHULTZ (1959).....*Research Assistant in Chemistry*
B.S., Muhlenberg, 1959.

ERNST BERNHARD SCHULZ (1927, 1946).....*Professor of Political Science*
B.S., Michigan, 1920; M.A., 1921; Ph.D., 1927.

ELI SCHWARTZ (1954, 1958).....*Associate Professor of Finance*
B.S., Denver, 1943; M.A., Connecticut, 1948; Ph.D., Brown, 1952.

MARVIN HERBERT SEGEL (1958).....*Graduate Assistant in Biology*
B.S., Muhlenberg, 1957; M.S., Lehigh, 1959.

CHARLES AUGUSTUS SEIDLE (1948, 1952).....*Director of Admission*
B.A., Pittsburgh, 1931; M.A., Columbia, 1936; Ed.D., 1948.

EDITH AMANDA SEIFERT (1923, 1956).....*Assistant Bursar*

*EARL JAMES SERFASS (1936, 1952).....*Professor of Chemistry, Head of the Department of Chemistry, Director of the Curriculum in Chemistry*
B.S. in Ch.E., Lehigh, 1933; M.S., 1935; Ph.D., 1938.

JONATHAN BURKE SEVERS (1927, 1951).....*Distinguished Service Professor of English, Head of the Department of English*
A.B., Rutgers, 1925; A.M., Princeton, 1927; Ph.D., Yale, 1935.

PAUL ALFRED SHELLY (1959).....*Part-time Lecturer in Education*
B.S., Kutztown State Teachers, 1950; M.A., Lehigh, 1952.

WILLIAM SHERIDAN (1911, 1954).....*Assistant Professor Emeritus of Physical Education*

CLARENCE ALBERT SHOOK (1930, 1946).....*Professor of Mathematics*
A.B., Western Reserve, 1916; A.M., Harvard, 1918; Ph.D., Johns Hopkins, 1923.

PAUL EDWARD SHORT (1938, 1946).....*Assistant Professor of Physical Education, Assistant Director and Business Manager of Athletics*
B.S. in Bus. Adm., Lehigh, 1934.

*Resigned, December 31, 1959.

JOHN T. SHUMAN (1954) ..... *Part-time Lecturer in Education*
Ph.B., Dickinson, 1928; M.S., Pennsylvania State, 1934; D.Ed., 1944.

RICHARD SHUMAN (1958) ..... *Research Assistant in Chemistry*
B.S., Muhlenberg, 1957.

GEORGE C. M. SIH (1958) ..... *Instructor in Mechanics*
B.S. in M.E., Portland, 1953; M.S. in M.E., New York, 1957.

LLOYD VANDERVEER SLOCUM (1958) ..... *Instructor in Electrical Engineering*
B.S., Pennsylvania State, 1955; M.S., 1957.

CLIFFORD WILSON SLOYER, JR. (1956, 1958) ..... *Instructor in Mathematics*
B.A., Lehigh, 1956; M.S., 1958.

EARL KENNETH SMILEY (1934, 1945) ..... *Vice-President, Secretary of the Board of Trustees*
A.B., Bowdoin, 1921; M.A., Lehigh, 1935; L.H.D., Moravian, 1947; LL.D., Waynesburg, 1952.

EDWARD OWEN SMITH, JR. (1957) ..... *Graduate Assistant in History*
A.B., Muhlenberg, 1957.

GEORGE LEONARD SMITH, JR. (1959) ..... *Instructor in Industrial Engineering*
B.S., Pennsylvania State, 1957; M.S., Lehigh, 1959.

GERALD FRANCIS SMITH (1958) ..... *Assistant Professor of Mechanics*
B.A., Buffalo, 1952; Ph.D., Brown, 1956.

JAMES ROBERT SMITH (1958) ..... *Assistant in Air Science*
Master Sergeant, U.S.A.F.

M. GLEN SMITH (1959) ..... *Graduate Assistant in Psychology*
B.S., Pennsylvania State, 1958.

ROBERT JENNINGS SMITH (1957) ..... *Assistant Professor of Education*
B.S., Black Hills Teachers, 1948; M.A., Stanford, 1949.

STANLEY FRED SMITH (1952) ..... *Research Assistant in Physics*
B.S., St. Lawrence, 1952; M.S., Lehigh, 1954.

WESLEY RICHARD SMITH (1958) ..... *Assistant Professor of Physics*
B.S. in E.P., Lehigh, 1950; M.S., 1951; Ph.D., Princeton, 1957.

WILLIAM ADAMS SMITH, JR. (1955, 1957) ..... *Assistant Professor of Industrial Engineering*
B.S., U.S. Naval Academy, 1951; M.S., Lehigh, 1957.

JUDSON GRAY SMULL (1919, 1950) ..... *Associate Professor Emeritus of Chemistry*
B.S. in Chem., Lehigh, 1906; M.S., 1921.

MAX DONALD SNIDER (1946) ..... *Assistant Professor of Marketing*
B.S., Illinois, 1936; M.S., 1937; M.B.A., Stanford, 1941.

ABRAHAM BARNETT SOBLE (1958) ..... *Assistant Professor of Mathematics*
A.B., Pennsylvania, 1935.

RAFAEL ARCHANGEL SOTO (1935, 1954) ..... *Associate Professor Emeritus of Romance Languages*
B.S., Illinois, 1912; B.A., 1915; M.A., 1917.

WILBER DEVILLA BERNHART SPATZ (1946, 1954) ..... *Associate Professor of Physics*
B.S., Lafayette, 1930; M.S., Purdue, 1934; Ph.D., New York, 1943.

ROBERT STEACY SPRAGUE (1957) ..... *Assistant Professor of Chemistry*
B.S., Washington and Jefferson, 1943; Ph.D., Illinois, 1949.

JOHN JAY STACHEL (1959) ..... *Instructor in Physics*
B.S., City College of New York, 1956; M.S., Stevens Institute of Technology, 1959.

JOHN CALVIN STAPLETON (1957) ..... *Professor of Military Science and Tactics, Head of the Department of Military Science and Tactics*
B.S., U.S. Military Academy, 1935; Colonel, U.S.A.

DAVID N. STEHLY (1959) ..... *Graduate Assistant in Chemistry*
B.S., Moravian, 1959.

REBECCA WEEBER STEWART (1958) ..... *Part-time Lecturer in Education*
A.B., Pittsburgh, 1933; M.A., Kent, 1952; Ed.D., Columbia, 1958.

*BRADLEY STOUGHTON (1923, 1944) ..... *Professor Emeritus of Metallurgical Engineering*
Ph.B., Yale, 1893; B.S., Massachusetts Institute of Technology, 1896; Eng.D., Lehigh, 1944.

ROBERT DANIEL STOUT (1939, 1956) ..... *Professor of Metallurgical Engineering, Head of the Department of Metallurgical Engineering, Director of Curriculum in Metallurgical Engineering*
B.S., Pennsylvania State, 1935; M.S., Lehigh, 1941; Ph.D., 1944.

CARL FERDINAND STRAUCH (1938, 1953) ..... *Professor of English*
A.B., Muhlenberg, 1930; M.A., Lehigh, 1934; Ph.D., Yale, 1946.

KENNETH RUSSELL STRAUSS (1957) ..... *Professor of Air Science, Head of the Department of Air Science*
B.S., Indiana, 1939; Colonel, U.S.A.F.

MILTON CALEB STUART (1926, 1952) ..... *Professor Emeritus of Mechanical Engineering*
B.S. in M.E., Pennsylvania, 1909; M.E., 1924.

ROBERT LAMB STUBBINGS (1949, 1957) ..... *Research Associate Professor of Chemistry*
B.S., Lehigh, 1941; M.S., 1946; Ph.D., 1949.

JAMES EDWARD STURM (1956) ..... *Assistant Professor of Chemistry*
B.A., St. John's (Minnesota), 1951; Ph.D., Notre Dame, 1957.

JEAN-MICHEL STURM (1958) ..... *Graduate Assistant in Mechanics*
Diploma, Swiss Federal Institute of Technology, 1954.

HARRY SUPRINICK (1956) ..... *Instructor in Metallurgical Engineering*
B.S., Michigan College of Mining & Technology, 1951; M.S., 1952.

JOHN JOSEPH SURASH (1957) ..... *Instructor in Chemistry*
B.S., Wilkes, 1950; M.S., Lehigh, 1952.

EDWARD CARL SWORD (1957) ..... *Assistant Professor of Civil Engineering*
B.S., Pennsylvania State, 1951; M.S., New York, 1955.

DONALD GEORGE TAILBY (1956) ..... *Instructor in Economics*
B.A., Rutgers, 1950; M.A., 1956.

LAMBERT TALL (1955) ..... *Research Associate in Civil Engineering*
B.E., Sydney (Australia), 1954; M.S., Lehigh, 1957.

GEORGE JOHN TAMARO, JR. (1959) ..... *Research Assistant in Civil Engineering*
B.C.E., Manhattan, 1959.

WILLIAM TANGREDI (1959) ..... *Research Assistant in Chemistry*
B.S., Manhattan, 1955; M.S., Marquette, 1957.

IVAN JACKSON TAYLOR (1953) ..... *Instruments Associate in Civil Engineering*

*Died December 30, 1959.

ROBERT SAXTON TAYLOR (1950) ..... *Associate Librarian*
A.B., Cornell, 1940; M.S. in L.S., Columbia, 1950; M.A., Lehigh, 1954.

ROBERT SAYRE TAYLOR, JR. (1950) ..... *Legal Counsel*
B.A., Lehigh, 1925; LL.B., Pennsylvania, 1928.

MEHMET UNER TAYSI (1959) ..... *Research Assistant in Civil Engineering*
B.S., Robert (Istanbul), 1957; M.S., Lehigh, 1959.

NOUBAR TCHEUREKDJIAN (1958) ..... *Research Assistant in Chemistry*
B.S., Illinois Institute of Technology, 1958.

EVERETT ANDERSON TEAL (1945) ..... *Director of Placement and Counseling*
B.S., Ball State Teachers, 1932; M.A., Columbia, 1941.

THEODORE ALFRED TERRY (1955) ..... *Instructor in Mechanical Engineering*
B.S., Drexel Institute of Technology, 1950; M.S., Lehigh, 1951.

HAROLD PRESCOTT THOMAS (1932) ..... *Professor of Education, Head of the Department of Education, Director of the General College Division, Director of the Summer Session, Director of the Adult Education Program*
B.S., Colgate, 1920; Ed.M., Harvard, 1925; Ed.D., 1932.

STANLEY JUDSON THOMAS (1923, 1956) ..... *Professor Emeritus of Bacteriology*
B.S., Lafayette, 1912; M.S., Lehigh, 1913; M.A., 1915; Ph.D., Pennsylvania, 1928.

DONALD DAVID THOMPSON (1959) ..... *Graduate Assistant in Psychology*
B.A., Virginia, 1958.

WILLIAM PAUL THOMPSON, JR. (1955) ..... *Research Assistant in Physics*
B.S., Yale, 1955; M.S., Lehigh, 1957.

*BRUNO THURLIMANN (1952, 1958) ..... *Research Professor of Civil Engineering*
Dipl., Swiss Federal Institute of Technology, 1946; Ph.D., Lehigh, 1951.

ROBERT EDWARD TIERNEY (1959) ..... *Assistant Professor of Air Science*
B.S., Omaha, 1953; M.B.A., Indiana, 1956; Major U.S.A.F.

CHARLES CARPENTER TILLINGHAST III (1958) ..... *Assistant to the Director of Development*
B.S. in M.E., Lehigh, 1958.

JIN-SENG TOH (1959) ..... *Research Assistant in Civil Engineering*
B.S., Nebraska, 1956; M.S., Lehigh, 1959.

JOSEPH ALEC TOTH (1954) ..... *Residence Hall Supervisor of Maintenance*

FRANCIS JOHN TREMBLEY (1928, 1949) ..... *Professor of Ecology*
B.S., Hobart, 1928; M.S., Lehigh, 1931; Ph.D., Pennsylvania, 1934.

JOHN SCHRADER TREMPER (1939, 1952) ..... *Associate Professor of German, Head of the Department of German, Secretary of the Faculty*
A.B., Colgate, 1928; M.A., Cornell, 1932; Ph.D., 1938.

ROCCO JOHN TRESOLINI (1949, 1958) ..... *Professor of Political Science*
A.B., Hartwick, 1942; M.A., Syracuse, 1947; Ph.D., 1949.

KENNETH MANGOLD TRUMBORE (1946) ..... *Assistant Manager of the Supply Bureau*
B.A., Moravian, 1940.

WENDELL PIGGOTT TRUMBULL (1957, 1958) ..... *Professor of Accounting, Head of the Department of Accounting*
B.S., Illinois, 1937; M.A., Michigan, 1941; Ph.D., 1954; C.P.A., Mississippi, 1949.

*Resigned, January 31, 1960.

HEIKKI VILLE TUOMINEN (1957).....*Associate Professor of Geology*
Ph.Mag., Helsinki, 1945; Ph.D., Abo Akademi, 1957.

JOHN HENRY URBAN (1954, 1958).....*Associate Professor of Economics*
B.S., Purdue, 1948; M.S., 1949; Ph.D., 1951.

VICTOR MANUEL VALENZUELA (1957).....*Assistant Professor of Romance Languages*
B.A., San Francisco State, 1951; M.A., Columbia, 1952.

RALPH NEWCOMB VANARNAM (1928, 1942).....*Assistant Professor of Mathematics and Astronomy*
E.E., Cornell, 1926; M.S., 1927.

RALPH CARLTON VAN KUREN (1959).....*Graduate Assistant in Civil Engineering*
B.S. in C.E., Bucknell, 1959.

EUGENE VASILEW (1956).....*Assistant Professor of Speech*
B.A., New York, 1942; M.A., Iowa State, 1947; Ph.D., Ohio State, 1955.

GADI V. VENKATESULU (1957).....*Instructor in Electrical Engineering*
B.E., Mysore (India), 1950.

JACQUELINE IRENE VERBA (1958).....*Laboratory and X-Ray Technician, University Health Service*
Eastern School for Physicians' Aides.

CHARLES JOSEPH VERSACCI (1958, 1959).....*Instructor in Education*
A.B., Lafayette, 1954; M.A., Lehigh, 1959.

WILLIAM WADDINGTON (1958)....*Graduate Assistant in Civil Engineering*
B.S.C.E., Swarthmore, 1958.

JAMES HAROLD WAGNER (1949, 1951).....*Registrar*
B.A., Gettysburg, 1947; M.A., Pennsylvania, 1950.

RICHARD EDWARD WAITE (1959).....*Research Assistant in Psychology*
B.S., Ursinus, 1959.

SHERWOOD GEORGE WALTERS (1950, 1958).....*Associate Professor of Marketing*
A.B., Western Maryland, 1949; M.S., Columbia, 1950; M.B.A., 1953; Ph.D., New York, 1960.

ROBERT FALCON WARNER (1957, 1959).....*Research Associate in Civil Engineering*
B.E., N.S.W. University of Technology (Australia), 1955; M.E., 1957.

THOMAS W. WATKINS (1949).....*Part-time Lecturer in Education*
A.B., Dickinson, 1931; M.A., Lehigh, 1942.

RICHARD ALLEN WATT (1958).....*Instructor in German and Russian*
A.B., Dartmouth, 1954; M.A., Michigan, 1956.

BARRY HAYWARD WATTS (1959).....*Commonwealth Research Librarian*
B.A., Rhodes, 1950.

DAVID HOWARD WEANER (1959).....*Graduate Assistant in Physics*
A.B., Gettysburg, 1956.

FRANK RUEBEN WEAVER (1956).....*Assistant Superintendent of Buildings and Grounds*

JOHN FRANKLIN WEEDON, JR. (1958)....*Assistant University News Editor*
B.S., Maryland, 1955.

DAVID WEIMER (1958).....*Instructor in Physics*
B.S., Ohio State, 1941; M.S., 1946.

SOLOMON WEINSTOCK (1956).....*Assistant Professor of Psychology*
B.S., City College of New York, 1944; Ph.D., Indiana, 1954.

WILLIAM LEWIS WEISS (1958) ....*Graduate Assistant in Civil Engineering*
B.S., Lehigh, 1958.

PATRICIA FAYE WEITZEL (1957).....*Cataloger*
A.B., Albright, 1955; M.S. in L.S., Western Reserve, 1956.

LEONARD ANDREW WENZEL (1951, 1956) .....*Associate Professor of Chemical Engineering*
B.S., Pennsylvania State, 1943; M.S., Michigan, 1948; Ph.D., 1949.

KARL LEROY WERKHEISER (1950).....*Assistant Accountant*
B.S., Rider, 1950.

DONALD BINGHAM WHEELER, JR. (1947, 1957) .....*Associate Professor of Physics*
B.S. in Eng. Phys., Lehigh, 1938; Ph.D., California Institute of Technology, 1947.

MARTIN DEWEY WHITAKER (1946)..... ... *President*
B.A. Wake Forest, 1927; M.A., North Carolina, 1930; Ph.D., New York, 1935; LL.D., Lafayette, 1946; Sc.D., Moravian, 1947; Sc.D., Wake Forest, 1947; LL.D., Rutgers, 1948.

LAWRENCE WHITCOMB (1930, 1939).....*Associate Professor of Geology*
Ph.B., Brown, 1922; A.M., Princeton, 1928; Ph.D., 1930.

RUDOLPH HENRY WIENS (1959).....*Graduate Assistant in Physics*
B.S., Albright, 1959.

JAMES WIGHTMAN (1958) .....*Research Assistant in Chemistry*
B.S., Randolph-Macon, 1955; M.S., Lehigh, 1958.

ALBERT WILANSKY (1948, 1957).....*Professor of Mathematics*
B.A., Dalhousie (Canada), 1941; B.S., 1942; Ph.D., Brown, 1947.

BRADFORD WILLARD (1939, 1959).....*Professor Emeritus of Geology*
B.A., Lehigh, 1921; A.M., Harvard, 1922; Ph.D., 1923.

ROBERT LAWRENCE WINDISH (1959).....*Assistant Professor of Physical Education, Assistant Varsity Football Coach, Varsity Lacrosse Coach*
B.S., Georgetown, 1952.

DAVID L. WOOD (1958).....*Research Assistant, Computer Laboratory*
B.S., Pennsylvania State, 1958.

RALPH CHARLES WOOD (1958)..... *Associate Professor of German*
B.A. and B.E., Cincinnati, 1928; M.A., 1930; Ph.D., Cornell, 1932.

HORACE WETHERILL WRIGHT (1921, 1950)....*Professor Emeritus of Latin*
A.B., Wisconsin, 1908; Ph.D., Pennsylvania, 1917.

WILLARD ROSS YATES (1955, 1959).....*Associate Professor of Political Science*
B.A., Oregon, 1948; M.A., 1949; Ph.D., Yale, 1956.

BUNG-TSENG YEN (1957).....*Research Assistant in Civil Engineering*
B.S., National Taiwan, 1955; M.S., Lehigh, 1959.

THOMAS EDWIN YOUNG (1958).....*Assistant Professor of Chemistry*
B.S., Lehigh, 1949; M.S., 1950; Ph.D., Illinois, 1952.

MICHAEL ZALESKI (1958).....*Research Assistant in Chemistry*
St. Andrews (Scotland), 1951.

ALBERT CHARLES ZETTLEMOYER (1941, 1950).....*Professor of Chemistry, Director National Printing Ink Research Institute*
B.S. in Ch.E., Lehigh, 1936; M.S., 1938; Ph.D., Massachusetts Institute of Technology, 1941.

HOWARD J. B. ZIEGLER (1947, 1953).....*Clara H. Stewardson Professor of Philosophy, Head of the Department of Philosophy*
B.A., Franklin and Marshall, 1930; B.D., Theological Seminary of the Reformed Church in U.S., 1933; S.T.M., Lutheran Theological Seminary at Philadelphia, 1941; Ph.D., Columbia, 1950.

JANNETTE DOREEN ZISKO (1958).....*Nurse, University Health Service*
R.N., St. Luke's Hospital School of Nursing, 1953.

SCHOLARS AND FELLOWS

SYED MAZHAR ALI.....*Henry Marison Byllesby Memorial Research Fellow in Civil Engineering*
B.E., Karachi (Pakistan), 1958.

ROBERT ALAN BAILLIE.....*Esso Education Foundation Fellow in Chemical Engineering*
B.S., Delaware, 1959.

KENNETH EUGENE BARNES.....*Roy R. Hornor Research Fellow in Metallurgical Engineering*
B.E., Youngstown, 1959.

COLONEL HUGH BLOOM, JR.....*Socony-Mobil Oil Company Fellow in Chemical Engineering*
B.A., Princeton, 1954; B.S., Lehigh, 1955.

ROGER HILL BOHL.....*National Science Foundation Cooperative Fellow in Mechanics*
B.S., Lehigh, 1959.

FERDINAND CHARLES CATANEO.....*Allied Chemical Corporation Fellow in Chemical Engineering*
B.Ch.E., City College of New York, 1958.

MINOTTE MCINTOSH CHATFIELD.....*James Ward Packard Fellow in English*
A.B., Yale, 1936; M.A., Lehigh, 1955.

MAHLON FORREST CLEAVER.....*University Scholar in English*
B.A., Muhlenberg, 1959.

SAMUEL LEE COZZENS.....*Howard Flint Fellow in Chemistry*
B.S., Muhlenberg, 1954; M.S., Lehigh, 1956.

MARILYN DRAKE DAVIS.....*University Scholar in English*
B.A., Emory, 1958.

ROBERT LAWRENCE DONOVAN.....*University Scholar in Civil Engineering*
B.S., Lehigh, 1952.

GERAINT NANTGLYN DAVIES EVANS.....*Charles W. Parkhurst Fellow in History*
B.A., Trinity, Cambridge, 1957.

FRED JACK FISCH.....*Westinghouse Electric Corporation Fellow in Mechanical Engineering*
B.S., Lehigh, 1956.

DENNIS JOHN FITZGERALD.....*University Scholar in International Relations*
Dip. Econ., Ruskin, Oxford, 1955; L.L.B., London, 1959.

HAROLD SAMUEL GUREV.....*Linde Air Products Company Fellow in Metallurgy*
B.S., Case Institute of Technology, 1957; M.S., 1959.

THOMAS CHARLES HAGER.....*William C. Gotshall Scholar in Chemical Engineering*
B.S., Drexel Institute of Technology, 1958.

HOLGER VICTOR HANSEN.....*Student Chemistry Foundation Fellow in Chemistry*
B.S., Lehigh, 1957.

ROBERT JOHN HARDY.....*National Science Foundation Cooperative Fellow in Physics*
B.S., Reed, 1956; M.S., Lehigh, 1958.

JEFFREY WILLIAM JOHN HARROD.....*George Gowen Hood Fellow in International Relations*
L.L.B., London, 1959.

ALOIS JOSEPH HARTMANN.....*National Science Foundation Cooperative Fellow in Mechanics*
B.C.E., Manhattan, 1958.

MICHAEL HERBERT.....*Katherine Comstock Thorne Fellow in Biology*
B.S., Maryland, 1953; M.S., Lehigh, 1958.

RAYMOND DAVID HOFFMAN.....*Sun Chemical Corporation Fellow in Chemistry*
B.S., Lemoyne, 1956; M.S., Lehigh, 1958.

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DEWEY GEORGE HOLLAND.....*Althouse Chemical Company Fellow in Chemistry*
B.S., Fordham, 1958.

PAUL JOSEPH HORVATH.....*Gordon Foundation Fellow in Metallurgy*
B.S., Lehigh, 1959.

NANCY HSIEH.....*C. Kemble Baldwin Research Fellow in Mathematics*
B.A., Western College for Women, 1959.

JAE KYUNG HYUN.....*C. Kemble Baldwin Research Fellow in Physics*
B.A., Berea, 1959.

NICHOLAS KAFES.....*C. Kemble Baldwin Research Fellow in Chemical Engineering*
B.S., Massachusetts Institute of Technology, 1955; M.S., Lehigh, 1958.

JOAN MARY KATHERINE KARP.....*University Scholar in Psychology*
B.A., Saint Joseph's College for Women, 1959.

LYNN WATSON KENNEDY.....*William C. Gotshall Scholar in Physics*
B.A., Pomona, 1956; M.A., California (Berkeley), 1958.

RAM KRISHEN KHATRI.....*C. Kemble Baldwin Research Fellow in Electrical Engineering*
B.Sc., Agra (India), 1952; B.E., Sagar (India), 1956.

GARY NEIL KIRBY.....*J. Heber Parker, Carpenter Steel, Fellow in Metallurgy*
B.S., Cornell, 1957.

DAVID WARREN KIRKPATRICK.....*University Scholar in History*
B.S., North Adams (Massachusetts) State Teachers, 1959.

JOSEPH JOHN KOCISCIN.....*Heat Exchange Institute Fellow in Chemical Engineering*
B.S., Maryland, 1959.

ROSS ALLAN KREMER.....*Procter and Gamble Company Fellow in Chemical Engineering*
B.S., Pennsylvania State, 1959.

ALLAN HENRY LAUFER.....*American Chemical Society Petroleum Research Fund Fellow in Chemistry*
A.B., New York, 1956.

LAWRENCE EDWARD LAVISTA.....*Henry Marison Byllesby Memorial Research Fellow in Industrial Engineering*
B.S., Lehigh, 1959.

MARY SUE LODER.....*University Scholar in Biology*
A.B., Wellesley, 1936.

JOANNE ROBERTA KRUG LOGUIDICE.....*University Scholar in Psychology*
B.S., Pennsylvania State, 1959.

JOHN FRANCIS LOONEY.....*George Gowen Hood Fellow in History*
A.B., Saint Anselm's, 1951; M.A., New Hampshire, 1957.

MIGUEL ANGEL MACIAS, JR.....*Henry Marison Byllesby Memorial Research Fellow in Civil Engineering*
Ing. Civil, Instituto Technologico y de Estudios Superiores de Monterrey, 1957.

DAVID STUART MCLACHLAN.....*C. Kemble Baldwin Research Fellow in Physics*
B.Sc., Natal (South Africa), 1958; M.Sc., 1959.

NORMAN CHARLES MORANTZ.....*William C. Gotshall Scholar in Civil Engineering*
B.E., McGill, 1959.

PAUL BENTON MYERS.....*George Gowen Hood Fellow in Geology*
A.B., Colgate, 1955; M.S., Lehigh, 1957.

MAGGE SUBHAMANYAM NATESH.....*Henry Marison Byllesby Memorial Research Fellow in Mechanics*
B.E., Mysore (India), 1956; M.E., Indian Institute of Science, 1958.

FELICISIMO SALAZAR OPLE, JR.....*William C. Gotshall Scholar in Civil Engineering*
B.S., University of the Philippines, 1958.

WILSON THOMAS PIATT.....*University Scholar in Geology*
A.B., Lafayette, 1958.

RICHARD CARL PROGELHOF.....*James Ward Packard Research Fellow in Mechanical Engineering*
B.S., Newark College of Engineering, 1958.

MARLYN LUTHER RABENOLD.....*United States Steel Foundation Fellow in Industrial Engineering*
B.S., Pennsylvania State, 1959.

THILLAISTHANA BALASUBRAMANYA RAMACHANDRAN ....*University Scholar in Electrical Engineering*
B.Sc., Madura (India), 1950; Diploma, Madras Institute of Technology (India), 1953; M.S., Lehigh, 1959.

NADIGAR NAGARAJA RAO.....*William C. Gotshall Scholar in Civil Engineering*
B.E., University of Mysore (India), 1956; M.S., University of Madras (India), 1957.

DALE FRANKLIN RITTER.....*New Jersey Zinc Company Fellow in Geology*
A.B., Franklin and Marshall, 1955; B.S., 1959.

MELVIN SCHLECTER .....*The National Institutes of Health Fellow in Chemistry*
B.S., Queens (New York), 1953; M.S., Virginia Polytechnic Institute, 1958.

WILLIAM CULLEN SHERWOOD.....*National Science Foundation Cooperative Fellow in Geology*
B.A., Virginia, 1954; M.A., 1958.

MITCHELL ELI SISLE.....*James Ward Packard Research Fellow in Electrical Engineering*
B.S., Lehigh, 1958.

ROBERT GEORGE SMERKO.....*Socony-Mobil Oil Company Fellow in Chemistry*
B.S., Moravian, 1958.

JAMES RUDOLPH SMITH.....*University Scholar in History*
A.B., Lincoln, 1954; M.A., Lehigh, 1959.

ALAN LEE STOCKETT.....*American Chemical Society Petroleum Research Fund Fellow in Chemical Engineering*
B.S., Lehigh, 1956; M.S., Oregon State, 1958.

ROBERT JAMES SWENSON.....*National Science Foundation Cooperative Fellow in Physics*
B.S. in Eng. Phys., Montana State, 1956; M.S., Lehigh, 1958.

DONALD LEE TALHELM.....*International Telephone and Telegraph Corporation Fellow in Electrical Engineering*
B.S., Lehigh, 1959.

PAUL EUGENE TAX ..... *Hercules Powder Company Fellow in Chemical Engineering*
B.Ch.E., New York, 1956; M.S., Lehigh, 1958.

JOSEPH TENO ..... *National Science Foundation Faculty Fellow in Electrical Engineering*
B.S., Lehigh, 1951; M.S., 1952.

SHIRLEY ELIZABETH LAURA THUN ..... *University Scholar in Psychology*
B.A., Alberta, 1958.

SINASI TIMURTAS ..... *University Scholar in Mechanical Engineering*
B.S., Massachusetts Institute of Technology, 1950; M.S., Lehigh, 1956.

WILLIAM ELLIOTTE TYLER ..... *Armstrong Cork Company Fellow in Chemistry*
B.S., Randolph Macon, 1956; M.S., Lehigh, 1958.

YUKIO UEDA ..... *Garrett Linderman Hoppes Research Fellow in Civil Engineering*
B.E., Osaka (Japan), 1955; M.E., 1957.

SEWELL DAVID WEAVER ..... *Texaco Fellow in Chemical Engineering*
B.S., Purdue, 1959.

EUGENE ARTHUR WESLEY ..... *Union Carbide Corporation Fellow in Chemistry*
B.A., Lafayette, 1954.

JOHN DUDLEY WOOD ..... *Allegheny-Ludlum Fellow in Metallurgy*
B.S., Case Institute of Technology, 1953; M.S., Lehigh, 1959.

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B.S., Taiwan Provincial Cheng Kung University, 1953.

PAUL JOSEPH ZARZECZNY ..... *Henry Marison Eyllesby Memorial Research Fellow in Civil Engineering*
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SUMMER SESSIONS

(In addition to members of the regular staff)

WALTER H. BRACKIN ..... *Chairman Department of Psychology, Muhlenberg College, Allentown, Pennsylvania*

ANNA DEPLANTER BOWES ..... *Chief, Nutrition Division, Pennsylvania Department of Health, Harrisburg, Pennsylvania*

JOHN S. CARTWRIGHT ..... *Superintendent of Schools, Allentown, Pennsylvania*

ALFRED CASTALDI ..... *Belmont Hills Elementary School, Belmont Hills, Pennsylvania*

CHARLES E. CHAFFEE ..... *Superintendent of Schools, Bethlehem, Pennsylvania*

PAUL DRUMM ..... *Reading Consultant, Springfield Township School, Abington, Pennsylvania*

HOBART FARBER ..... *Retired County Superintendent of Schools, Lehigh County, Allentown, Pennsylvania*

ROBERT FINA ..... *Reading Specialist, Allentown Public Schools, Allentown, Pennsylvania*

MAX GARDNER ..... *Executive Director, Northampton County Tuberculosis and Health Society, Bethlehem, Pennsylvania*

PHIL HARBACH ..... *Elementary School Teacher, Merion Township Schools, Philadelphia, Pennsylvania*

DALE HOLLERN ..... *Public Health Educator, Lehigh County Tuberculosis and Health Society, Allentown, Pennsylvania*

RICHARD W. JACKSON.....*Executive Director, Lehigh County Tuberculosis and Health Society, Allentown, Pennsylvania*

PETER LAMANA.....*Reading Teacher, Palisades Joint School District, Kintnersville, Pennsylvania*

DOROTHY LOCHNER.....*Reading Specialist, Allentown Public Schools, Allentown, Pennsylvania*

BERNICE MAGNIE.....*Director of Art, Public Schools, East Orange, New Jersey*

SLAVA MALAC.....*Nutrition Consultant, Pennsylvania Department of Health, Reading, Pennsylvania*

JAMES E. NANCARROW.....*Principal, Upper Darby Township Senior High School, Upper Darby, Pennsylvania*

TED OCHS .....*Reading Specialist, Strasburg, Pennsylvania*

ELMER O'DAY.....*Director of the Reading Clinic, Valley Forge Military Academy, Wayne, Pennsylvania*

PAUL PHILLIPS.....*Principal Cynwyd Elementary School, Bala-Cynwyd, Pennsylvania*

JOHN S. SANDEL.....*Assistant Superintendent of Schools, Bethlehem, Pennsylvania*

ELIZABETH A. SLATER.....*Program Director, Northampton County Tuberculosis and Health Society, Bethlehem, Pennsylvania*

CORRINE SNOW .....*Music Coordinator, Public Schools, East Orange, New Jersey*

JOHN A. STOOPS.....*Principal, Neshaning Senior High School, Langhorne, Pennsylvania*

HARRY L. TENNYSON.....*Superintendent, Lehighton Area Union, Lehighton, Pennsylvania*

THOMAS W. WATKINS.....*Supervising Principal, Southern Lehigh School District, Coopersburg, Pennsylvania*

GERALD WEINSTEIN.....*Regional Consultant, Bureau of Community Mental Health Services, Department of Welfare, Harrisburg, Pennsylvania*

PHILIP WEXLER.....*Department of Mental Health Service, State of New York, Albany, New York*

SUPERVISORS OF STUDENT TEACHING IN COOPERATING HIGH SCHOOLS

EARL J. BAUMAN.....*Social Studies, Fountain Hill High School*
ALPHONSE CALVO.....*History, Broughal Junior High School*
JOHN J. CONTI.....*General Science, Broughal Junior High School*
WALTER F. DANEY.....*Social Studies, Liberty High School*
MRS. MARY LOUISE DURST.....*English, Broughal Junior High School*
WILBUR G. JACKSON.....*Mathematics, Liberty High School*
MISS MABELL L. KELCHNER.....*Biology, Liberty High School*
FRANK T. KERNAN .....*English, Liberty High School*
PAUL E. LARASH.....*Civics, Fountain Hill High School*
MRS. IRENE T. LEITH.....*Mathematics, Southern Lehigh High School*
MRS. FAYE T. SPRANDEL.....*English, Southern Lehigh High School*
CLIFFORD Q. STEINBACK.....*Mathematics, Liberty High School*

STANDING COMMITTEES OF THE FACULTY, 1959-60

(In each case the chairman is the member whose name appears first. The President and Vice-Presidents are *ex officiis* members of all committees.)

ADMISSION: C. A. Seidle *(ex officio)*; D. D. Feaver, W. J. Richardson, J. H. Urban.

ATHLETIC ELIGIBILITY: R. D. Stout (1960), T. C. Kubelius (1961), R. J. Tresolini (1962); P. L. Sadler, Executive Secretary *(ex officio)*.

DISCIPLINE: J. D. Leith *(ex officio)*; J. D. Ryan (1961), R. S. Sprague (1962).

EDUCATIONAL POLICY: A. S. Foust (1961), F. B. Jensen (1960), A. E. Pitcher (1960), E. D. Amstutz (1961), C. B. Joynt (1962), R. D. Stout (1962); C. E. Allen, L. V. Bewley, G. J. Christensen, W. H. Congdon, J. D. Leith, H. A. Neville *(ex officiis)*; J. H. Wagner, Secretary *(ex officio)*.

FACILITIES: E. W. Glick, C. E. Allen, L. V. Bewley, C. B. Campbell, G. J. Christensen, T. E. Jackson, A. W. Litzenberger, H. A. Neville, P. Parr, E. K. Smiley *(all members ex officiis)*.

GRADUATE FACULTY, EXECUTIVE COMMITTEE OF THE: W. H. Congdon, H. A. Neville *(ex officiis)*; J. J. Karakash (1960), C. F. Strauch (1961), F. A. Bradford (1962), P. Havas (1963), H. R. Gault (1964).

HONORARY DEGREES: A. C. Zettlemoyer (1960), J. E. Jacobi (1961), W. J. Eney (1962), R. T. Gallagher (1963), B. W. Parker (1964), J. A. Maurer (1965); H. A. Neville, E. K. Smiley, M. D. Whitaker *(ex officiis)*.

NOMINATIONS: J. B. Severs (1960), E. J. Serfass (1961), J. E. Jacobi (1962).

PUBLICATIONS, BOARD OF: P. Parr, J. B. McFadden, C. J. Moravec *(ex officiis)*; F. S. Hook (1960); and four student members.

RELIGIOUS LIFE: R. E. Fuessle, J. D. Leith *(ex officiis)*; J. O. Liebig (1960), J. E. Jacobi (1961), E. H. Emerson (1962); three members of the Alumni Association: R. A. Harrier (1960), J. W. Watters (1961), W. A. Schrempel (1962); and three student members.

SAFETY AND PREVENTIVE MAINTENANCE: T. E. Jackson, G. E. Kane, G. W. McCoy, L. A. Wenzel; A. W. Litzenberger *(ex officio)*.

STANDING OF STUDENTS: H. A. Neville, C. E. Allen, L. V. Bewley, G. J. Christensen; J. D. Leith, Executive Secretary; J. H. Wagner, Recording Secretary *(all members ex officiis)*.

STUDENT ACTIVITIES: P. Parr *(ex officio)*; D. W. Johnson (1960), G. W. Kyte (1961); and three student members.

STUDENT APPRAISAL OF INSTRUCTORS AND COURSES: T. M. Haynes (1960), J. H. Urban (1961), G. E. Kane (1962); and three student members.

STUDENT CONCERTS-LECTURES SERIES: P. Parr (1960), T. Hailperin (1961), J. B. Elkus (1962); C. J. Moravec, Executive Secretary *(ex officio)*; and three student members.

STUDENT LIFE: J. B. McFadden (1960), G. P. Conard (1961), V. V. Latshaw (1962); E. D. Amstutz (representing the Committee on Educational Policy); C. B. Campbell, R. E. Fuessle, P. Parr *(ex officiis)*; and four student members.

UNDERGRADUATE AWARDS AND PRIZES: J. D. Ryan (1960), W. A. Smith (1961); J. D. Leith, P. L. Sadler *(ex officiis)*; J. H. Wagner, Secretary *(ex officio)*.

UNDERGRADUATE SCHOLARSHIPS AND LOANS: J. D. Leith *(ex officio)*; A. P. Koch (1960), C. B. Campbell (1961), J. A. Hertz (1962), J. F. Libsch (1963).

UNIVERSITY CENTER, ADVISORY COMMITTEE OF THE: P. Parr, C. B. Campbell, E. W. Glick *(ex officiis)*; J. J. Karakash (1960), F. J. Trembley (1961), R. L. Armstrong (1962), G. J. Christensen (1963), S. G. Walters (1964); the President of Arcadia and six additional student members.

UNIVERSITY EXERCISES: P. L. Sadler, C. J. Moravec, J. C. Stapleton, K. R. Strauss *(ex officiis)*; J. D. Mack (1960), D. W. Johnson (1961).

*USHERS: D. W. Johnson (1960), C. L. Moore (1960) E. H. Cutler (1961), R. J. Tresolini (1961), L. S. Beedle (1962), V. B. Fish (1962), E. H. Emerson (1963), S. B. Ewing (1963), C. W. Brennan (1964), L. A. Wenzel (1964).

WILLIAMS SENIOR PRIZES: J. B. Severs, F. A. Bradford, H. B. Davis, N. B. Gross, G. D. Harmon, H. J. B. Ziegler.

*Special Committee

Lehigh University

Lehigh University is a non-denominational, private institution comprising the College of Arts and Science, the College of Business Administration, the College of Engineering, the Graduate School, and the Institute of Research. Its offering of the baccalaureate degree is limited to men, although men and women are admitted to the Graduate School, the Summer Session, and the Adult Education Program.

Its buildings are located on a 180-acre campus on South Mountain above the City of Bethlehem, Pennsylvania, a site situated approximately halfway between New York City and Harrisburg. A field house, gymnasium, and playing field on the north side of the city are included among the University's athletic and recreation facilities. The University recently acquired additional land on the western slope of South Mountain and in Saucon Valley south of Bethlehem, bringing the total acreage to almost 700.

Supplementing the formal academic program is an extensive program of extra-curricular activities, in all of which students have the assistance of competent faculty advisers.

Lehigh is distinctly a university with a purpose. This purpose is a heritage from its founder, the Honorable Asa Packer, industrialist and philanthropist.

Beginning life as a poor farm boy in Connecticut, Asa Packer moved to Pennsylvania as a youth and became one of America's pioneer captains of industry. He recognized and developed the great natural resources of that richly endowed section of Pennsylvania known as the Lehigh Valley.

Looking back from the peak of his career Mr. Packer saw clearly how much easier his tasks would have been and how much fuller the fruits of his labor had he been fortified in youth with a background of training in the arts and natural sciences. Looking forward with penetrating vision, he foresaw the great industrial development that was then just beginning. He realized that the training he lacked was to become more and more essential in the years to come.

Originally the founder had in mind a school primarily technical, catering to the youth of the Lehigh Valley. However, as the details of the project were worked out by Judge Packer and his

educational advisers, the scope of the educational services contemplated were greatly broadened. They foresaw the complex social, economic, and technical problems which the future would bring, and the need for service and leadership in these areas.

Thus it was that in 1865 Lehigh University was founded to provide young men with a sound basis for successful living, in the fullest sense of the phrase, and to insure leadership for the complex business and industrial civilization of the future.

During his lifetime and by bequest Judge Packer gave Lehigh over three million dollars including land, buildings, and endowment. The generosity of the Packer family and other friends of Lehigh, the distinguished faculty originally assembled, and the prominence of early alumni firmly established the reputation of Lehigh in college education, and the young University took its place proudly among older and larger institutions.

The endowment fund of the University now exceeds fourteen and a half million dollars. The value of equipment, buildings, and grounds is over twenty-two million dollars.

The new institution, which opened its doors to young men from the country at large in 1886, was given the character of a small university. From the very beginning Lehigh combined in a unique fashion the traditional American college of liberal arts, the continental university, and the new technical institute of university rank.

Lehigh continues to base its program on the premise that an education for successful living must combine the acquisition of knowledge and skills fundamental in the professions with courses designed to broaden the vision and to enrich the personal life of the individual. Therefore, at Lehigh requirements for graduation include studies preparatory to a career, a generous number of courses to acquaint the student with the nature and problems of the world in which he lives, and opportunities to develop himself as an individual.

The organization of Lehigh as a small University contributes to the goal of meeting individual needs by enabling students enrolled in one college to pursue in other undergraduate divisions those studies for which they are qualified and from which they can best profit.

It is also important to note that students may move from one curriculum to another. For instance, a freshman may discover that

his first choice was ill-founded. After consultation and investigation he is permitted to transfer to a curriculum more suited to his interests and abilities.

A comprehensive student advisory system assures that a student will seek and obtain advice in planning for his future career. The services of the officers and departments concerned with advising students are provided on a compulsory and voluntary basis so that when help is needed, it is available.

Lehigh students have ample opportunity to discuss with qualified and sympathetic advisers problems related to courses of study and problems of a personal nature. (See "Placement and Counseling Services".)

Lehigh's location in Bethlehem places it approximately 60 miles north of Philadelphia and 90 miles west of New York City, in the center of the cultural East and in the heart of the industrial production of the Middle Atlantic states.

It was no mere chance that Lehigh was placed on the slope of Old South Mountain. When Judge Packer selected a large tract of land near the banks of the Lehigh River, he knew he was establishing a new University at the very doors of the mighty industries and the historic institutions of the Atlantic seaboard. Bethlehem was at the gateway to westward expansion by railroad and highway. It was (and is) a city which could serve admirably as a "college town"—providing a bustling industrial community and historic cultural background as laboratories for students.

Settled in 1740 by Moravians, Bethlehem is rich in historic traditions with picturesque homes and well-kept gardens. Numbered among its historic places of interest is the Bell House erected in 1745. The bell served the settlers as a call to worship as well as warning them of fire or Indians. Colonial Hall, erected in 1748, was used during the Revolutionary War as a hospital for wounded soldiers of the Continental Army.

Each spring Bethlehem is the mecca for thousands of music-lovers from far and near, who come to hear the famous Bach Choir in Packer Memorial Church on the Lehigh Campus.

With a population of about 75,000, Bethlehem is a city of modern commercial and industrial importance. But the 180-acre campus of Lehigh on a hillside on the south side of the Lehigh River ensures the residential character of the University.

Admission Requirements

The enrollment of Lehigh University is strictly limited by action of its board of trustees, with a resulting limitation in the number of candidates who can be admitted each year to the several divisions of the University.

In the selective procedure necessitated by this limitation, the University, through its Office of Admission, takes into account a number of criteria which are believed to have some individual validity and in combination a high degree of validity in predicting probable success in college work.

(1) HIGH SCHOOL UNITS

The sixteen courses required as entrance credit represent the quantitative equivalent of the usual four-year secondary school program and include certain prescribed subjects and sufficient electives to make up the following totals:

For the College of Arts and Science—

English	4
Foreign Language	2
Elementary and Intermediate Algebra	1½
Plane Geometry	1
Required for students planning programs in the natural and physical sciences or in arts-engineering:	
Plane Trigonometry and Logarithms	
Recommended but not required:	
Advanced Algebra and Solid Geometry	
Chemistry	
Electives	7½
	16

For the College of Business Administration—

English	4
Elementary and Intermediate Algebra	1½
Plane Geometry	1
Electives*	9½
	16

For the College of Engineering—

English	4
Elementary and Intermediate Algebra	1½
Plane Geometry	1
Plane Trigonometry and Logarithms	½
Recommended but not required:	
Advanced Algebra and Solid Geometry	
Chemistry	
Electives *(including Advanced Algebra and Chemistry)*	9
	16

*See page 104 for language requirements in the College of Business Administration.

The electives may be offered in any subjects studied under standard conditions in an accredited secondary school. However, it is recommended that in addition to the above minimum subject matter requirements all candidates include as many courses in science, history, mathematics, and language as their programs and schools will permit.

(2) QUALITY OF WORK

The quality of the candidate's work will be judged by such factors as his rank or relative average grade in his class; the extent to which he has made grades distinctly higher than the minimum passing grade; evidence of improvement or deterioration in quality of record as he has progressed through secondary school; success or failure in the particular subjects which he proposes to continue in college; and the comments and recommendations of his principal or headmaster.

(3) ENTRANCE EXAMINATIONS

All candidates for admission to the freshman class at Lehigh University are required to write entrance tests prepared and administered by the *College Entrance Examination Board.*

Each candidate is required to write a full series of tests: *Morning Program:* Scholastic Aptitude Test; *Afternoon Program:* English Composition Achievement Test, and two additional tests.

Candidates for the College of Arts and Science and for the College of Business Administration may write language, science, mathematics, or social studies tests for the additional afternoon tests.

Candidates for the College of Engineering, for a science major in the College of Arts and Science, or for the combined Arts-Engineering Programs are required to write the advanced mathematics test and the physics or chemistry test for the additional afternoon tests.

Lehigh requires candidates to write the Scholastic Aptitude Test in December, January, or February and the three afternoon achievement tests in March of the senior year in secondary school.

Information and application forms for the tests should be secured from the *College Entrance Examination Board* at one of the following addresses (whichever is closer to the candidate's home

or school): *P. O. Box 592, Princeton, New Jersey,* or *P. O. Box 27896, Los Angeles 27, California.*

The candidate is responsible for requesting that his test scores be sent to Lehigh—either by indicating Lehigh on his College Board application blank or, if he failed to do this, by special request to the College Board office. In addition to requesting College Board scores, the candidate must submit an application for admission to the freshman class at Lehigh.

(4) OTHER CRITERIA AND INTERVIEWS

Information about other qualifications of candidates is obtained from principals, headmasters, and counselors. Such information relates to the candidate's health, emotional stability, intellectual motivation, social adjustment, participation in school activities, and established habits of industry and dependability.

The University reserves the right to require any candidate for admission to present himself for an interview and to base the selection of candidates in part upon the appraisals obtained through such interviews. However, *a personal interview is not required of all candidates.*

If a candidate wishes to visit the University, he should make an appointment in advance of the visit. Interviews may be scheduled on weekdays between 9:30 and 11:30 a.m. and from 1:30 to 4 p.m. and on Saturday mornings from 9 to 11:30. The Office of Admission is closed Sundays, national holidays, Saturday afternoons during the school year, and all day Saturday during the summer months. A particularly good time for a candidate to visit Lehigh is during the summer between the junior and senior years in secondary school.

Admission Procedure

ADMISSION TO THE FRESHMAN CLASS

A candidate for admission to the freshman class should secure from the Office of Admission an application blank and should submit this early in his last year of preparation for college. First consideration is given to applications received prior to *February 1.*

On the application for admission the candidate is asked to indicate his proposed major field of study at Lehigh. Each candidate is urged to read this *Catalog* or the *Undergraduate Announcement* thoroughly and carefully so that he will be familiar with the programs and opportunities at Lehigh before he indicates his proposed field of study.

He should arrange with his school adviser to register for morning and afternoon tests administered by the College Entrance Examination Board. (See page 49.)

Most important of all he should maintain a strong academic record. He should work hard to develop sound study habits which will assure high achievement in secondary school and will give him a good start in his freshman year in college.

ADVANCED STANDING FROM SECONDARY SCHOOLS

A few private and public secondary schools now offer truly advanced courses for limited numbers of selected students. If a candidate has completed, or expects to complete, such a course in an approved secondary school, he may establish advanced standing by taking an anticipatory examination in the particular subject.

This privilege is granted only on written request to the Director of Admission not later than June first of the year the student plans to enter college.

The examinations are given at the University at times scheduled by the University. A fee of $5 is charged for each such examination.

Exceptions to this method of establishing advanced standing from secondary schools are made only when a particular school and Lehigh University have agreed to accept well recommended students with advanced standing for specified courses. The school is expected to take the initiative in approaching the University for such an understanding.

ADVANCED STANDING FROM ANOTHER COLLEGE

Candidates for admission by transfer from other institutions may be admitted with advanced standing subject to the enrollment limitations of the several divisions of the University. Such candi-

dates must have met the entrance requirements (other than examinations) prescribed for undergraduates at Lehigh.

A candidate who has studied at another college prior to applying for admission to Lehigh will be considered on the basis of the quality of his record at that college. *A candidate who has been dropped from another college for disciplinary reasons or for poor scholarship or who is not in good standing at his former college is not eligible for admission to Lehigh University.*

A student who is planning to transfer to Lehigh University should so arrange his work in college that he will cover as many as possible of the subjects of the freshman and sophomore years of the curriculum he selects.

A student who desires to transfer to Lehigh University from another university, college, or junior college must submit an application for admission (on a special transfer form) and an official transcript of his academic record at each college he has attended. Such a transcript must include a complete list of all courses taken, a list of entrance credits accepted for admission, and a statement of honorable dismissal. A copy of the catalog of each college previously attended should be sent to the Office of Admission at the time the transcript is forwarded.

A candidate who has attended more than one university, college, or junior college must present a record from each institution. Failure to submit a complete record of former academic experience will result in cancellation of admission or registration.

APPLICATION FEE

Each undergraduate application for admission to the freshman class, with advanced standing, or to the General College Division must be accompanied by an *application fee* in the amount of $10. The check or money order for the application fee should be made payable to Lehigh University. The application fee is nonrefundable in event the candidate does not matriculate at Lehigh University. It is not applied toward tuition if the candidate matriculates.

ACCEPTANCE OF ADMISSION AND DEPOSIT

When a candidate's preliminary credentials are complete and he has been offered formal admission to Lehigh University, he

will be asked to notify the Director of Admission of his acceptance of the offer of admission by making a deposit of $50 to hold a place for him in the limited enrollment. This deposit is not an additional fee but is applied toward tuition charges for the first semester. However, the deposit is forfeited in case of failure to enroll for the specified semester.

Early offers of admission for the freshman class entering in September are sent in March following receipt of January College Board scores and preliminary secondary school records through the first semester of the senior year. Normally acceptable candidates who write both morning and afternoon tests in March may expect to be notified before the middle of May.

Lehigh does not admit a freshman class in February. A transfer student will not be admitted until he has completed at least two semesters of study at an accredited institution of higher learning.

Undergraduate Fees

The tuition for undergraduates is $550 per semester in the College of Engineering, the College of Arts and Science, the College of Business Administration, and the General College Division. Undergraduates enrolled in the College of Engineering will pay, in addition to tuition, a fee of $50 per semester. A student regularly enrolled in any of the undergraduate divisions of the University who registers for fewer than the normal hours of work will pay either $46 for each semester-hour carried* or the regular tuition plus the $50 fee for engineering students, whichever amount is lower.

Students registered in the five-year programs leading to degrees in Arts and Science and in Engineering pay the regular Arts and Science fee for one year and the fees collected from students in the College of Engineering during subsequent years of enrollment in the combined program.

There are no fees for athletics, health service, library, student activities, or student concerts-lectures. In addition, there are no matriculation, graduation, or laboratory fees.

Undergraduate fees are payable prior to registration. A bill will be rendered by the Bursar's Office which will indicate the

*In computing tuition charges on the semester-hour basis, English 0 and Mathematics 0 are considered three-hour courses.

payment date. If desired, payment may be made in installments of 60 per cent, plus a service charge of $3 per semester, due prior to registration, 20 per cent due one month after registration, and 20 per cent due two months after registration. The $3 service charge is not refundable.

Military and Band Deposits. A deposit of $25 is made by each student enrolling in military or air science and tactics or band. This deposit is refunded when the property issued to the student is returned.

Chemistry Breakage. Students taking chemistry laboratory courses are required to reimburse the University for returnable equipment broken or otherwise damaged and for all chemicals used in excess of reasonable amounts. To cover possible charges of this nature, all students registering for laboratory courses in chemistry purchase coupon books costing $5, the unused portions of which are redeemed.

Examination Fees. Students who for satisfactory reasons absent themselves from final examinations will be allowed, upon petition, to take make-up examinations without payment of any examination fee. A fee of $5 is charged for any examination subsequent to the first regular final or make-up examination allowed upon petition in any course. This regulation applies to the psychological and placement examinations required of new students if taken at some time other than those scheduled.

A fee of $5 is charged for anticipatory examinations taken by students to establish advanced standing on the basis of work completed in secondary schools. (See page 51.)

Shop and Surveying Courses. A three-week shop course for industrial and mechanical engineering students is required during the summer following the sophomore year, and three-week surveying courses are required by the Departments of Civil Engineering and Mining Engineering during the summer following the sophomore year. Tuition charges are made for the shop course which is given in Bethlehem under the Department of Industrial Engineering, and for the surveying courses, which are conducted at camps or on campus under the auspices of the Departments of Civil Engineering and Mining Engineering. The tuition charge

for all of these courses is the regular summer rate per semester hour. To this is added the cost of room and board at prevailing rates.

Late Registration Fees. The penalty for procuring a registration ticket after the time specified by the Registrar shall be $10. A student who does not complete his registration within three days after the date of his registration ticket is subject to a penalty of $10. No registration will be accepted later than the tenth day of instruction in a regular semester or the fifth day of instruction in any summer term.

Late Pre-Registration Fee. The penalty for a late pre-registration or a change in pre-registration is $10. This will be waived for cause upon the recommendation of the curriculum director or dean concerned.

Change-of-Roster Fee. Having once registered in any semester, a student may not add or drop any course except on the recommendation of the director of his curriculum. There will be a $10 change-of-roster fee for each such change unless it is waived by the curriculum director or college dean.

Late Installment Payment. In certain cases, students are permitted to pay semester bills in three payments. In other cases, emergency short term loans are granted to be repaid in period installments within the semester in which the loan is granted. A penalty fee of $10 is levied on any student who fails to make payment in accordance with the agreed schedule.

Late Payment of Fees. University fees are payable prior to registration. If payment, or provision for payment satisfactory to the University, is not made prior to registration, a fee of $10 will be assessed if such payments, or provisions for payments, are made after the registration date.

Late Application for Degree Fee. Refer to General Regulations—Notice of Candidacy for Degree.

Application for Admission Fee. A fee of $10 is required with each application for admission to the undergraduate colleges of the University.

Listener's Fee. A fee of $35 is charged undergraduate students enrolled in less than a full program and paying less than the full tuition as a listener's fee for each student who wishes to attend a course without desiring to obtain credit for the course.

Refunds

Undergraduate. If a student withdraws from the University, he is entitled to receive a refund of his tuition including the fee paid by undergraduates of the College of Engineering less $50 and less a deduction of 2 per cent of the tuition and engineering fee for each day of instruction completed, computed from the first day of instruction in the semester. In the event of the death of a student or his involuntary induction into the Armed Forces, tuition will be refunded in proportion to the fraction of the semester remaining at the time of his death or induction. No student who is suspended or expelled from the University shall be entitled to any refund.

A summer session student who formally withdraws from the University is entitled to receive a refund of his total tuition less $5 for each credit hour for which he is registered and less a deduction for each day of regular instruction of 4 per cent of the total tuition paid computed from the first day of instruction in the session.

Residence Hall Rental. Residence hall rental paid in advance is refundable (i) in its entirety for any term in which the student does not register in the University or (ii) on a proportional basis for cancellation due to the student's death or involuntary induction into the armed forces. Otherwise, refunds are limited to the proportional charge for the unexpired portion of the student's lease less a charge of $25, and to cases of (i) withdrawal from the University (for reasons not involving misconduct) or (ii) transfer of lease to another student (for whom no other accommodations exist), subject to approval of the Director of Residence Halls. Refunds authorized under this regulation shall be certified to the Bursar by the Dean of Students.

DINING SERVICES. Refunds will be allowed only on written request to the Treasurer approved by the Dean of Students. Normally such requests will be approved in cases of confining illness requiring absence from all University activities for a period longer than 14 consecutive days or in cases of voluntary withdrawal from the University, involuntary induction into the Armed Forces, or death of the student. Refunds will be computed on the basis of $2.40 per day for each full day of absence involved.

If a student is suspended or expelled from the University, he may be allowed as a refund 50 per cent of the amount representing the unexpired portion of his original dining service contract for the semester.

GRADUATE. A graduate student who formally withdraws from the University or who, on the advice of his department head and with the approval of the Dean, reduces his roster below twelve hours may qualify for a tuition refund equal to the tuition paid for the courses dropped, less a service charge of $5 for each semester hour dropped and less 10 per cent of the tuition charge for each full or fractional week of the semester which has lapsed, the time being counted from the first meeting of the course dropped. During summer sessions, the 10 per cent charge is increased to 20 per cent.

No refunds will be made to any undergraduate student for any reduction in his schedule after the tenth day of instruction in a regular semester or the corresponding relative date in a summer session.

A minimum of ten days is normally required to process refund checks.

Estimate of Expenses for the College Year

Items of personal expense are dependent upon each student's personal habits and circumstances. There are certain basic expenses, however, which must be met by all students. An *estimate* of annual cost is listed below.

	Arts and Science Business Administration	*Engineering*
Tuition	$1100	$1100
Engineering Fee		100*
Books and Supplies	75	150
Room	300	300
Subsistence (estimate)	550	550
	$2025	$2200

(Note: Students taking military or air science are required to make a $25 deposit which is refundable at the end of the school year.)

Books, stationery, and drawing instruments may be purchased at the Supply Bureau in the University Center.

Dormitory students are required to eat in the University Center. Board will be billed on a semester basis payable prior to registration.

Living Arrangements

Nearly all Lehigh undergraduates live in the six University residence halls (50 per cent), or in 30 fraternity houses by invitation (40 per cent), or are commuters (10 per cent). All freshmen who do not live at home are required to live in the residence halls.

Each student who lives in the Residence Halls is provided with board in the University dining service in the new University Center. The following three board plans are available:

a. Twenty-one meals per week (3 meals daily beginning with the evening meal before the first day of classes and continuing except announced holidays through the evening meal of the last day of classes of each semester)—$500 per school year.

b. Seventeen meals per week (Monday breakfast through and including Saturday lunch) beginning with evening meal on the day before the beginning of classes and continuing, except holidays, through the last day of classes for each semester—$450 per school year.

c. Fifteen meals per week (Monday breakfast through Friday dinner beginning with the evening meal before the first day of classes and continuing, except announced holidays, through the last day of classes each semester)—$430 per school year.

*This fee is not charged in the freshman year of the combined Arts-Engineering program but it is charged in the second and subsequent years in this program.

Plan A is required for freshmen residing on the campus. Upperclassmen residing on the campus have the choice of any of the three plans.

Students who do not reside on the campus may participate in any of the above board plans if space is available in existing facilities, or they may eat in the coffee shop.

Freshmen residing on the campus are required to eat their meals at the University dining service at the University Center during freshman week. There will be an additional charge of $17 for serving the three meals per day during the freshman week.

During examination periods, meals will be available at the University dining service in the University Center on a cash basis for a la carte service.

Each student who participates in one of the board plans will receive a dining services identification card which is not transferable. Use of the card by others than to whom it is issued is illegal and will result in disciplinary action. New cards will be issued to replace lost cards upon the payment of a fee of $5.

Visitors on campus may eat in the Asa Packer Room, the faculty and guest dining room in the University Center.

The freshmen occupy three residence halls staffed by a corps of carefully selected upperclass counselors under graduate resident officers responsible to the Director of Residence Halls and the Dean of Students.

Room rents in the residence halls range from $110 to $160 per student per semester with maid service included. The typical room is shared by two students. For each student there is provided a bed, box spring, mattress, chest of drawers, desk and chair; residents supply desk lamps, waste baskets, bedding, etc. Commercial linen service is available at a rate presently $27 per year. Personal laundry is arranged for by the student on an individual basis.

Residents will be held responsible for any damage done to their rooms or any other part of the Residence Hall and its equipment.

The University is not responsible for the loss or destruction of any student property whether such losses occur in the residence halls, lockers, classrooms, etc. The safekeeping of student property is the responsibility of each individual student and no reimbursement can be expected for the loss of such property from the

University. Insurance protection, if desired, may be obtained by a student or his parents from an insurance broker or agent.

The University's Bureau of Housing Information stands ready to aid married students with their housing problems.

Use of Motor Vehicles at Lehigh University

Permission for students to have and to operate motor vehicles while in residence is granted so long as there is no evidence that having such a motor vehicle interferes with academic progress and the demands of good citizenship, except that:

Any student operating a motor vehicle on the property of the University must register it with the Office of Buildings and Grounds and must conform to the regulations of the office.

A freshman is not permitted to have or to operate a motor vehicle while in residence.

A sophomore will be issued a motor vehicle permit provided:

a. He has applied to the Dean of Students for the permit and has submitted a written request from his parents supporting the application.
b. He has a cumulative average of 1.5 or better and is in good standing academically.
c. His permanent record shows no adverse action by the University Discipline Committee.
d. He and his motor vehicle are adequately covered by liability insurance.
e. His application has been approved by the Dean of Students.

A sophomore permit shall automatically become invalid if changes in the student's record are such that they would have prevented the issuing of a permit originally.

Exceptions to the foregoing may be made for students living at home, for students under medical care, or in other exceptional cases upon petition by the student to the dean of students.

The University reserves the right, for cause, to deny to any student permission to have or to operate a motor vehicle while in residence. The University assumes no jurisdiction over the use of a motor vehicle on family business by a student living at home.

The College of Arts and Science

The College of Arts and Science

Administrative Officers

Martin Dewey Whitaker, *President*
Harvey Alexander Neville, *Vice-President and Provost*
Earl Kenneth Smiley, *Vice-President*
Glenn James Christensen, *Dean of the College of Arts and Science*
John Douglas Leith, *Dean of Students*
Charles Augustus Seidle, *Director of Admission*
James Harold Wagner, *Registrar*
James Decker Mack, *Librarian*

The College of Arts and Science of Lehigh University comprises the departments of biology, classical languages, education, English, fine arts, geology, German, history and government, international relations, mathematics and astronomy, music, philosophy, psychology, religion, and romance languages. Interdepartmental programs are offered in foreign careers and natural resources. Courses in economics, sociology, accounting, and finance are provided by the College of Business Administration; physics and chemistry are supplied by the College of Engineering.

The degree of Bachelor of Arts is conferred upon graduates of the College.

PURPOSES

Under the name "School of General Literature," the College of Arts and Science was a part of the original plan of the Univsity, and its aims have remained constant, although the means employed have been adapted to the changing times.

The purpose of the College is to prepare a man for the exercise of his individual responsibility in the affairs of mature life. This purpose recognizes three distinguishing characteristics of an educated man; the ability to think in a disciplined manner, the ability and willingness to make discriminating judgments, and the capacity to apply his creative imagination.

In order to achieve this purpose the faculty shares with the student the range of human knowledge: the world of fact, and its counterpart, the world of ideas. The fundamentals of this experience remain what they have been for generations: a comprehensive study of all the broad areas of knowledge—the humanities, the natural and physical sciences, and the social sciences—and a rigorous training in one of them.

PREPARATION FOR PROFESSIONAL SCHOOLS AND THE PROFESSIONS

The College of Arts and Science provides the preliminary training necessary for admission to the various graduate schools and, in some cases, prepares directly for a profession. Since a large proportion of the graduates of the College of Arts and Science of Lehigh University continue their work in graduate schools, the College offers a number of course combinations designed to give preliminary training for such various fields as medicine, dentistry, public service, public health, law, theology, engineering, and business administration. Students who are looking forward toward any one of the graduate schools should consult the dean of the College and the director of their major program.

THE CURRICULA

The College of Arts and Science offers two curricula: the four-year curriculum with a major in one of the arts or sciences, and the five-year curriculum in Arts-Engineering. Both are based on the principles of distribution and concentration. Distribution requirements are the same for both curricula. In the Arts-Engineering program, the engineering general studies requirements are met by completing the Arts College distribution requirements.

Distribution Requirements

The object of the distribution requirements is to give the student an elementary knowledge of the fields of contemporary thought and to orient him in the world of man and nature.

The distribution requirements are administered by the dean of the College of Arts and Science in accord with the group regulations given below. The subjects required of the individual student depend in part upon the field in which he expects to major, in part upon his personal preference, and in part upon the subjects he has taken in secondary school.

Group I: Humanities

Freshman English. Six semester hours. The normal requirement is Engl. 1 and 2, Composition and Literature. Students who demonstrate satisfactory ability in written composition in the freshman placement tests will meet this distribution requirement

by passing Engl. 11 and 12, Types of World Literature. Three extra hours of composition, carrying no credit toward graduation, must be taken and passed by those whose preparation, as evidenced by the placement tests, has been poor.

LITERATURE. Six semester hours. This requirement can be met by passing two courses chosen from:

(a) Courses in English or American literature.
(b) Greek 50, Greek Literature in Translation.
Latin 51, Latin Literature in Translation.
(c) Literature courses at the third-year level in a foreign language, provided that such courses are not also used to satisfy the Foreign Language requirement.

Students who meet the Freshman English requirement by passing Engl. 11 and 12 will be considered to have met the Literature requirement as well as the Freshman English requirement.

FOREIGN LANGUAGE. Number of hours varies depending on previous language study. Each student is required to complete successfully one year (6 hours) of advanced college courses in one language. The requirement is normally met by pursuing in course the language to be used in satisfaction of the requirement. Eighteen hours of course work are normally taken by students who begin a new language in college.

Students who present at entrance three or four years of foreign language normally are able to meet this requirement with one year of advanced college work or by examination.

With the approval of the dean of the College, an option is offered those who find it necessary to pursue in college the study of two foreign languages, provided that neither language was studied in secondary school. Such students may offer in satisfaction of the language requirement two years (12 hours) of one foreign language and one year (6 hours) of another.

FINE ARTS OR MUSIC. Three semester hours.

PHILOSOPHY OR RELIGION. Three semester hours.

Group II: Natural and Physical Science

Twelve semester hours chosen from a least three of the following fields: astronomy, biology, chemistry, geology, mathematics, physics, psychology.

One course chosen to meet this requirement shall be Math. 3, Introduction to Mathematical Analysis; Math. 11, Analytic Geometry and Calculus I; or Phil. 14, Logic and Scientific Method. If the course chosen from these three is Phil. 14, it may not also be used to meet the Philosophy or Religion requirement.

Group III: Social Science

Twelve semester hours, chosen from at least three of the following fields: ancient civilization, economics, education, government, history, international relations, sociology.

Concentration Requirements

Concentration requirements are different for the two curricula.

Concentration Requirements in Arts and Science

During the second semester of the freshman year if possible, and in any event no later than the end of the sophomore year, each student in the four-year Arts and Science curriculum must select some sequence of studies as his major field. A major consists of at least twelve semester hours of advanced work in the field chosen. Including preliminary college work, the minimum number of hours constituting a major is twenty-four. The actual major requirements are those stated under "Details of Major Sequences," pages 71 to 97.

Change of major is permitted up to the end of the sophomore year. Major programs must be approved by the director of the major chosen and by the dean of the College.

The major work is designed to enable a student to master his chosen field so far as that is possible during undergraduate years. In all fields, certain courses are prescribed, but the mere passing of courses will not satisfy the major requirements. It is expected that the student will read widely in his subject and will prepare himself largely through his own reading and through independent work for his final comprehensive examination.

After a student has selected a major subject, the head of the department in which the major was selected becomes the official adviser of the student and guides him in his choice of courses. The dean of the College remains the curriculum director.

Concentration Requirements in Arts-Engineering

The standard major for students enrolled in the five-year Arts-Engineering curriculum is Applied Science (page 88). This major is normally completed during the first four years, during which the dean of the College of Arts and Science is the curriculum director. At the end of the fourth year it is expected that Arts-Engineering students will have taken their B.A. degree and will transfer to the appropriate engineering curriculum for their final year. The director of that engineering curriculum, who has meanwhile been acting as adviser of the major sequence, becomes curriculum director for the fifth year.

Pattern rosters which show the normal combination of courses for the first four years of the Arts-Engineering curriculum are given on pages 88-97.

Under special circumstances, Arts-Engineering students may take one of the other majors offered in the College of Arts and Science. Such a change in program, however, must have the approval both of the dean of the College of Arts and Science and of the curriculum director under whom work for the B.S. will be completed. In some instances it may be advisable to take the two degrees at the end of the fifth year. Such an irregular program requires a petition to the Committee on Standing of Students.

To qualify for both the B.A. and the B.S. in Engineering, a student must submit for the second degree thirty credit hours in addition to the number required for the B.S. alone.

SUPERVISION AND COUNSELING

Each student in the College of Arts and Science is considered from the beginning as an individual. The College expects every student to have a well-defined purpose at entrance, but recognizes the student's right to change his objectives and for that reason gives him time in which to find himself and establish the direction of his future career. To help the student in his decision, the College provides an advisory staff consisting of the dean of the College, as curriculum director, his assistants, and the directors of the major sequences. The individual program for each student is outlined tentatively in an interview with the dean of the College or one of his assistants before the beginning of the first

semester of the freshman year. This preliminary program is determined by the nature and quality of the student's preparation and by his personal interests. The final program, which is made out in detail no later than the end of the sophomore year, takes into account, in addition, demonstrated aptitudes and pre-professional or vocational needs.

These individual programs admit of considerable elective choice, depending upon the demands of the distribution and concentration requirements. In general the student in the College of Arts and Science may elect any undergraduate course for which he has the prerequisites.

REQUIREMENTS FOR GRADUATION

There are three basic requirements for graduation with a B.A. in either curriculum:

1. The completion with the required average of a minimum of 120 credit hours of collegiate work, apportioned so as to cover the distribution and concentration requirements. These hours are in addition to physical education and the basic courses in military or air science and tactics, both of which are required of all students in the University.

Arts-Engineering students will normally complete by the end of their fourth year approximately the number of hours required for the B.S. in their chosen branch of engineering.

2. The passing of an impromptu writing test in the junior year.

3. The passing of a comprehensive examination in the major field.

Junior English Impromptu

Toward the end of the junior year, each junior in the College of Arts and Science must report to the department of English for an exercise in impromptu writing. Students found seriously deficient in this test are reported to the dean of the College, who may require that they take additional English without credit toward graduation.

Students in the College of Arts and Science who persistently use poor English may be reported at any time to the dean of the College. He may require that they take additional English without credit toward graduation.

Comprehensive Examination

A comprehensive examination in the major subject is required of all students. This examination is given at the end of the senior year and may be oral or written or both. The comprehensive examination is given under the direction of the head of the major department. At least two University teachers and, whenever possible, representatives of at least two departments take part in the examination. At the direction of the various departments, the appropriate Graduate Record Examination may be made a part of the comprehensive.

No student is allowed to take the senior comprehensive examination more than twice in any one field. In case of failure on the first attempt, a second trial is not permitted until a period of three months has passed.

HONORS AND UNSCHEDULED WORK

Qualified students in both curricula in the College of Arts and Science may choose to work for either Special Honors or College Honors. Particularly well-qualified students sometimes work for both.

Special Honors

Special, or departmental, honors are awarded at the end of the senior year, on recommendation of the head of the department concerned and by vote of the faculty, to students who have done advanced work of unusual merit in some chosen field. Candidates for special honors must indicate to their major adviser during their junior year their intention to work for such honors. Awards are based on grades obtained in the subject chosen, the results in extra work assigned, and the general proficiency of the candidate as evidenced by either a final examination or a thesis, as the head of the department involved may direct. No student who fails to pass his comprehensive examination with distinction is graduated with special honors.

College Honors

The College Honors Program is open to undergraduates from all three Colleges. It offers to students who have demonstrated outstanding ability the opportunity to devote part of their junior and senior years to independent study through a series of limited-

enrollment seminars and the writing of a thesis. The seminars, one in each of the four large areas of human knowledge, combine breadth, which balances the concentration in a major, with the depth which is possible in small classes of students carefully selected from all majors. The seminars and the thesis also provide a foretaste of the kind of work and of the standards the students will encounter in graduate and professional schools.

Students in this program are graduated with College Honors if, in addition to meeting all requirements for graduation, they have:

(1) Completed the four Honors Seminars with an average grade of at least 3.25.

(2) Completed a thesis adjudged by the Honors Council to be of distinguished quality.

(3) Passed with distinction the senior comprehensive examination required by their major department.

(Honors students who have met all the requirements for graduation in their college but who fail to achieve the specified levels will receive their degree without College Honors.)

Admission

A student will apply for admission to the Honors Program early in his fourth semester. (Application forms may be procured in the Office of the Dean, College of Arts and Science.) A student is eligible to apply for admission if he has a cumulative three-semester average of at least 3.0, or in unusual cases, has had an outstanding record in the preceding two semesters.

Admission requires the approval of the head of the department in which he is majoring and of the Honors Council.

Each applicant will be notified of the decision on his application far enough in advance of pre-registration for the ensuing fall semester to make appropriate plans.

In unusual situations an outstanding student may, with the approval of the Honors Council, schedule one or more Honors Seminars without committing himself to the whole program. Such special permission will be granted, however, only when the Council feels certain that his admission will not interfere with the maximum effectiveness of the program for those regularly enrolled.

The Program

A student admitted to the Honors Program will:

(1) Continue with his departmental major.

(2) Schedule one Creative Concepts seminar (see course offerings, page 253) each semester of his junior and senior years.

(3) Write an undergraduate thesis (usually, but not necessarily, in his major department). Time for the writing of the thesis may be provided by scheduling a thesis course or through the provision for unscheduled work.

The College Honors Program is administered by the dean of the College of Arts and Science. The organization and conduct of the Honors Seminars will be directed by the Honors Council, which shall consist of (a) all faculty members currently teaching in the program or designated to teach in it, (b) the teacher or teachers who have conducted seminars during the preceding semester, and (c) the dean of the College, ex officio. Seminar teachers may be members of the faculty of any of the three colleges. The writing of the thesis will be directed by the head of the department in which the student has scheduled the thesis or by someone designated by the department head.

Unscheduled Work

On the advice of the head of the department in which the major work is being done and with the consent of the dean of the College, a senior of unusual merit who wishes to concentrate in his chosen field may be allowed to substitute not more than six hours of unscheduled work per semester for six hours of elective work otherwise required for graduation.

This provision is particularly useful for the honors candidate who wishes to pursue independent study in connection with his extra work or honors thesis. Interested students should consult with their department heads.

DETAILS OF MAJOR SEQUENCES

Major Sequences in Arts and Science

(For Pattern Rosters in Arts-Engineering, see pages 88-97.)

Biology. The department offers a major in biology with approved electives in the junior and senior years. This major sub-

stantially exceeds the minimum requirements for admission to a medical or dental school.

Required Preliminary Courses

FRESHMAN YEAR

FIRST SEMESTER				SECOND SEMESTER			
Biol.	11	General Biology	4	Biol.	12	General Biology	4
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
Math.	3	Int. to Math. Anal.	3	Math.	4	Int. to Math. Anal.	3

NOTE: Students planning a biology major should have completed plane trigonometry before coming to college. Otherwise they must take Math. 1, Plane Trigonometry (3) and defer taking Math. 3 and 4 until the sophomore year.

Required Major Courses

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Biol.	18	Genetics	2	Biol.	14	Comparative Anatomy	3
Chem.	35	Analytical Chemistry	4	Biol.	35	Microbiology	3

JUNIOR YEAR

Phys.	12	Intro. to Phys.	3	Phys.	16	General Phys.	3
		*Approved Elect.	3	Phys.	17	Gen. Phys. Lab.	2
						*Approved Elect.	3

SENIOR YEAR

		*Approved Elect.	3	Biol.	320	Physiology	3
Chem.	150	Organic Chem.	3			*Approved Elect.	3
Chem.	165	Organ. Chem. Lab.	2	Chem.	151	Organic Chem.	3

*Three of these electives must be chosen with the approval of the major adviser from the following courses:

Biol.	313	General Histology	3	Biol.	314	Embryology	3
Biol.	353	Virology	3	Biol.	306	Ecology	3
Biol.	321	Undergrad. Res.	3	Biol.	322	Advanced Botany	3

Additional courses, generally available to graduate students, may be taken by qualified undergraduates depending upon the interest and competence of the student and availability of the course: Biol. 356, Industrial Microbiology (3), Biol. 361, Sanitary Microbiology (3).

Suggested additional courses outside of the department are: Chem. 371, Elements of Biochemistry (3); Phil. 261, Philosophy of the Natural Sciences (3); Phil. 241, Evolution of Scientific Ideas (3); Geol. 311, Paleontology (3); Psych. 324, Intermediate Psychological Statistics (3).

Biology: Natural Resources Option. Students interested in natural resources and their conservation may take the major in biology, slightly modified to permit taking collateral courses in geology and other pertinent fields.

CHEMISTRY.

Required Preliminary Courses

Chem.	4, 5.	General Chemistry	(8)
Math.	11.	Analytic Geometry and Calculus I	(3)
Math.	12.	Analytic Geometry and Calculus II	(3)
Phys.	1.	Mechanics of Mass Points	(4)

Required Major Courses

SOPHOMORE YEAR

Math.	13.	Analytic Ge metry and Calculus III	(3)
Phys.	3.	Heat and Electricity	(4)
Phys.	4.	Electricity, Light, and Atomic Physics	(4)
Chem.	35, 36.	Analytical Chemistry	(8)

JUNIOR YEAR

Chem.	91.	Physical Chemistry	(3)
Chem.	92.	Physical Chemistry Laboratory	(1)
Chem.	150, 151.	Organic Chemistry	(6)
Chem.	165, 167.	Organic Chemistry Laboratory	(4)
Chem.	190.	Physical Chemistry	(3)
Chem.	192.	Physical Chemistry Laboratory	(1)
Chem.	356.	Quantitative Organic Analysis	(1)

SENIOR YEAR

Chem.	194.	Physical Chemistry	(3)
Chem.	197.	Electrochemistry Laboratory	(1)
Chem.	302.	Principles of Inorganic Chemistry	(3)

and at least one ot the following:

Chem.	303.	Nuclear and Radiochemistry	(3)
Chem.	305.	Systematic Inorganic Chemistry	(3)
Chem.	306.	Inorganic Preparations	(2)
Chem.	337.	Instrumental Methods of Analysis	(3)
Chem.	357.	Qualitative Organic Analysis	(3)
Chem.	358.	Advanced Organic Chemistry	(3)
Chem.	371.	Elements of Biochemistry	(3)
Chem.	390.	Physical Chemistry	(3)

CLASSICAL LANGUAGES. Students who elect Greek and Latin as a major will choose one of two groups of courses:

Group 1 (Emphasis upon Greek).

Required Preliminary Courses

Gk.	1, 2.	Elementary Greek	(6)
Gk.	3, 4.	Second-Year Greek	(6)

Required Major Courses

Gk.	11, 12.	Greek Drama	(6)
Gk.	13.	Greek Historians	(3)
Gk.	14.	Greek Oratory	(3)
Gk.	111.	Homer	(3)
Gk.	116.	Plato	(3)
Gk.	21.	Ancient History	(3)
Lat.	22.	Ancient History	(3)

Six hours of Latin language, specific courses depending on the student's preparation.

Group 2 (Emphasis upon Latin).

Required Preliminary Courses

Lat.	61.	Elementary Latin	(3)
Lat.	62.	Caesar	(3)
Lat.	63.	Nepos and Cicero	(3)
Lat.	64.	Ovid and Terence	(3)

Required Major Courses

Lat.	65.	Vergil	(3)
Lat.	66.	Horace	(3)
Gk.	21.	Ancient History	(3)
Lat.	22.	Ancient History	(3)

and twelve semester hours from the following:

Lat.	67.	Livy	(3)
Lat.	68.	Latin Drama	(3)
Lat.	106.	Roman Prose Writers of the Empire	(3)
Lat.	108.	Lucretius	(3)
Lat.	169.	Satire	(3)
Lat.	170.	Medieval Latin	(3)

Six hours of Greek language, specific courses depending upon the student's preparation.

Recommended Electives

Astr.	1.	Descriptive Astronomy	(3)
Astr.	2.	General Astronomy	(3)
Educ.	330.	History of Education in Europe	(3)
Govt.	1.	Foundations of Government	(3)
Hist.	25.	European History	(3)
Phil.	14.	Logic and Scientific Method	(3)
Phil.	231.	Ancient Philosophy	(3)

CONSERVATION. See Natural Resources, page 84.

ECONOMICS AND BUSINESS ADMINISTRATION. Three majors are offered in the field of economics and business administration: economics, finance, and accounting.

Economics.

Required Preliminary Courses

SOPHOMORE YEAR

Eco.	3, 4.	Economics	(6)

Required Major Courses

JUNIOR YEAR

Eco.	306.	Intermediate Economic Theory	(3)
Eco.	307, 308.	Advanced Economics	(6)
E.S.	45.	Statistical Method	(3)
E.S.	346.	Business Cycles and Forecasting	(3)
Fin.	123.	Financial Institutions	(3)
Fin.	130.	Money and Banking	(3)

SENIOR YEAR

Eco.	333.	Labor Problems	(3)
Eco.	336.	Government and Business	(3)
Fin.	241.	International Trade and Finance	(3)
Fin.	351.	Public Finance: Federal	(3)
Soc.	262.	Social Problems	(3)

Recommended Electives

Acctg.	104.	Fundamentals of Accounting	(3)
Eco.	235.	Transportation	(3)
Eco.	303.	Economic Development	(3)
Eco.	334.	Labor Legislation	(3)
E.S.	347.	National Income Analysis	(3)
Govt.	357.	City Government	(3)
Govt.	360.	Public Administration	(3)
Hist.	327, 328.	Development of American Institutions	(6)
I.E.	162.	Industrial Management	(3)
Mkt.	11.	Marketing	(3)
Soc.	42.	Principles of Sociology	(3)
Soc.	265.	Development of Sociological Theory	(3)

Finance.

Required Preliminary Courses

SOPHOMORE YEAR

Eco.	3,	4.	Economics	(6)

Required Major Courses

JUNIOR YEAR

Fin.	123.	Financial Institutions	(3)
Fin.	125.	Principles of Corporation Finance	(3)
Fin.	130.	Money and Banking	(3)
Fin.	326.	Problems in Financial Management	(3)
E.S.	45.	Statistical Method	(3)
Acctg.	104.	Fundamentals of Accounting	(3)

SENIOR YEAR

Fin.	323.	Investments	(3)
Fin.	351.	Public Finance: Federal	(3)

plus twelve hours selected from the following:

Acctg.	105.	Financial Statements and Reports	(3)
Eco.	160.	Insurance	(3)
Eco.	301.	Business Management	(3)
Eco.	333.	Labor Problems	(3)
Fin.	241, 342.	International Trade and Finance	(6)
Fin.	324.	Investments	(3)
Fin.	331.	Bank Credit Management	(3)
Fin.	332.	Monetary-Fiscal Policy	(3)
Fin.	352.	Public Finance: State and Local	(3)

Recommended Electives

Acctg.	106.	Fundamentals of Cost Accounting	(3)
Eco.	306.	Intermediate Economic Theory	(3)
E.S.	346.	Business Cycles and Forecasting	(3)

Accounting.*

Required Preliminary Courses

Acctg.	1,	2.	Accounting	(6)

Required Major Courses

Acctg.	13,	14.	Intermediate Accounting	(6)
Acctg.	115.		Cost Accounting	(3)
Eco.	3,	4.	Economics	(6)
Fin.	125.		Corporation Finance	(3)
Fin.	123.		Financial Institutions	(3)
Law	1,	102.	Business Law	(6)
Law	204.		Wills, Estates, and Trusts	(3)

plus nine semester hours to be selected from the following:

Acctg.	203, 204.	Federal Tax Accounting	(6)
Acctg.	218.	Advanced Cost Accounting	(3)
Acctg.	304.	Governmental and Institutional Accounting	(3)
Acctg.	315.	Advanced Accounting	(3)
Acctg.	320.	Auditing	(3)

Recommended Electives

Eco.	301.	Business Management	(3)
Eco.	306.	Intermediate Economic Theory	(3)
E.S.	45.	Statistical Method	(3)
E.S.	346.	Business Cycles and Forecasting	(3)
Fin.	323.	Investments	(3)

*Requirements for the C.P.A. certificate in New York cannot be fulfilled by the completion of this major in the College of Arts and Science. Students interested in qualifying for the C.P.A. certificate in the State of New York should consult with the head of the Department of Accounting.

EDUCATION.

Required Preliminary Courses

Educ.	1.	Introduction to Education	(3)
Psych.	1.	Introduction to Psychology	(3)
Educ.	20.	Educational Psychology	(3)

Required Major Courses

Educ.	331.	History of Education in the United States	(3)
Educ.	350.	Foundations of Secondary Education	(3)
Educ.	352.	Methods of High School Teaching	(3)
Educ.	353.	Observation of Secondary School Teaching	(3)
Educ.	354.	Practice Teaching of Secondary School Subjects	(3)
		Elective	(3)
Biol.	13.	Human Biology	(3)
Speech	30.	Fundamentals of Speech	(3)

ENGLISH. Two majors are offered by the department of English: English literature, and journalism.

English Literature.

The major program in English literature is designed for those men who look forward to teaching English or pursuing graduate courses in the field, and for those who seek the personal development and general benefits that such a study provides.

Required Preliminary Courses

Engl. 1, 2.	Composition and Literature	(6)	}	(6)
or				
Engl. 11, 12.	Types of World Literature	(6)		
and				
Engl. 8, 9.	English Literature	(6)		

Required Major Courses

Engl.	323, 324.	Shakespeare and the Elizabethan Drama	(6)

and eighteen semester hours from the following courses:

Engl.	183, 184.	Readings in English Literature	(6)
Engl.	321, 322.	Twentieth-Century Literature	(6)
Engl.	325.	English Literature of the Romantic Era	(3)
Engl.	326.	English Literature of the Victorian Era	(3)
Engl.	331.	Milton	(3)
Engl.	333.	Restoration and Augustan Literature	(3)
Engl.	334.	The Age of Johnson	(3)
Engl.	335.	History of the English Language	(3)
Engl.	336.	Writing for Publication	(3)
Engl.	337.	The Renaissance	(3)
Engl.	338.	The Seventeenth Century	(3)
Engl.	339.	Chaucer	(3)

Plus six hours in literature or related courses approved by the head of the department.

Collateral courses are recommended in history, philosophy, history and criticism of the fine arts, and classical and modern languages and literature. Students planning to pursue graduate studies should acquire a reading knowledge of German, French, and Latin as undergraduates.

Journalism.

Required Preliminary Courses

Journ.	1-2.	*Brown and White*	(2)
Journ.	11.	News Writing	(3)

Required Major Courses

Journ.	3-8.	*Brown and White*	(2-6)

(*Brown and White* must be rostered each semester while the student is in the Journalism major.)

Journ.	12.	Reporting of Public Affairs	(3)
Journ.	16.	Law of the Press	(3)
Journ.	17.	Magazine Article Writing	(3)
Journ.	113.	Editing	(3)
Journ.	115.	Interpretive Writing	(3)
Journ.	118.	History of American Journalism	(3)
Journ.	120.	Journalism Proseminar	(3)
Gk.	21.	Ancient History (3)	(3)
or			
Lat.	22.	Ancient History (3)	
Govt.	352.	Civil Rights	(3)
Phil.	14.	Logic and Scientific Method	(3)
Phil.	15.	Ethics	(3)

Recommended Electives

Majors in journalism are advised to enroll in certain courses in economics, English, government, history, international relations, philosophy, and sociology. Electives should be chosen in consultation with the major adviser.

Fine Arts.

Required Preliminary Courses

F.A.	1, 2.	Survey of Painting and Sculpture	(6)
F.A.	31 or 32.	Elements of Art	(3)
Phil.	14.	Logic	(3)*
or			
Phil.	15.	Ethics	
or			
Psych.	1.	Introduction to Psychology	

Required Major Courses

F.A.	3.	Pre-Renaissance Architecture	(3)
F.A.	4.	Architects and Architecture	(3)
F.A.	16.	Art in the United States	(3)
F.A.	19.	Nineteenth Century Art	(3)
F.A.	20.	Form and Milieu in Twentieth Century Art	(3)
F.A.	33, 34.	Painting Practices and Principles	(6)
Phil.	100.	Philosophy of Contemporary Civilization	(3)
Mus.		Approved Course	(3)

Plus one of the following pairs of courses:

For students emphasizing architecture:

F.A.	41.	Basics in Architecture	(3)
F.A.	42.	Contemporary Architectural Design	(3)

For students emphasizing painting:

F.A.	131, 132.	Advanced Studio Practice	(6)

*Students emphasizing architecture may substitute Math. 11, Mech. 1, or C.E. 61.

Foreign Careers. An interdepartmental major designed to give students the grounding in language, history, economics, and related subjects needed for successful work with private industry or governmental agencies in their overseas activities. The program is under the direction of Professor Finn B. Jensen of the department of economics.

Each student in the program will schedule all courses in the Common Core and in one of the Options. In addition, he will, in consultation with the director, select courses in language, history, and other subjects which will give him an intensive knowledge of the culture of the area in which he is interested.

The program also affords a broad base for graduate study in social sciences and business administration. Students interested in this aspect of the major sequence should consult with the director early in their college careers.

Common Core

Required Preliminary Courses

Eco.	3,	4.	Economics	(6)
Govt.	3.		Foreign Governments	(3)
Math.	3.		Introduction to Mathematical Analysis	(3)

Required Major Courses

Hist.	49,	50.	History of Latin America	(6)
Eco.	303.		Economic Development	(3)
Eco.	305.		Economic Development of Latin America	(3)
E.S.	45.		Statistical Method	(3)
Hist.	365,	366.	Modern Latin America	(6)

Accounting Option

Acctg.	1,	2.	Accounting	(6)
Acctg.	13,	14.	Intermediate Accounting	(6)
Acctg.	115.		Cost Accounting (3)	(3)
or				
Acctg.	315.		Advanced Accounting (3)	
Law	1.		Business Law	(3)

Foreign Trade Option

Acctg.	104.		Fundamentals of Accounting	(3)
Fin.	123.		Financial Institutions	(3)
Fin.	241,	342.	International Trade and Finance	(6)
			Six hours of economics, finance, or marketing in consultation with the adviser	(6)

Public Administration Option

Acctg.	104.		Fundamentals of Accounting	(3)
I.R.	352.		International Organization	(3)
or				
I.R.	361.		International Law	
Fin.	351.		Public Finance	(3)
Govt.	360.		Public Administration	(3)
Govt.	363.		Contemporary Political Thought	(3)
or				
Govt.	364.		Contemporary Political Thought	
Govt.	3xx*		Comparative Administrative Systems	(3)

*New course now being developed.

Open Option

In place of any of the three preceding options, a student may take an Open Option by meeting the advanced course requirements for one of the other Arts College majors. The Open Option is most feasible with humanities and social science majors but will

require a careful combining of distribution courses and free electives with the eighteen hours normally given to the option. Students interested in the Open Option should consult the director of the Foreign Careers major as early as possible.

GEOLOGY. The program is designed to give a background in the several areas of geology and in the supporting collateral sciences. The major offers basic preparation for graduate study and research in any phase of geology.

Considerable concentration in a second field of knowledge may also be obtained by the selection of appropriate electives. Careful combination of the technical elective and the approved electives affords opportunity for preparation for geochemistry, geophysics, and mining geology; scientific journalism, and scientific documentation; secondary school science teaching, and natural resources management. Geological training may be utilized in government service, business, industry, and education.

Required Preliminary Courses

FRESHMAN YEAR

FIRST SEMESTER				SECOND SEMESTER			
Geol.	1	Principles of Geology ..	3	Geol.	34	Minerals and Rocks.....	3
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
Math.	11	An. Geo. and Cal. I....	3	Math.	12	An. Geo. and Cal. II..	3

Required Major Courses

SOPHOMORE YEAR

Geol.	23	Structural Geology	3	Geol.	12	Historical Geology	3
Biol.	1	Introductory Geology....	3	Chem.		.....	3
or		or		(Chem. 38, 93, 150, or 302;			
Biol.	11	General Biology	4	may be taken later.)			
Phys.	12	Intro. to Physics.....	3	Phys.	16	General Physics	3
				Phys.	17	Gen. Physics Lab.....	2

JUNIOR YEAR

Geol.	311	Paleontology	3	Geol.	312	Strat. and Sediment	3
Geol.	333	Cryst. and Min. Opt...	4				

SENIOR YEAR

Geol.	141	Field Geology	3	Geol.	334	Theo. Petrology	4
Geol.	257	Intro. to Eco. Geol.....	3,	or may be taken second semester.			
*Geol.		.....	1-3	**Technical elective			3

*Chosen, with approval of major adviser, from Geol. 337 (3), 339 (1-2), 352 (2), 364 (3), 374 (3), or 390 (3).

**To be selected in consultation with major adviser; additional preparation in some collateral field; may be elected earlier as a prerequisite for other elective courses in a related field.

An extended field trip may be held each semester for advanced undergraduates in conjunction with work in advanced required major courses.

Attendance at an approved summer field camp is most strongly recommended for all majors, particularly those preparing for graduate study or the Natural Resources option. Satisfactory credit obtained therefor will be accepted for Geol. 141 and the approved technical elective or unspecified geology course.

Natural Resources Option: Majors in geology interested in natural resourses and their conservation may, in consultation with both major advisers and the curriculum director, arrange a program with suitable major concentrations and collateral subjects to provide an interdepartmental major.

GERMAN.

Required Preliminary Courses

Ger.	1,	2.	Elementary German	(6)
Ger.	11,	12.	Intermediate German	(6)

Required Major Courses

Ger.	31.		Conversation and Composition	(3)
Ger.	33,	34.	Types of German Literature	(6)
Ger.	36.		Goethe's *Faust*	(3)

and at least two of the following:

Ger.	32.	Conversation and Composition	(3)
Ger.	201.	The Classical Period	(3)
Ger.	202.	The German *Novelle*	(3)
Ger.	203.	Nineteenth Century German Drama	(3)
Ger.	204.	Medieval German Literature	(3)
Ger.	205.	Twentieth Century German Literature	(3)
Ger.	250.	Special Topics	(3)

Collateral courses will be required or advised in accordance with the candidate's educational interests and objectives. Normally such collateral work should include appropriate courses in European history, fine arts, music, philosophy, and in languages and literature other than German.

HISTORY AND GOVERNMENT. The department of history and government offers undergraduate courses which provide a foundation for law school, government service, journalism, teaching, or graduate work in the fields of the historical evolution of the world in which we live. Its courses are designed to develop habits of thought and methods of approach which are conducive to an objective consideration of the broader human and political questions of today.

HISTORY. A major in history consists of forty-two hours of courses made up as follows: the twelve hours of required preliminary courses; twenty-four chosen, with the approval of the major adviser, from Groups A and B, with at least eighteen hours

in one group; and of six hours in government or international relations, again chosen with the approval of the major adviser.

Required Preliminary Courses

Hist.	13,	14.	United States History (6)
Hist.	25,	26.	European History (6)

Required Major Courses

A. American History

Hist.	49,	50.	Latin America (6)
Hist.	319.		Seventeenth Century America (3)
Hist.	320.		Eighteenth Century America (3)
Hist.	321.		United States History, 1789-1877 (3)
Hist.	322.		United States History since 1877 (3)
Hist.	327,	328.	Development of American Institutions (6)
Hist.	329,	330.	American Foreign Policy (6)
Hist.	365,	366.	Modern Latin America (6)

B. European History

Hist.	15,	16.	History of England (6)
Hist.	151.		The Civilization of the Middle Ages (3)
Hist.	152.		Renaissance and Reformation (3)
Hist.	345.		England, 1066 to 1603 (3)
Hist.	347.		British Empire, 1603 to 1848 (3)
Hist.	348.		British Empire and Commonwealth since 1848 (3)
Hist.	353.		European History, 1648 to 1848 (3)
Hist.	354.		European History since 1848 (3)
Hist.	355,	356.	Intellectual Expansion of Modern Europe (6)

Plus six hours in Government or International Relations, to be approved by major adviser.

Majors in history are required to write an acceptable senior paper, which will be due on one of the following days: the third Monday in April for University Day degrees; the third Monday in September for Founder's Day degrees; the third Monday in January for February degrees.

Majors in history will find it advantageous to enroll for certain courses in economics, English literature, government, international relations, journalism, philosophy, psychology, and sociology. Students planning to pursue graduate studies should acquire a reading knowledge of German, French, Russian, or Spanish as undergraduates, choosing the language or languages most appropriate to their area of concentration.

GOVERNMENT. The major in government consists of a program of courses dealing with the machinery, the processes, the functions, and the purposes of government in the United States and other countries. It is designed to provide students with an understanding of political ideologies, institutions, and practices.

This major is suitable for undergraduates who intend to become lawyers, social science teachers, journalists specializing in the

"public affairs" field, government officials, political party leaders, and staff members of bureaus of governmental research. Graduate work in the fields of political science and public administration is usually necessary for persons who plan to teach political science at the college level, engage in governmental research, or pursue a public service career as city managers, as administrators at the top and middle management levels, or as foreign service officers. The major in government prepares students for the graduate training requisite to careers of the above-mentioned type. Prospective civic leaders, regardless of their particular occupations, also will benefit from concentrated study in the political science field.

Required Preliminary Courses

Govt.	1.	Foundations of Government	(3)
Govt.	2.	American Political Ideas (3)	(3)
or			
Govt.	4.	Political Parties (3)	

Required Major Courses

Govt.	3.	Foreign Governments	(3)
Govt.	6.	Democracy (3)	(3)
or			
Govt.	101.	History of Political Thought (3)	
Govt.	51, 52.	American Government	(6)
Govt.	357.	City Government	(3)
Govt.	363, 364.	Contemporary Political Thought	(6)

Plus six hours from the following:

Govt.	351.	Constitutional Law	(3)
Govt.	352.	Civil Rights	(3)
Govt.	354.	Administrative Law	(3)
Govt.	359.	Law-Making	(3)
Govt.	360.	Public Administration	(3)

Six hours to be selected, with the approval of the political science staff, from the fields of history or international relations.

Recommended Electives

Majors in government are advised to enroll for certain courses in the fields of economics, journalism, philosophy, psychology, public finance, and sociology. The particular course selections should be made in consultation with the political science staff.

INTERNATIONAL RELATIONS. This major is designed for men aspiring to the United States Foreign Service, to journalism on the international plane, to commercial employment abroad, or to advanced study in the field, and for those whose intellectual interests lie across national frontiers. Students contemplating a career in the United States Foreign Service are advised to continue language study throughout their course.

Required Preliminary Courses

Int.Rel.	1, 2.	Diplomacy	(6)

Required Major Courses

Int.Rel.	341, 342.	International Relations	(6)
Int.Rel.	351, 352.	International Organization	(6)
Int.Rel.	361, 362.	International Law	(6)

and twelve semester hours to be selected, with the approval of the head of the department, from international relations, history, and government.

MATHEMATICS. The major in mathematics is designed to prepare students for careers in teaching, in government service, in industry, or for graduate work leading to such careers.

Required Preliminary Courses

Math.	11.	Analytic Geometry and Calculus I	(3)
Math.	12.	Analytic Geometry and Calculus II	(3)
Math.	13.	Analytic Geometry and Calculus III	(3)
Math.	14.	Analytic Geometry and Calculus IV	(3)

It is strongly recommended that students preparing for teaching, government service, or industry take Physics 1, 3, and 4.

Required Major Courses

SOPHOMORE YEAR

Math.	51.	Advanced Algebra	(3)
Math.	54.	Higher Geometry	(3)

JUNIOR YEAR

Math.	219.	Principles of Analysis	(3)
Math.	220.	Principles of Analysis	(3)
Math.	221.	Differential Equations	(3)
		Approved Elective	(3)

SENIOR YEAR

Math.	315.	Theory of Functions of a Complex Variable	(3)
Math.	340.	Higher Algebra	(3)
		Approved Electives	(6)

The three elective courses may be chosen, with the approval of the head of the department, from the following:

Math.	233, 234.	Mathematical Statistics	(6)
Math.	301.	Vector and Tensor Analysis	(3)
Math.	303.	Mathematical Logic	(3)
Math.	305.	Computer Programming	(3)
Math.	322.	Differential Equations and Harmonic Analysis	(3)
Math.	324.	Probability and Numerical Analysis	(3)
Math.	341.	Higher Algebra	(3)
Mech.	302.	Advanced Dynamics	(3)
Mech.	303.	Mechanics of Continua I	(3)
Mech.	304.	Mechanics of Continua II	(3)
Phil.	261.	Philosophy of Natural Sciences	(3)
Phil.	263.	Special Topics in the Phil. of Phys. and Math	(3)
Phys.	266.	Atomic and Nuclear Physics	(3)
Phys.	268.	Introduction to Modern Physical Theories	(3)
Phys.	269.	Introduction to Modern Physical Theories	(3)

With the consent of the head of the department, other courses in the University may be substituted for one or more of the above approved electives.

Students interested in Actuarial Science are advised to elect such courses as Math. 233, 234, Mathematical Statistics; Math. 305, Computer Programming; and Math. 324, Probability and Numerical Analysis. They may also prepare for certain actuarial examinations by electing Math. 171, Reading Course in Mathematics, in which they may do reading in such fields as Life Insurance, Finite Differences, and Probability.

NATURAL RESOURCES. An interdepartmental major planned to give the student the basic preparation for a career in the management and conservation of our natural resources, or for graduate work leading to such a career. The major is under the direction of Professor Trembley of the department of biology.

Required Preliminary Courses

Biol.	11,	12.	General Biology	(8)
Chem.	4,	5.	General Chemistry	(8)
Geol.	1.		Principles of Geology	(3)
Math.	3,	4.	Introduction to Mathematical Analysis	(6)
Phys.	12.		Introduction to Physics	(3)

Required Major Courses

Biol.	35.	Microbiology	(3)
Biol.	306.	Ecology	(3)
Biol.	322.	Advanced Botany	(3)
Chem.	35.	Analytical Chemistry	(4)
Chem.	93.	Physical Chemistry	(3)
Geol.	23.	Structural Geology	(3)
Geol.	34.	Minerals and Rocks	(3)
Geol.	364.	Hydrometeorology	(3)
Geol.	374.	Geology of Soils	(3)
Phys.	16.	General Physics	(3)
Phys.	17.	General Physics Laboratory	(2)

A student who is taking a major in biology, geology, or journalism, and who is interested in natural resources and their conservation, should consult with his major adviser. His program can be so arranged as to provide an adequate major concentration combined with appropriate collateral work so selected as to develop his knowledge of natural resources and the problems of their management.

PHILOSOPHY.

Required Preliminary Courses

Phil.	14.	Logic and Scientific Method	(3)
Phil.	15.	Ethics: The Theory of Conduct	(3)

Required Major Courses

Phil.	231.	Ancient Philosophy	(3)
Phil.	235.	Modern Philosophy	(3)

and eighteen additional hours, at least twelve of which shall be chosen from the courses listed below. The other six may be taken from appropriate advanced courses in other fields as approved by the head of the department of philosophy.

Phil.	171, 172.	Readings in Philosophy	(6)
Phil.	233.	Medieval Philosophy	(3)
Phil.	237.	Nineteenth Century Philosophy	(3)
Phil.	239.	Twentieth Century Philosophy	(3)
Phil.	241.	Evolution of Scientific Ideas	(3)
Phil.	254.	Logic and Philosophy of Language	(3)
Phil.	261.	Philosophy of the Natural Sciences	(3)
Phil.	263.	Special Topics in the Philosophy of Physics and Mathematics	(3)
Phil.	281.	Philosophy of the Social Sciences	(3)
Math.	303.	Mathematical Logic	(3)

Physics.

Required Preliminary Courses

Chem.	4, 5.	General Chemistry	(8)
Math.	11.	Analytical Geometry and Calculus I	(3)
Math.	12.	Analytical Geometry and Calculus II	(3)
Phys.	1.	Mechanics of Mass Points	(4)

Required Major Courses

Phys.	3.	Heat and Electricity	(4)
Phys.	4.	Electricity, Light, and Atomic Physics	(4)
Phys.	32.	Electricity and Electronics	(3)
Phys.	110, 111.	Electrical Laboratory	(2)
Phys.	171.	Proseminar	(1)
Phys.	191.	Laboratory Techniques	(1)
Phys.	192.	Advanced Physics Laboratory	(1)
Phys.	213.	Introductory Theory of Electricity and Magnetism	(3)
Phys.	252.	Geometrical and Physical Optics	(4)
Phys.	268, 269.	Introduction to Modern Physical Theories	(6)
Phys.	270.	Atomic and Nuclear Physical Laboratory	(1)
Phys.	340.	Heat, Thermodynamics, and Pyrometry	(4)
*E.E.	110.	Electronics	(4)
Math.	13.	Analytical Geometry and Calculus III	(3)
Math.	14.	Analytical Geometry and Calculus IV	(3)
Math.	206.	Applied Mathematics I (3)	(3) or (6)
or			
Math.	219, 220.	Principles of Analysis (6)	(3) or (6)
Mech.	1.	Statics	(3)
Mech.	102.	Dynamics	(3)

*E.E. 104 (5) is a desirable elective as preparation for E.E. 110.

Psychology. The major program in psychology is based on a core sequence which provides a broad coverage of the field of psychology and related science and a solid background for later specialization in psychology as a science and a profession. Students with research interests or interests in special areas (industrial, clinical) may take additional courses designed to enrich the core sequence. Pre-medical students may choose psychology as a major, but should consult with the Faculty Committee on Pre-Medical Training in planning their program in order to make sure that their undergraduate training will meet the requirements of the medical school to which they intend to apply, eventually, for admission.

Required Preliminary Courses

FRESHMAN YEAR

FIRST SEMESTER				SECOND SEMESTER			
Psych.	1	Intro. to Psych.	3	Psych.	20	Stat. An. & Exp.	4
Psych.	2	Intro. Psych. Lab.	1	Biol.	2	Elementary Biology	3
Biol.	1	Elementary Biology	3	Math.	4	Intro. to Math. An.	3
Math.	3	Intro. to Math. An.	3	or			
or				Math.	12	Anal. Geo. & Cal. II	3
Math.	11	Anal. Geo. & Cal. I.	3				

Required Major Courses

SOPHOMORE YEAR

Chem.	4	General Chemistry	4	Psych.	28	Personality	3
Phil.	14	Logic	3	Phys.	16	Gen. Physics	3
Phys.	12	Intro. to Phys.	3	Phys.	17	Gen. Physics Lab.	2

JUNIOR AND SENIOR YEARS

Psych. 102. Psychological Measurement ..... (3)
Psych. 330. Physiological Psychology ..... (3)
plus
Nine hours, with approval of head of department, from departmental courses numbered 100 or above ..... (9)
plus
Six hours chosen, with approval, from
Psych. 361. Sensation .....
Psych. 362. Perception ..... (6)
Psych. 363. Learning .....

ROMANCE LANGUAGES. Majors are offered in French and Spanish.

French.

Required Preliminary Courses

Fr. 1, 2. Elementary French ..... (6)
Fr. 11, 12. Intermediate French ..... (6)

Required Major Courses

Eighteen hours from the following of which at least six hours shall be chosen from Fr. 221, 222, 223, 224:

Fr. 13, 14. Types of French Literature ..... (6)
Fr. 21, 22. Seventeeth and Eighteenth Century French Literature ..... (6)
Fr. 31, 32. Nineteenth Century French Literature ..... (6)
Fr. 41, 42. French Oral and Written Composition ..... (6)
Fr. 221. French Literature before the Seventeenth Century ..... (3)
Fr. 222. Contemporary French Literature ..... (3)
Fr. 223, 224. Proseminar ..... (6)

The student will be expected to complete supplementary reading, the list of which he will receive at the beginning of his major work, and to correlate the knowledge gained in courses and readings through the use of some recommended history of French literature.

Spanish.

Required Preliminary Courses

Span. 1, 2. Elementary Spanish ..... (6)
Span. 11, 12. Intermediate Spanish ..... (6)

Required Major Courses

Eighteen hours from the following of which at least six shall be chosen from Spanish 221, 222, 223, 224, 231, 232.

Span. 13. Cultural Evolution of Spain ..... (3)
Span. 14. Cultural Evolution of Latin-America ..... (3)
Span. 21. Introduction to Modern Spanish Fiction ..... (3)
Span. 22. Introduction to Modern Spanish Drama ..... (3)
Span. 31, 32. Spanish Conversation and Composition ..... (6)
Span. 221. Spanish Drama of the Golden Age ..... (3)
Span. 222. Spanish Fiction of the Golden Age ..... (3)
Span. 223, 224. Proseminar ..... (6)
Span. 231, 232. Spanish-American Literature ..... (6)

In addition to the outside reading and reports required in connection with these courses, the student will be expected to acquire a knowledge of the history of Spanish literature as a whole.

Sociology. A major in sociology is designed to provide pre-professional preparation for graduate work in law, social work, social research, the ministry, institutional work, personnel work, teaching, interracial and intercultural work, and civil service appointments with local, state, and federal governmental agencies.

Required Preliminary Courses

Soc.	41.	Cultural Anthropology	(3)
Soc.	42.	Principles of Sociology	(3)
Eco.	3, 4.	Economics	(6)
Psych.	1.	Elementary Psychology	(3)

Required Major Courses

Soc.	44.	The American Community	(3)
Soc.	262.	Social Problems	(3)
Soc.	263.	Introduction to Social Work	(3)
Soc.	264.	The Family	(3)
Soc.	265.	Development of Sociological Theory	(3)
Soc.	266.	Population Problems	(3)
E.S.	45.	Statistical Method	(3)

Recommended Electives

Soc.	271, 272.	Readings in Sociology	(6)
Biol.	13.	Human Biology	(3)
Eco.	333.	Labor Problems	(3)
or			
Eco.	334.	Labor Legislation	(3)
Educ.	1.	Introduction to Education	(3)
Govt.	357.	City Government	(3)
Hist.	327, 328.	Development of American Institutions	(6)
Psych.	26.	Social Psychology	(3)
Relig.	101.	Religion in Society and Culture	(3)

Major Sequences in Arts-Engineering

The standard major for students in the five-year Arts-Engineering curriculum is Applied Science. This major is open only to Arts-Engineers.

Applied Science.

Required Preliminary Courses

Chem.	4,	5.	General Chemistry	(8)
C.E.	61.		Engineering Graphics	(3)
Math.	11,	12.	Analytic Geometry and Calculus I and II	(6)
Phys.	1.		Mechanics of Mass Points	(4)

Required Major Courses

Math.	13,	14.	Analytic Geometry and Calculus III and IV	(6)
Mech.	1.		Statics	(3)
Phys.	3.		Heat and Electricity	(4)
Phys.	4.		Electricity, Light, and Atomic Physics	(4)

plus

(1) A minimum of twenty-four hours of the advanced work in the mathematical, physical, or engineering sciences required for the B.S. degree to be conferred on completion of the fifth year.

(2) All additional courses necessary to prepare for the appropriate B.S. degree in one additional year.

Other Arts or Science Major.

Able Arts-Engineers with special interests outside engineering are frequently able to combine another Arts or Science major with their engineering program. Interested students should consult with the dean of the Arts College and with the head of their engineering department.

ARTS-ENGINEERING PATTERN ROSTERS

The following pattern rosters, prepared with the help of the heads of the several engineering departments, show the most effective way to combine arts and engineering courses to prepare for the last year in the branch of engineering chosen. (For descriptions of the engineering curricula, see pages 126-151.)

ARTS-CHEMICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.		.....	3	Lang.		.....	3
Engl.		.....	3	Engl.		.....	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
C.E.	61	Engr. Drawing	3	Phys.	1	Mech. of Mass Points..	4
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science.....	2	MS/AS	12	Mil./Air Science.....	2
P.E.	1	Physical Education .....—		P.E.	2	Physical Education .....—	

SECOND YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	3	Ch.E.	70	Ind. Stoichiometry	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Chem.	35	Anal. Chemistry	4	Chem.	36	Anal. Chemistry	4
Phys.	3	Heat & Electricity.....	4	Phys.	4	Electricity, Light, & Atomic Physics	4
MS/AS	21	Mil./Air Science.....	2	MS/AS	22	Mil./Air Science.....	2
P.E.	3	Physical Education .....—		P.E.	4	Physical Education .....—	

THIRD YEAR

Lang.		.....	3	Lang.		.....	3
Eco.	3	.....	3	Eco.	4	.....	3
Chem.	150	Organic Chem.	3	Dist.		.....	3
Chem.	165	Org. Chem. Lab.....	2	Chem.	151	Organic Chem.	3
Chem.	94	Phys. Chemistry	3	Chem.	191	Phys. Chemistry	3
Chem.	92	Phys. Chem. Lab.....	1	Chem.	192	Phys. Chem. Lab.....	1
Mech.	1	Statics	3	Math.	206	.....	3

FOURTH YEAR

Dist.		.....	6	Dist.		.....	6
Ch.E.	171	Ch.E. Thermo.	3	Ch.E.	172	Unit Operations II	3
Ch.E.	200	Engr. Mat. & Proc.....	3	Chem.	179	Lit. of Chem.	1
Met.	63	Unit Operation I.....	3	Elect.		.....	6

(Ch.E. 100. Eight (8) weeks industrial employment with report should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-CHEMISTRY

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.		.....	3	Lang.		.....	3
Engl.		.....	3	Engl.		.....	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points..	4	C.E.	61	Engr. Drawing	3
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science.....	2	MS/AS	12	Mil./Air Science.....	2
P.E.	1	Physical Education .....—		P.E.	2	Physical Education .....—	

SECOND YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	3	Dist.		.....	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity.....	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Chem.	35	Analytical Chem.	4	Chem.	36	Analytical Chem.	4
MS/AS	21	Mil./Air Science.....	2	MS/AS	22	Mil./Air Science.....	2
P.E.	3	Physical Education .....—		P.E.	4	Physical Education .....—	

THIRD YEAR

Lang.		.....	3	Lang.		.....	3
Eco.	3	.....	3	Eco.	4	.....	3
Dist.		.....	3	Dist.		.....	3
Chem.	91	Phys. Chemistry	3	Chem.	151	Organic Chem.	3
Chem.	92	Phys. Chem. Lab.....	1	Chem.	167	Org. Chem. Lab.....	2
Chem.	150	Organic Chem.	3	Chem.	356	Quant. Org. Anal.	1
Chem.	165	Org. Chem. Lab.....	2	Chem.	190	Phys. Chemistry	3
				Chem.	192	Phys. Chem. Lab.....	1

FOURTH YEAR

Dist.		.....	3	Dist.		.....	3
*Opt.		.....	3	*Opt.		.....	6
Chem.	194	Phys. & El'trochem.....	3	Elect.		.....	6
Chem.	197	Electrochem. Lab.....	1				
Chem.	302	Inorgan. Chem.....	3				
Elect.		.....	3				

*Must take 3 courses chosen from Chem. 357 (first semester), 303, 337, 357, 371 (all second semester).

(Ch.E. 100. Eight (8) weeks industrial employment with report should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-CIVIL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.		.....	3	Lang.		.....	3
Engl.		.....	3	Engl.		.....	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points..	4	C.E.	61	Engr. Drawing	3
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science.....	2	MS/AS	12	Mil./Air Science.....	2
P.E.	1	Physical Education .....—		P.E.	2	Physical Education .....—	

SECOND YEAR

Lang.		.....	3	Lang.		.....	3
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Mech.	1	Statics	3	Phys.	4	Electricity, Light, & Atomic Physics	4
Phys.	3	Heat & Electricity.....	4				
MS/AS	21	Mil./Air Science.....	2	C.E.	40	Prin. of Surv.	3
P.E.	3	Physical Education .....—		MS/AS	22	Mil./Air Science.....	2
				P.E.	4	Physical Education .....—	

Summer School C.E. 41 Engineering Surveys (3)

THIRD YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	9	Dist.		.....	6
Mech.	102	Dynamics	3	Mech.	11	Mech. of Materials	3
Math.	206	Applied Math. I.....	3	Mech.	13	Materials Testing Lab.	1
				E.E.	160	Elec. Cir. & Appar.....	3
				E.E.	161	Elect. Problems	1
				E.E.	162	Dynamo Lab.	1

FOURTH YEAR

Dist.		.....	3	C.E.	124	Applied Hydrology	2
C.E.	112	Adv. Mech. of Mat.....	3	C.E.	111	Mat. of Constr.....	1
C.E.	121	Mech. of Fluids.....	3	C.E.	139	Soil Mechanics	3
C.E.	123	Fluid Mech. Lab.....	1	C.E.	154	Structural Anal. II.....	3
C.E.	150	Structural Anal. I.....	3	Geol.	6	Engr. Geology	4
Elect.		.....	6	Met.	61	Engr. Met.	2

(C.E. 100. Industrial employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-ELECTRICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.			3	Lang.			3
Engl.			3	Engl.			3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points..	4	C.E.	61	Engr. Drawing	3
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—

SECOND YEAR

Lang.			3	Lang.			3
Dist.			3	Dist.			3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Mech.	1	Statics	3				
MS/AS	21	Mil./Air Science	2	Mech.	11	Mech. of Mater.	3
P.E.	3	Physical Education	—	Mech.	13	Mater. Test. Lab.	1
				MS/AS	22	Mil./Air Science	2
				P.E.	4	Physical Education	—

THIRD YEAR

Lang.			3	Lang.			3
Eco.	3		3	Eco.	4		3
Dist.			3	Dist.			3
M.E.	104	Thermodynamics	4	C.E.	121	Mech. of Fluids	3
Math.	206	Applied Math. I	3	C.E.	123	Hydraulics Lab.	1
Mech.	102	Dynamics	3	Met.	63	Engr. Mat. & Proc.	3

FOURTH YEAR

Dist.			3	Dist.			3
E.E.	104	Alt. Cur. Circuits	5	E.E.	106	Electrical Machinery	5
Phys.	266	Atom. & Nucl. Phys...	3	E.E.	110	Electronics	4
Phys.	110	Electrical Lab.	1	Phys.	111	Electrical Lab.	1
Elect.			3	Elect.			3

(E.E. 100. Summer employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-ENGINEERING MECHANICS

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.			3	Lang.			3
Engl.			3	Engl.			3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points..	4	C.E.	61	Engr. Drawing	3
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—

SECOND YEAR

Lang.			3	Lang.			3
Dist.			3	Dist.			3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Mech.	1	Statics	3				
MS/AS	21	Mil./Air Science	2	Mech.	11	Mech. of Mater.	3
P.E.	3	Physical Education	—	Mech.	13	Mater. Test. Lab.	1
				MS/AS	22	Mil./Air Science	2
				P.E.	4	Physical Education	—

THIRD YEAR

Lang.			3	Lang.			3
Eco.	3		3	Eco.	4		3
Dist.			3	Math.	324	Probab. & Num. Anal.	3
Math.	301	Vector Analysis	3	E.E.	160	Elect. Cir. & Appar.	3
Met.	63	Eng. Materials	3	E.E.	161	Elect. Problems	1
Mech.	102	Dynamics	3	E.E.	162	Dynamo Lab.	1
				C.E.	121	Mech. of Fluids	3
				C.E.	123	Hydraulic Lab.	1

FOURTH YEAR

Dist.			3	Dist.			3
Dist.			3	Math.	322	Diff. Eq. & Harm. Ana.	3
Math.	221	Diff. Equations	3	Mech.	302	Adv. Dynamics	3
Mech.	301	Adv. Mech. of Mat.	3	Opt.			6
Opt.			6				

(Mech. 100. Summer employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-ENGINEERING PHYSICS

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.		.....	3	Lang.		.....	3
Engl.		.....	3	Engl.		.....	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points..	4	C.E.	61	Engr. Drawing	3
Chem.	4	Gen. Chem.	4	Chem.	5	Gen. Chem.	4
MS/AS	11	Mil./Air Science.....	2	MS/AS	12	Mil./Air Science.....	2
P.E.	1	Physical Education .....—		P.E.	2	Physical Education .....—	

SECOND YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	3	Dist.		.....	3
Eco.	3	.....	3	Eco.	4	.....	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity.....	4	Phys.	4	Electricity, Light, & Atomic Physics	4
MS/AS	21	Mil./Air Science.....	2	MS/AS	22	Mil./Air Science.....	2
P.E.	3	Physical Education .....—		P.E.	4	Physical Education .....—	

THIRD YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	6	Dist.		.....	6
Mech.	1	Statics	3	Mech.	102	Dynamics	3
Math.	206	Applied Math. I.....	3	Phys.	32	Elect. & Electron.....	3
Elect.		.....	3			Approved Math.....	3

FOURTH YEAR

E.E.	104	Circuit Analysis.....	5	Phys.	111	Electronics Lab	1
Phys.	213	Theo. of Elec. & Mag.	3	Phys.	252	Optics	4
Phys.	110	Elect. Measure.....	1	Phys.	191	Lab. Techniques	1
Elect.		.....	6	E.E.	110	Electronics	4
				Elect.		.....	6

(Phys. 100. Industrial employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-INDUSTRIAL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.		.....	3	Lang.		.....	3
Engl.		.....	3	Engl.		.....	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
C.E.	61	Engr. Drawing	3	Phys.	1	Mech. of Mass Points..	4
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science.....	2	MS/AS	12	Mil./Air Science.....	2
P.E.	1	Physical Education .....—		P.E.	2	Physical Education .....—	

SECOND YEAR

Lang.		.....	3	Lang.		.....	3
Dist.		.....	3	Psych.	1	Elem. Psychology	3
Math.	13	Anal. Geom. & Calc. III	3	Dist.		.....	3
Phys.	3	Heat & Electricity.....	4	Math.	14	Anal. Geom. & Calc. IV	3
MS/AS	21	Mil./Air Science.....	2	Phys.	4	Electricity, Light, & Atomic Physics	4
P.E.	3	Physical Education .....—		MS/AS	22	Mil./Air Science.....	2
				P.E.	4	Physical Education .....—	

THIRD YEAR

Lang.		.....	3	Lang.		.....	3
Eco.	3	.....	3	Eco.	4	Economics	3
Dist.		.....	3	Dist.		.....	6
Math.	233	Math. Statistics.....	3	Math.	234	Math. Statistics.....	3
Mech.	1	Statics	3	Mech.	11	Mech. of Mater.....	3
Met.	63	Engr. Mat. & Proc.....	3	Mech.	13	Mater. Test. Lab.	1

Summer School. I.E. 40. Machine Shop Practice (3)
(Preregister during Spring Preregistration and in I.E. Office)

FOURTH YEAR

I.E.	110	Engr. Economy	3	I.E.	115	Personnel Admin.....	3
I.E.	114	Plant Administration....	3	I.E.	116	Plant Administration....	3
M.E.	101	Elem. Mach. Design....	3	M.E.	102	Mach. Design	3
Mech.	102	Dynamics	3	E.E.	160	Elect. Cir. & Appar.....	3
Elect.		.....	3	E.E.	161	Elect. Problems	1
				E.E.	162	Dynamo Lab.....	1
				I.E.	140	Mfg. Processes Lab.....	1

SUMMER

I.E. 100. Industrial employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-MECHANICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.			3	Lang.			3
Engl.			3	Engl.			3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
C.E.	61	Engr. Drawing	3	Phys.	1	Mech. of Mass Points..	4
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—

SECOND YEAR

Lang.			3	Lang.			3
Dist.			3	Dist.			3
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—

THIRD YEAR

Lang.			3	Lang.			3
Dist.			3	Dist.			9
Math.	206	Applied Math. I	3	Met.	64	Engr. Mat. & Proc.	3
Mech.	1	Statics	3	Mech.	11	Mech. of Mater.	3
E.E.	160	Elect. Cir. & Appar.	3	Mech.	13	Mater. Test. Lab.	1
E.E.	161	Elect. Problems	1				
E.E.	162	Dynamo Lab.	1				

Summer School I.E. 40. Machine Shop Practice (3)
(Preregister during Spring Preregistration and in I.E. Office)

FOURTH YEAR

M.E.	101	Mach. Design I	3	M.E.	102	Mach. Design II	3
M.E.	104	Thermodynamics I	4	M.E.	105	Thermodynamics II	4
Mech.	102	Dynamics	3	C.E.	121	Mech. of Fluids	3
Met.	67	Met. Lab.	2	C.E.	123	Fluid Mech. Lab.	1
Elect.			6	Elect.			6

(M.E. 100. Summer employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-METALLURGICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER				SECOND SEMESTER			
Lang.			3	Lang.			3
Engl.			3	Engl.			3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
C.E.	61	Engr. Drawing	3	Phys.	1	Mech. of Mass Points..	4
Chem.	4	General Chemistry	4	Chem.	5	General Chemistry	4
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—

SECOND YEAR

Lang.			3	Lang.			3
Dist.			3	Dist.			3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Eco.	3	Economics	3	Eco.	4	Economics	3
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—

THIRD YEAR

Lang.			3	Lang.			3
Dist.			6	Dist.			6
Chem.	38	Analytical Chem.	3	Chem.	190	Physical Chem.	3
Chem.	91	Physical Chem.	3	Met.	1	Intro. to Met.	3
Mech.	1	Statics	3	Mech.	11	Mech. of Mater.	3

FOURTH YEAR

Dist.			3	Dist.			3
Met.	230	Physical Met. I	4	Met.	102	Ferrous Met. I	3
Ch.E.	160	Engr. in Chem. Mfg.	3	Met.	231	Physical Met. II	4
M.E.	166	Proced. of Mach. Des.	2	Mech.	102	Dynamics	3
Met.	103	Nonferrous Met.	4	Elect.			3

(Met.E. 100. Industrial employment should precede fifth year. Consult Engineering Curriculum Director.)

ARTS-MINING ENGINEERING

Arts-Engineers who wish to take Mining Engineering usually take their Arts major in Geology. Interested students should see the heads of the Departments of Geology and of Mining Engineering.

The College of Business Administration

The College of Business Administration

Administrative Officers

Martin Dewey Whitaker, *President*
Harvey Alexander Neville, *Vice-President and Provost*
Earl Kenneth Smiley, *Vice-President*
Carl Elmer Allen, *Dean of the College of Business Administration*
John Douglas Leith, *Dean of Students*
Charles Augustus Seidle, *Director of Admission*
James Harold Wagner, *Registrar*
James Decker Mack, *Librarian*

The College of Business Administration, which is a member of the American Association of Collegiate Schools of Business, offers a program of study designed to provide thorough and systematic training in the fundamentals of business. More specifically, the College aims to develop in the student an intelligent understanding of business principles, an ability to analyze industrial facts, and habits of thought which will enable him to cope with the problems that increasing executive responsibilities will bring him in later life. Stress is on the building of a sound foundation, since it is the firm belief of the College that no substitute can be furnished for the training and experience provided by actual contact with the complex problems of modern business. Accordingly, the student's interests are best served by equipping him with those fundamental facts and insights which will make it possible for him to profit more readily from practical experience after graduation.

In accordance with this plan of training in fundamentals, the student is required to learn the basic principles that underlie all business. No student is permitted to omit basic work in the principles and problems of economics, economic history, accounting, corporation finance, money and banking, marketing, business law, labor problems, management, and statistical method, which are essential for a career in all types of business enterprise. This insistence upon an acquaintance with the fundamentals of the broad field not only equips the student with the elementary

requisites for a career in a variety of commercial and industrial enterprises but also gives him an invaluable means of discovering his real abilities and making a sound choice of a profession. A major function of the curriculum in business administration is to aid students in their efforts to discover their best talents, not only those individuals who enter college uncertain of their ultimate objectives but also those whose choice of a future profession or field of business may have been determined already but predicted upon inadequate grounds.

In addition to this principle of a generalized training in business fundamentals, the College regards as important the principle that the training as a whole shall offer an education commensurate with the standards of a university. The curriculum permits no student to devote himself exclusively to business subjects. He must acquire at least a rudimentary acquaintance with the cultural and humanitarian aspects of the world around him, and at least a brief contact with science. Consequently, a large part of the curriculum is devoted to work in liberal and scientific subjects. In general in the freshman and sophomore years, two courses each semester are taken in the College of Business Administration. Throughout the entire four years work there is emphasis on the social aspects of the subjects considered. If a student develops alongside his business work a special interest in some such field as languages, mathematics, or science, he is given opportunity through electives to pursue his special line.

In view of the breadth of training afforded by the variety of required and elective courses, satisfactory preparation for careers in fields other than commerce and industry is also available to students in the College of Business Administration. This is particularly true of law, for which business curricula of the better type are now recognized as excellent preliminary training. Lehigh University has been included by the leading law schools of the country among the institutions whose business curricula meet their admissions requirements.

Perhaps the most distinctive feature of the work in business administration at Lehigh is the character of the class work. Much of the work of the curriculum is taken in the College of Arts and Science, while students of this division and of the College of Engineering avail themselves of the courses given in the College of Business Administration. There is no segregation of students by

colleges, and students in business administration take their courses in competition with students trained in liberal arts and in the exact sciences. This condition has a marked influence on the standards of work and the quality of the student. Qualified students in Business Administration are eligible for the College Honors Program (See page 69).

Although emphasis is upon broad training, rather than specialization, the College recognizes that some degree of concentration is desirable after the student's interests may reasonably be expected to have crystallized. Accordingly, in the junior and senior years, every student is required to pursue a series of related courses in some more restricted field. Seven fields of concentration are offered, viz: accounting, economics, economic statistics, finance, management, marketing, and general business. The detailed programs of study in each of the above fields are set forth on the following pages.

In times of normal business activity, students who have made creditable records may reasonably expect to receive one or more offers of positions before the date of their graduation. The College of Business Administration enjoys happy relations with many of the country's leading industries. Representatives regularly visit the campus to engage the services of students graduating in business administration. The University assumes no responsibility for finding positions for its graduates, but every effort is made by the College and by the University placement service to put its graduating students in touch with desirable opportunities for employment.

Graduates of this curriculum receive the degree of Bachelor of Science in Business Administration.

A five-year curriculum in industrial engineering and business administration is outlined on pages 113-115.

A graduate program leading to the degree of Master of Business Administration is outlined on page 160.

THE CURRICULUM IN BUSINESS ADMINISTRATION

Total hours required for Degree of B.S. in Business Administration: 128

I. Required Courses (62 hours)

Course No.	*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Acctg. 1	Accounting	3	Eco. 301	Bus. Mgmt. or	
Acctg. 2	Accounting	3	I.E. 162	Ind. Mgmt.	3
Eco. 1	Ind. Evolution	3	Fin. 125	Corporation Finance	3
Eco. 3	Economics	3	Fin. 123	Financial Institutions	3
Eco. 4	Economics	3	Math. 10	Gen. Math. for Bus.	3
Mkt. 11	Marketing	3	Math. 40	Math. of Finance	3
Eco. 50	Economic Geography	3	MS/AS 11	Mil./Air Science	2
Eco. 333	Labor Problems	3	MS/AS 12	Mil./Air Science	2
Engl. 1	Composition & Lit.	—	MS/AS 21	Mil./Air Science	2
or Engl. 11	Types of World Lit.	3	MS/AS 22	Mil./Air Science	2
Engl. 2	Composition & Lit.	—	P.E. 1	Physical Education	—
or Engl. 12	Types of World Lit.	3	P.E. 2	Physical Education	—
E.S. 45	Statistical Method	3	P.E. 3	Physical Education	—
E.S. 346	Business Cycles	3	P.E. 4	Physical Education	—
Law 1	Business Law	3			

II. Major Program (24 hours)

Before the end of the second semester of their sophomore year students will select a major or field of concentration. A major program will consist of twenty-four hours of sequential or related courses prescribed by the dean of the College and the head of the department concerned.

III. Optional Courses (33 hours)

English or Foreign Language Option (12 hours)

Students who present two units in one foreign language for entrance credit will not be required to take further work in foreign languages. Students who present less than two units of a foreign language for entrance credit will be required to take six hours in one foreign language. Credit for less than six hours in an elementary language will not be accepted in partial satisfaction of this requirement.

All courses offered by the Department of English which require work in composition, either oral or written, or a study of literature will be accepted in satisfaction of the English requirement. Journalism courses which do not require work in composition or study of literature will not be accepted.

Other Arts Options (12 hours)

The Arts Options requirement may be met by taking a total of twelve hours work in the following fields, not more than six hours to be in any one of the fields designated: astronomy, education, fine arts, government, history, international relations, mathematics, music, philosophy, psychology, religion, sociology.

Science Option (9 hours)

Not more than six hours in the Science Option may be taken in one department. The following courses are acceptable in satisfaction of the science requirement: Biol. 1, 2, or 13; Geol. 1 and 2; Chem. 15 and 16; Phys. 12 and 16.

IV. Electives (9 hours)

Any courses in the University for which a student has the prerequisites may be used to meet this requirement, including advanced military or air science up to six hours.

COURSES OF STUDY

UNIFORM FRESHMAN YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Acctg.	1	Accounting	3	Acctg.	2	Accounting	3
Eco.	1	Ind. Evolution	3	Eco.	50	Economic Geography	3
Math.	10	Gen. Math. for Bus.	3	Math.	40	Math. of Finance	3
		English[1]	3			English[1]	3
		Optional Course[2]	3			Optional Course[2]	3
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—
			17				17

[1]For a statement of the freshmen English requirement see "Freshman Composition" under the heading "English" in the section "Description of Courses."

[2]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see opposite page.

Major in Accounting*

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Acctg.	13	Intermed. Acctg.	3	Acctg.	14	Intermed. Acctg.	3
				E.S.	45	Statistical Method	3
		Optional Courses[1]	9			Optional Courses[1]	6
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Law	1	Business Law	3	Mkt.	11	Marketing	3
E.S.	346	Business Cycles	3	Eco.	333	Labor Problems	3
Fin.	123	Financial Institutions	3	Fin.	125	Corporation Finance	3
Eco.	301	Bus. Mgmt. or					
I.E.	162	Ind. Mgmt.	3				
		Optional Courses[1]	6			Optional Courses[1]	6
		Major Program Elective[2]	3			Major Program Electives[2]	6
		Free Electives[3]	6			Free Elective[3]	3
		Required Courses in Major					
Acct.	115	Cost Accounting	3	Law	102	Business Law	3
				Law	204	Wills, Estates & Trusts	3
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Accounting Major may be chosen from the following in consultation with advisor:

Acctg.	320	Auditing	3	Acctg.	218	Adv. Cost Acctg.	3
Acctg.	219	Spec. Acctg. Systems	3	Acctg.	304	Govt. & Inst. Acctg.	3
Acctg.	203	Fed. Tax Acctg.	3	Acctg.	204	Fed. Tax Acctg.	3
				Acctg.	315	Adv. Accounting	3

[3]Suggested Free Electives:

Fin.	323	Investments	3	Eco.	306	Intermed. Eco. Theory	3
E.S.	352	Adv. Stat. Method	3	Fin.	326	Prob. in Fin. Mgmt.	3

*The New York State Board of Certified Public Accountant Examiners requires 8 credit hours of finance for candidates for the C.P.A. examinations in that state. The New Jersey State Board of Public Accountants also requires 8 hours of finance and also 30 hours of accounting for candidates for the C.P.A. examination in that state. It is, therefore, recommended that students who anticipate becoming candidates for the C.P.A. examinations in either of those states take 3 additional credit hours of finance courses and students who anticipate becoming candidates for the C.P.A. examinations in New Jersey also take 6 additional credit hours in Accounting, as a part of their elective program. Lehigh University's College of Business Administration is registered with both the above boards.

Major in Economics

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Law	1	Business Law	3	Mkt.	11	Marketing	3
				E.S.	45	Statistical Method	3
		Optional Courses[1]	9			Optional Courses[1]	6
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
E.S.	346	Business Cycles	3	Fin.	125	Corporation Finance	3
Fin.	123	Financial Institutions	3	Eco.	301	Bus. Mgmt. or	
Eco.	333	Labor Problems	3	I.E.	162	Industrial Mgmt.	3
		Optional Courses[1]	6			Optional Courses[1]	6
		Major Program Elective[2]	3			Major Program Electives[2]	6
		Free Elective[3]	3			Free Electives[3]	6
		Required Courses in Major					
Eco.	306	Inter. Eco. Theory	3	Fin.	130	Money & Banking	3
Eco.	307	Adv. Economics	3	Eco.	334	Labor Legislation	3
Fin.	351	Pub. Fin.: Fed	3				
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Economics major may be chosen from the following in consultation with advisor:

E.S.	347	Nat. Inc. Analysis	3	E.S.	348	Adv. Bus. Cycles	3
Fin.	241	Inter. Trade & Fin.	3	Fin.	342	Inter. Trade & Fin.	3
Eco.	235	Transportation	3	Eco.	308	Adv. Economics	3
Eco.	371	Readings in Eco.	3	Eco.	336	Bus. & Govt.	3
				Eco.	372	Readings in Eco.	3
				Eco.	303	Eco. Development	3

[3]Suggested Free Electives:

Acctg.	13	Intermed. Acctg.	3	Phil.	14	Logic & Scient. Meth.	3
Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Hist.	327	Dev. Amer. Inst.	3	Hist.	328	Dev. Amer. Inst.	3
Hist.	355	Intel. Expan. Eur.	3	Hist.	356	Intel. Expan. Eur.	3

Major in Economic Statistics

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Law	1	Business Law	3	E.S.	45	Statistical Method	3
		Optional Courses[1]	9			Optional Courses[1]	9
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Mkt.	11	Marketing	3	Fin.	125	Corporation Finance	3
Fin.	123	Financial Institutions	3	Eco.	301	Bus. Mgmt. or	
E.S.	346	Business Cycles	3	I.E.	162	Industrial Mgmt.	3
Eco.	333	Labor Problems	3				
		Optional Course[1]	3			Optional Courses[1]	6
		Major Program Electives[2]	6			Major Program Elective[2]	3
		Free Elective[3]	3			Free Electives[3]	6
		Required Courses in Major					
E.S.	347	Nat. Inc. Analysis	3	Fin.	130	Money & Banking	3
E.S.	352	Adv. Stat. Method or		Eco.	306	Inter. Eco. Theory	3
E.S.	353	Time Series Analysis	3	E.S.	348	Adv. Bus. Cycles	3
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Economic Statistics major are to be selected in consultation with advisor.

[3]Suggested Free Electives:

Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II 3
Hist.	327	Dev. Amer. Inst.	3	Math.	340	Higher Algebra 3
E.S.	371	Readings in Eco. Stat.	3	Hist.	328	Dev. Amer. Inst. 3
				E.S.	372	Readings in Eco. Stat. 3

Major in Finance

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Law	1	Business Law	3	E.S.	45	Statistical Method	3
		Optional Courses[1]	9			Optional Courses[1]	9
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Mkt.	11	Marketing	3	Eco.	333	Labor Problems	3
E.S.	346	Business Cycles	3	Eco.	301	Business Mgmt. or	
Fin.	125	Corporation Finance	3	I.E.	162	Industrial Mgmt.	3
Fin.	123	Financial Institutions	3				
		Optional Course[1]	3			Optional Courses[1]	6
		Major Program Elective[2]	6			Major Program Elective[2]	3
		Free Elective[3]	3			Free Electives[3]	6
		Required Courses in Major					
Fin.	323	Investments	3	Eco.	306	Inter. Eco. Theory	3
Fin.	351	Pub. Fin.: Fed.	3	Fin.	326	Prob. in Fin. Mgmt.	3
				Fin.	130	Money & Banking	3
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Finance major may be chosen from the following in consultation with advisor:

Fin.	332	Mon.-Fiscal Policy	3	Fin.	324	Investments	3
Fin.	241	Inter. Trade & Fin.	3	Fin.	331	Bank Credit Mgmt.	3
E.S.	347	Nat. Inc. Analysis	3	Fin.	342	Inter. Trade & Fin.	3
Acctg.	105	Fin. Stat. & Reports or		Fin.	352	Pub. Finance: State & Local	3
Acctg.	13	Intermed. Acctg.	3	E.S.	348	Adv. Bus. Cycles	3
				Eco.	160	Insurance	3
				Law	204	Wills, Estates & Trusts	3
				Acctg.	14	Intermed. Acctg.	3

[3]Suggested Free Electives:

Acctg.	320	Auditing	3	Acctg.	106	Fund of Cost Acctg.	3
Eco.	307	Adv. Economics	3	Eco.	308	Adv. Economics	3
Fin.	371	Readings in Fin.	3	Fin.	372	Readings in Fin.	3

Major in Management

FIRST SEMESTER		SOPHOMORE YEAR			SECOND SEMESTER	
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco. 4	Economics	3
				Law 1	Business Law	3
				Mkt. 11	Marketing	3
		Optional Courses[1]	12		Optional Courses[1]	6
MS/AS	21	Mil./Air Science	2	MS/AS 22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E. 4	Physical Education	—
			17			17

FIRST SEMESTER		JUNIOR AND SENIOR YEARS			SECOND SEMESTER	
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
E.S.	45	Statistical Method	3	E.S. 346	Business Cycles	3
Fin.	125	Corporation Finance	3	Fin. 123	Financial Institutions	3
Eco.	333	Labor Problems	3		Optional Courses[1]	6
		Optional Course[1]	3		Major Prog. Elective[2]	3
		Major Prog. Elective[2]	3		Free Electives[3]	6
		Free Elective[3]	3			
I.E.	162	Industrial Mgmt.	3			
		Required Courses in Major				
Acctg.	105	Fin. Statements & Reports	3	Eco. 334	Labor Legislation	3
Eco.	306	Inter. Eco. Theory	3	Fin. 326	Prob. in Fin. Mgmt.	3
Eco.	301	Business Management	3	Eco. 302	Bus. Pol. & Org.	3
			30			30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Management Program may be chosen from the following in consultation with advisor:

E.S.	347	Nat. Inc. Analysis	3	Fin.	331	Bank Credit Mgmt.	3
Mkt.	217	Industrial Marketing	3	Eco.	336	Bus. & Govt.	3
Psych.	201	Industrial Psychology	3	Acctg.	204	Fed. Tax Acctg.	3
I.E.	329	Wage & Salary Admin.	3	Mkt.	312	Market Research	3
				I.E.	115	Personnel Admin.	3
				I.E.	330	Industrial Relations	3

[3]Suggested Free Electives:

Acctg.	203	Fed. Tax Acctg.	3	Psych.	1	Elem. Psychology	3
Soc.	42	Princ. of Sociology	3	Mkt.	214	Sell. & Sales Mgmt.	3
				Soc.	266	Population Problems	3
				Eco.	303	Eco. Development	3

Major in Marketing

SOPHOMORE YEAR

FIRST SEMESTER					SECOND SEMESTER		
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Law	1	Business Law	3	Mkt.	11	Marketing	3
		Optional Courses[1]	9			Optional Courses[1]	9
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER					SECOND SEMESTER		
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
E.S.	45	Statistical Method	3	E.S.	346	Business Cycles	3
Fin.	123	Financial Institutions	3	Fin.	125	Corporation Finance	3
Eco.	333	Labor Problems	3	Eco.	301	Business Mgmt. or	
				I.E.	162	Industrial Mgmt.	3
		Optional Course[1]	3			Optional Courses[1]	6
		Major Program Elective[2]	6			Major Program Elective[2]	3
		Free Electives[3]	6			Free Elective[3]	3
		Required Courses in Major					
Mkt.	113	Advertising	3	Mkt.	115	Retailing	3
Eco.	306	Inter. Eco. Theory	3	Mkt.	214	Sell. & Sales Mgmt.	3
				Mkt.	312	Mkt. & Dist. Research	3
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the Marketing major may be chosen from the following in consultation with advisor:

Mkt.	217	Industrial Mkt.	3	Soc.	266	Population Prob.	3
Acctg.	115	Cost Accounting	3	Psych.	16	Psych. of Business	3
E.S.	347	Nat. Inc. Analysis	3	Fin.	342	Inter. Trade & Fin.	3
Eco.	371	Readings in Eco.	3	Eco.	160	Insurance	3
Eco.	235	Transportation	3	Eco.	372	Readings in Eco.	3
Fin.	241	Inter. Trade & Fin.	3				

[3]Suggested Free Electives:

Engl.	41	Business Letters	3	Speech	31	Bus. & Prof. Speaking	3
Journ.	43	Commun. in Industry.	3	Journ.	44	Commun. in Industry.	3

Major in General Business

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
				Mkt.	11	Marketing	3
		Optional Courses[1]	12			Optional Courses[1]	9
MS/AS	21	Mil./Air Science	2	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

JUNIOR AND SENIOR YEARS

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
E.S.	45	Statistical Method	3	E.S.	346	Business Cycles	3
Fin.	125	Corporation Finance	3	Fin.	123	Financial Institutions	3
Law	1	Business Law	3	Eco.	333	Labor Problems	3
Eco.	301	Business Mgmt. or					
I.E.	162	Ind. Mgmt.	3				
		Optional Course[1]	3			Optional Course[1]	3
		Major Program Elective[2]	3			Major Program Elective[2]	3
		Free Elective[3]	3			Free Electives[3]	6
		Required Courses in Major					
Acctg.	13	Intermed. Acctg. or		Fin.	326	Prob. in Fin. Mgmt.	3
Acctg.	115	Cost Accounting	3	Eco.	306	Inter. Eco. Theory	3
Fin.	351	Pub. Fin.: Fed.	3	Law	102	Business Law	3
Mkt.	113	Advertising or					
Mkt.	214	Sell. & Sales Mgmt.	3				
			30				30

[1]Optional Courses fall into three groups: English or Foreign Language, Arts, and Science. For a general statement concerning these groups see page 104.

[2]Electives in the General Business Program may be chosen from the following in consultation with advisor:

Acctg.	13	Intermed. Acctg. or		Eco.	160	Insurance	3
Acctg.	115	Cost Accounting	3	Eco.	308	Adv. Economics	3
Acctg.	203	Fed. Tax Acctg.	3	E.S.	348	Adv. Bus. Cycles	3
E.S.	347	Nat. Inc. Analysis	3	Fin.	352	Pub. Finance:	
Fin.	323	Investments	3			State & Local	3
Fin.	241	Inter. Trade & Fin.	3	Mkt.	312	Marketing Research	3
Fin.	332	Mon.-Fiscal Policy	3	Eco.	336	Bus. & Govt.	3
Mkt.	113	Advertising or					
Mkt.	214	Sell. & Sales Mgmt.	3				
E.S.	352	Adv. Stat. Method	3				

[3]Suggested Free Electives:

Eco.	235	Transportation	3	Eco.	334	Labor Legislation	3
Soc.	42	Princ. of Soc.	3	Soc.	262	Social Problems	3
				I.E.	115	Personnel Admin.	3

FIVE-YEAR CURRICULUM IN INDUSTRIAL ENGINEERING AND BUSINESS ADMINISTRATION

Students who desire to pursue both industrial engineering and business administration may complete the required work for the degree of Bachelor of Science in Industrial Engineering by the end of the fourth year and that required for the degree of Bachelor of Science in Business Administration by the end of the fifth year. It is necessary that a student be enrolled in the curriculum in industrial engineering for the first four years and that he complete the requirements in this curriculum as outlined on pages 140 and 141. At the beginning of the fifth year the student transfers to the curriculum in business administration and is required to complete thirty-three semester hours in one of the following majors:

Major in Accounting

FIRST SEMESTER				FIFTH YEAR			SECOND SEMESTER	
				Required Courses				
Law	1	Business Law	3	Law	102	Business Law	3
Fin.	123	Financial Institutions	3	Law	204	Wills, Estates & Trusts	3
E.S.	346	Business Cycles	3	Mkt.	11	Marketing	3
Fin.	125	Corporation Finance	3	Acctg.	218	Adv. Cost Acctg.	3
		and nine semester hours to be selected from the following in consultation with the advisor:						
Acctg.	203	Fed. Tax Acctg.	3	Acctg.	315	Adv. Accounting	3
Acctg.	320	Auditing	3	Acctg.	204	Fed. Tax Acctg.	3
Acctg.	219	Spec. Acctg. Systems	3	Acctg.	304	Govt. & Inst. Acctg.	3

Major in Economics

FIRST SEMESTER				FIFTH YEAR			SECOND SEMESTER	
				Required Courses				
Law	1	Business Law	3	Eco.	306	Inter. Eco. Theory	3
Fin.	123	Financial Institutions	3	Eco.	308	Adv. Economics	3
Eco.	307	Adv. Economics	3	Fin.	125	Corporation Finance	3
Fin.	351	Pub. Fin.: Federal	3				
		and twelve semester hours to be selected from the following in consultation with the advisor:						
Eco.	235	Transportation	3	Soc.	42	Sociology	3
Fin.	241	Inter. Trade & Fin.	3	Eco.	334	Labor Legislation	3
E.S.	347	Nat. Inc. Analysis	3	Fin.	342	Inter. Trade & Fin.	3
Eco.	371	Readings in Eco.	3	E.S.	348	Adv. Bus. Cycles	3
E.S.	352	Adv. Stat. Method	3	Soc.	262	Social Problems	3
E.S.	353	Time Series Analysis	3	Eco.	372	Readings in Eco.	3
				Eco.	336	Bus. & Govt.	3

Major in Economic Statistics

FIRST SEMESTER		FIFTH YEAR			SECOND SEMESTER		
		Required Courses					
Law	1	Business Law	3	Eco.	306	Inter. Eco. Theory	3
Fin.	123	Financial Institutions	3	E.S.	348	Adv. Bus. Cycles	3
E.S.	347	Nat. Inc. Analysis	3	Fin.	125	Corporation Finance	3
E.S.	352	Adv. Stat. Method or					
E.S.	353	Time Series Analysis	3				

and twelve semester hours to be selected in consultation with the advisor.

Major in Finance

FIRST SEMESTER		FIFTH YEAR			SECOND SEMESTER		
		Required Courses					
Law	1	Business Law	3	Fin.	326	Prob. in Fin. Mgmt.	3
Fin.	123	Financial Institutions	3	Eco.	306	Inter. Eco. Theory	3
Fin.	323	Investments	3	E.S.	346	Business Cycles	3
Fin.	351	Pub. Fin.: Federal	3				

and twelve semester hours to be selected from the following in consultation with the advisor:

Fin.	241	Inter. Trade & Fin.	3	Eco.	160	Insurance	3
Eco.	235	Transportation	3	Fin.	342	Inter. Trade & Fin.	3
Fin.	371	Readings in Fin.	3	Fin.	324	Investments	3
Fin.	332	Mon.-Fiscal Policy	3	Fin.	352	Pub. Finance:	
Bus.	301	Bus. Mgmt.	3			State & Local	3
Acctg.	105	Fin. Statements &		Eco.	336	Bus. & Govt.	3
		Reports or		Acctg.	14	Intermed. Acctg.	3
Acctg.	13	Intermed. Acctg.	3	Fin.	372	Readings in Fin.	3
				Law	204	Wills, Estates & Trusts	3

Major in Management

FIRST SEMESTER			FIFTH YEAR			SECOND SEMESTER	
Law	1	Business Law 3	Eco.	306	Inter. Eco. Theory 3		
Fin.	123	Financial Institutions .. 3	Eco.	334	Labor Legislation..... 3		
Acctg.	105	Fin. Statements & Reports 3	Fin.	326	Prob. in Fin. Mgmt..... 3		
Fin.	125	Corporation Finance.... 3	Eco.	302	Bus. Policy & Org..... 3		
Eco.	301	Business Mgmt. 3					
		and six semester hours to be selected from the following in consultation with the advisor:					
E.S.	347	Nat. Inc. Analysis 3	Fin.	331	Bank Credit Mgmt. 3		
Mkt.	217	Industrial Marketing.... 3	Eco.	336	Bus. & Govt..... 3		
I.E. (300 level) courses not taken previously 6			Mkt.	214	Sell. & Sales Mgmt..... 3		
			Mkt.	312	Market Research 3		
			Eco.	160	Insurance 3		

Major in Marketing

FIRST SEMESTER			FIFTH YEAR			SECOND SEMESTER	
		Required Courses					
Law	1	Business Law 3	Mkt.	115	Retailing 3		
Fin.	123	Financial Institutions .. 3	Eco.	306	Inter. Eco. Theory 3		
Mkt.	113	Advertising 3	Mkt.	214	Sell. & Sales Mgmt..... 3		
E.S.	346	Business Cycles 3					
		and twelve semester hours to be selected from the following in consultation with the advisor:					
Fin.	241	Inter. Trade & Fin..... 3	Eco.	160	Insurance 3		
Eco.	235	Transportation 3	Fin.	342	Inter. Trade & Fin..... 3		
Eco.	371	Readings in Eco..... 3	Acctg.	218	Adv. Cost Acctg. 3		
Mkt.	217	Industrial Mkt. 3	Eco.	372	Readings in Eco..... 3		
Eco.	301	Bus. Mgmt. 3	Mkt.	312	Mkt. Research 3		
			Soc.	42	Sociology 3		

Major in Personnel and Industrial Relations

FIRST SEMESTER			FIFTH YEAR			SECOND SEMESTER	
		Required Courses					
Law	1	Business Law 3	Eco.	306	Inter. Eco. Theory 3		
Fin.	123	Financial Institutions .. 3	Eco.	334	Labor Legislation..... 3		
Psych.	201	Industrial Psych. 3	Soc.	42	Sociology 3		
			E.S.	346	Business Cycles 3		
		and twelve semester hours to be selected from the following in consultation with the advisor:					
Fin.	323	Investments 3	Law	102	Business Law 3		
Fin.	351	Pub. Fin.: Federal..... 3	Eco.	160	Insurance 3		
Fin.	241	Inter. Trade & Fin..... 3	Psych.	354	Human Engineering 3		
E.S.	347	Nat. Inc. Analysis 3	Govt.	360	Pub. Adm. 3		
Eco.	371	Readings in Eco..... 3	Soc.	262	Social Problems..... 3		
E.S.	352	Adv. Stat. Method 3	Eco.	372	Readings in Eco..... 3		
E.S.	353	Time Series Analysis .. 3	I.E.	115	Personnel Admin. 3		
			Eco.	301	Business Mgmt. 3		

The College of Engineering

The College of Engineering

Administrative Officers

Martin Dewey Whitaker, *President*

Harvey Alexander Neville, *Vice-President and Provost*

Earl Kenneth Smiley, *Vice-President*

Loyal Vivian Bewley, *Dean of the College of Engineering*

John Douglas Leith, *Dean of Students*

Charles Augustus Seidle, *Director of Admission*

James Harold Wagner, *Registrar*

James Decker Mack, *Librarian*

The College of Engineering offers curricula in chemical engineering, chemistry, civil engineering, electrical engineering, engineering mechanics, engineering physics, general science and mathematics, industrial engineering, mechanical engineering, metallurgical engineering, and mining engineering. Five-year courses combining the liberal arts and engineering, business administration and industrial engineering, electrical and mechanical engineering, electrical engineering and physics are also provided. In each of these combined curricula one baccalaureate degree is awarded upon the successful completion of four years of study, and a second baccalaureate degree is awarded at the end of the fifth year.

The engineering curricula were formulated on the basis of an intense study, by the faculty of Lehigh University, of the problems of technical education and the changing needs of modern industry. This study led to the conclusion that greater emphasis than heretofore should be placed upon the fundamentals of engineering, including mathematics, physics, chemistry, and theoretical and applied mechanics and less emphasis upon the highly specialized details of engineering practice; and that the engineer must know something of the social sciences and humanities, that is, the sciences which deal with human relations. The various engineering curricula accordingly emphasize the fundamental sciences

and those subjects from the social sciences and the humanities which are part of the equipment of every well-educated man. These latter are now recognized as essential to the proper training of engineers, not only because of their practical applications in industrial, business, and civic life, but also because they enrich the whole of a man's private life.

Provision is made for a uniform freshman year in the College of Engineering. The student's tentative choice of a specialized engineering curriculum, as recorded at the time of entrance, may be changed (within the limitations of enrollment in the various curricula) prior to his entering upon the sophomore year without loss of time. Engineering freshmen are admitted with "open" curriculum choice. Within a year of college experience, and on the basis of conferences with members of the faculty, it is hoped that any student who is uncertain as to his specialized curriculum choice may choose wisely. In the second semester of his freshman year, just prior to preregistration for the sophomore year, each engineering student must select a particular engineering curriculum. The sophomore year for many of the engineering curricula are sufficiently alike so as to be "tradeable" between these curricula, and it is thus possible for a student to transfer from one curriculum to another without loss of credit or having to make up courses at the end of his sophomore year.

The work of the first two years is fairly self-contained. To those who for one reason or another are unable to complete their engineering training, it affords preparation for careers as draftsmen, chiefs of party, shop foremen, or assistants in industrial laboratories or plants.

Since the University recognizes that an engineer can not be trained by purely academic process, the degree awarded upon graduation is Bachelor of Science in the particular division of engineering that has been studied, for example, Bachelor of Science in Civil Engineering. The successful completion of one year of full-time graduate study leads to the degree of Master of Science.

General Studies

General studies are non-professional, non-specialized studies in the large areas of human knowledge and experience with which

any educated man should be acquainted. These areas are three: the humanities, the natural sciences, and the social sciences. Since all engineers receive extensive training in the physical sciences, their general studies are restricted to life and earth sciences, the humanities and the social sciences. A carefully developed program strengthening the earlier offerings in this area has been developed.

The general studies sequence starts in the freshman year with a study of English composition and literature and a study of history in the course "Development of Western Civilization." It continues with a broad course in economics, including its social aspects, which extends throughout the sophomore year. This is followed by two courses selected from alternates, which are usually taken in the junior year. The first of these alternates is either biology or psychology, and the second either philosophy or literature. The first acquaints the student with an important life science, and the second strengthens his background in the humanities. The final two courses are elected by the student, under the guidance of his curriculum director, from at least two of the eight elective groups shown in the accompanying table.

Several of these required or elective courses (notably History 11 and 12, "Development of Western Civilization"; Biology 13, "Human Biology"; and Philosophy 100, "Philosophy of Contemporary Civilization") have been developed particularly for this program. They are designed to help it in its major aims: first to acquaint the student with that literary, social, political, and economic background which is our heritage, and second, to open intellectual doors in his mind and thus give him a sound start of self-education which will continue throughout his life.

The objective of the study of the humanities and the social sciences in technical schools has been stated by the American Society for Engineering Education to be the development of an "understanding of the evolution of the social organism within which we live . . . ; and the development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude." We conceive it to be the duty of the engineer to be a professional man in the broadest sense of the term, a member of a group whose primary aim is to advance human well-being.

General Studies Courses

Required Courses

English 1 and 2	Composition and Literature	(6)
History 11 and 12	Development of Western Civilization	(6)
Economics 3 and 4	Economics	(6)

Alternate Courses

Biology 13	Human Biology or	
Psychology 1	Introduction to Psychology	(3)
Philosophy 100	Philosophy of Contemporary Civilization, or	
Literature	In a foreign language or in English (see Group 4)	(3)

Elective Course Groups:

6 hours required

Not more than 3 hours from any one group

Group 1:	Biology 1, 13; Geology 1, 6; Astronomy 1; Psychology 1, 309, 351.
Group 2:	Greek 21, 202; Latin 22, 203; History, any course other than History 11-12.
Group 3:	Economics 306, 307, 308, 333, 334; Sociology 41, 42, 262, 266.
Group 4:	Literature course in a foreign language or in English (English 4, 5, 7, 8, 9, 11, 12, 18, 19, 20, 21, 36, or any English literature course above 100).
Group 5:	Speech 30, 32, or English 142, or a foreign language beyond the first year.
Group 6:	Fine Arts, any course; Music 20-30, any course; Speech 21.
Group 7:	Philosophy or Religion, any course.
Group 8:	Government or International Relations, any course.

Qualified Engineering students are eligible for the College Honors Program. (See page 69.) Creative Concepts Seminars may be substituted hour for hour for alternate and elective general studies courses.

The Uniform Freshman Year

An outline follows of the work of the freshman year, uniform for all engineering students. For schedules of the work of the upper three years, varying according to the several specialized curricula, see the subsequent pages.

FRESHMAN YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Chem.	4	Gen. Chemistry	4	Chem.	5	Gen. Chemistry	4
*Engl.	1	Composition & Lit.	3	Engl.	2	Composition & Lit.	3
Hist.	11	Dev. W. Civilization	3	Hist.	12	Dev. W. Civilization	3
‡Math.	11	Anal. Geom. & Calc. I	3	Math.	12	Anal. Geom. & Calc. II	3
Phys.	1	Mech. of Mass Points	4	C.E.	61	Engr. Graphics	3
or				or			
C.E.	61	Engr. Graphics	3	Phys.	1	Mech. of Mass Points	4
MS/AS	11	Mil./Air Science	2	MS/AS	12	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—
			18 or 19				18 or 19

*Engl. 1 and 2, Composition and Literature, are the courses normally taken in the first and second semesters respectively of the freshman year. Students who demonstrate superior ability in composition on the English placement tests are assigned to Engl. 11 and 12, Types of World Literature. Those whose performance is regarded as unsatisfactory are required to complete successfully Engl. 0, Elementary Composition, followed by Engl. 1 and 2.

‡Students whose performance on a Mathematics placement test is regarded as unsatisfactory are required to complete successfully Math. 0, Mathematics Review, before entering Math. 11.

Inspection Trips

Inspection trips to industrial plants are a required part of specific courses in the various curricula in engineering. Written reports may be required. These trips are generally held during the senior year and involve an average expense of about $25. The location of the University in the center of industrial activities of various types furnishes unusual opportunities for visits of inspection to engineering plants.

Combined Arts and Engineering Curricula

Under the five-year plan the student registers in the College of Arts and Science for four years, earning the B.A. degree on completion of a program which includes, along with specific B.A. training, the fundamental mathematical, scientific, and engineering subjects of the engineering curriculum of his choice. The fifth year is spent in the College of Engineering, carrying on a program leading to the degree of B.S. in his selected branch of engineering. This is usually the senior year curriculum of the chosen branch of engineering.

An engineering student who decides at any stage of his course that he wishes to work for both the B.A. and B.S. degrees, may register in one of the colleges concerned for a period of years and complete the combined requirements of both degrees in five or six years, depending upon the program followed before the decision is made. His curriculum is so arranged that the work for one degree may be finished at the end of a four-year period and the work for the subsequent degree at the close of the fifth or sixth year.

Cooperative Programs With Industry

Lehigh University has entered into agreements with certain industrial organizations whereby undergraduate students in various branches of engineering may pursue an interleaved course of study and industrial employment, comprising eight semesters of study at Lehigh University, and three periods (each approximately equal to a semester in length) of employment in industry, totaling four calendar years, at the successful completion of which the student

will receive a B.S. degree from Lehigh University and a suitable certificate from the industrial concern.

The objective of a cooperative program is: To give the student an opportunity to become familiar with industrial methods, policies, and environment to the end that he will acquire a greater degree of motivation towards his academic studies.

The scope of the academic part of a cooperative program is identical with that of the standard curriculum in which the student is registered. Exactly the same courses are taken and in substantially the same sequence.

The first industrial employment period commences at the end of the sophomore year. The third, or final, period follows the end of the senior year. The degree is conferred upon the completion of the senior year. Students electing a cooperative program are expected to complete it.

During the three periods of industrial employment the student is closely supervised to guarantee that he acquires a balanced training in industrial practice. Representatives from the University make periodic inspections of the industrial training part of the program for the purpose of assuring that this training is in keeping with the above objectives and that the student is receiving maximum benefits from the cooperative program. The student is required to render a comprehensive report on his observations and work while employed in industry.

While engaged in industrial employment the student is paid at prevailing rates for the type of work in which he is engaged.

There is no obligation, either legal or moral, on the part of the student to agree to accept permanent employment with the industrial concern with which he is connected on a cooperative program; nor is there any obligation on the part of the industrial concern to offer him permanent employment.

The details of cooperative programs vary with different curricula and industrial organizations. Interested students should consult their curriculum director. A typical four-year program be-

tween Electrical Engineering and the Philco Corporation, which comprises eleven approximately equal periods, is as follows:

FALL SEMESTER	SPRING SEMESTER	SUMMER SEMESTER
1. Freshman I	2. Freshman II	Vacation
3. Sophomore I	4. Sophomore II	5. Philco Corp.
6. Junior I	7. Philco Corp.	8. Junior II
9. Senior I	10. Senior II	11. Philco Corp.

During Period 7, while the student is with Philco Corporation, an evening course in Electronics (E.E. 110) is required.

Students interested in such a program should apply to their curriculum director not later than the middle of the semester preceding the first scheduled period with industry.

THE CURRICULUM IN CHEMICAL ENGINEERING

Graduates in chemical engineering are expected to develop competence in all phases of the work conducted by manufacturing establishments in which chemical and certain physical changes of materials are accomplished during the manufacturing processes. The various phases of this work are research, development, design, construction, operation, plant management, and sales. A small number of the industries that utilize such processes are atomic energy, petroleum and petro-chemicals, rubber, soap, and foods in addition to the generally recognized chemical industries.

Preparation for this broad field requires a sound background in the fundamental sciences of physics, chemistry, and mathematics plus a general background in engineering principles and intensive training in the application of these fundamentals to carrying forward into industrial production the new products and processes discovered in the laboratory. This latter training is directly called Chemical Engineering. In accord with this philosophy, the student is not trained for any specific industry, but the education is sufficiently broad that a graduate is competent in any of the chemical and allied industries.

The aim of the curriculum is to develop expertness in the sciences, the processes, and the unit operations which must be integrated into a chemical manufacturing operation. Some familiarity with factory methods under actual working conditions is acquired through contact with operations in nearby plants. Frequent visits are made to manufacturing plants in the immediate vicinity and nearby centers of activity in the chemical industry.

The program is also designed to prepare a student for graduate study in chemical engineering. Further study at the graduate level leading to advanced degrees is highly desirable in preparation for careers in the more highly technical aspects of manufacturing. The increasing complexity of modern manufacturing methods requires superior training for men working in the research, development, and design fields or for teaching. By proper election of technical option courses, the graduate can prepare for graduate study in chemistry.

THE CURRICULUM IN CHEMICAL ENGINEERING

FRESHMAN YEAR

(37 hrs.)

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Met.	63	Eng. Mat. & Proc.	3	Ch.E.	70	Ind. Stoichiometry	3
Chem.	35	Analytical Chem.	4	Chem.	36	Analytical Chem.	4
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Calculus III	3	Math.	14	Calculus IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
M.S.	3 or			M.S.	4 or		
A.S.	3	Mil./Air Science	2	A.S.	4	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			19				19

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Ch.E.	171	Unit Operations I	3	Ch.E.	172	Unit Operations II	3
Chem.	94	Phys. Chemistry	3	Ch.E.	175	Ch. Engr. Practice	1
Chem.	92	Phys. Chem. Lab.	1	Chem.	191	Phys. Chemistry	3
Chem.	150	Organic Chemistry	3	Chem.	192	Phys. Chem. Lab.	1
Chem.	165	Org. Chem. Lab.	2	Chem.	151	Organic Chemistry	3
Mech.	1	Statics	3	Chem.	179	Lit. of Chem.	1
		*General Study	3	Math.	206	App. Math. I	3
						*General Study	3
			18				18

SUMMER

Ch.E. 100 Eight (8) weeks industrial employment with report.

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Ch.E.	173	Unit Operations III	2	Ch.E.	174	Plant & Equip. Des.	3
†Ch.E.	177	Unit Ops. Lab.	2	Ch.E.	176	†Ch.E. Projects	2
Ch.E.	200	Ch.E. Thermo.	3	Mech.	11	Mech. of Materials	3
E.E.	160	Elec. Cir. & Appar.	3			‡Technical Options	6
E.E.	161	Elec. Problems	1			*General Study	3
E.E.	162	Dynamo Lab.	1				
		‡Technical Options	3				
		*General Study	3				
			18				17

†Approximately half the class will be scheduled for Ch.E. 176 in the fall semester and Ch.E. 177 in spring.

‡The technical options must represent a coherent group of approved courses such as: Any 200 or 300-level course in Ch.E. or Chem. (Students expecting to use organic chemistry are urged to include Chem. 167 in the junior year); Phys. 266, 268 or 367; Math. 208 or 233; I.E. 164; M.E. 322; Law 103; Acct. 104; Eco. 214 or 217.

*For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN CHEMISTRY

Chemists constitute nearly one-half of all professional research personnel in industry as shown by a report of the National Resources Planning Board. The American Chemical Society, which requires professional training and experience for eligibility, has a present membership of about 80,000. The consistently rapid increase in the membership of this society in recent years may be taken as an index of the expanding opportunities in the chemical profession.

The curriculum in chemistry provides a thorough grounding in the fundamentals of this science, with the requisite collateral training in physics and mathematics, and gives some consideration to industrial and engineering principles. As a curriculum in the engineering school leading to a bachelor of science degree, the fundamentals of chemistry as well as engineering are stressed. In addition to the liberal allotment of time to courses in English, German, economics, history and other non-professional studies, provision is made for twelve semester hours (ordinarily four courses) of professional electives in a minor field of concentration. The tabulation below indicates some of the possibilities of this guided selection of elective courses.

PREPARATION FOR	ELECTIVE SEQUENCE IN
Executive or sales departments of chemical industry	Business administration
Plant operation	Chemical engineering
Food and pharmaceutical industries	Biochemistry and bacteriology
Medicine	Biology
Graduate study or research in physical chemistry	Physics and mathematics
Teaching, especially in public schools	Education
Metals industries	Metallurgy

Since the freshman year of this curriculum is identical with that of chemical engineering, and the sophomore years in the two curricula are nearly the same, it is possible for the student to transfer from one curriculum to the other before the beginning of the junior year without a considerable sacrifice of credits. In

a transfer from chemical engineering to chemistry, the extra courses may be utilized as electives.

Seniors in the curriculum in chemistry may arrange to make the supervised visits to industrial plants, which are required in the curriculum in chemical engineering.

THE CURRICULUM IN CHEMISTRY

FRESHMAN YEAR

FIRST SEMESTER — SECOND SEMESTER

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Chem.	35	Analytical Chem.	4	Chem.	36	Analytical Chem.	4
Eco.	3	Economics	3	Eco.	4	Economics	3
†Ger.	1 or 3	German	3	†Ger.	6	German	3
Math.	13	Calculus III	3	Math.	14	Calculus IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
MS/AS	3	Mil./Air Science	2	MS/AS	4	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			19				19

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Chem.	91	Phys. Chemistry	3	Chem.	151	Organic Chemistry	3
Chem.	92	Phys. Chem. Lab.	1	Chem.	167	Org. Chem. Lab.	2
Chem.	150	Organic Chemistry	3	Chem.	356	Quant. Org. Anal.	1
Chem.	165	Org. Chem. Lab.	2	Chem.	190	Phys. Chemistry	3
†Ger.	27	Scientific German	3	Chem.	192	Phys. Chem. Lab.	1
		*General Study	3	Ch.E.	160	Unit Ops. Survey	3
		Elective	3			*General Study	3
						Elective	3
			18				19

SUMMER

Ch.E. 100 Eight (8) weeks industrial employment with report.

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Chem.	302	Inorganic Chem.	3	Chem.	337	Instrumental Methods of Analysis	3
Chem.	194	Phys. & El'trochem.	3				
Chem.	197	Electrochem. Lab.	1	Chem.	175	Research Lab.	3
		*General Study	3	Chem.	179	Hist. & Lit. Chem.	1
		Elective	3	Chem.	357	Qual. Org. Anal.	3
Chem.	358	Adv. Org. Chem.	}			*General Study	3
Chem.	372	or Elem. Biochem.	} 3			Elective	3
			16				16

*For an elucidation of this requirement see pages 120-122.

†Students in this curriculum are required to pass Ger. 7, Scientific German. Those who are able to omit one or both semesters of the courses prerequisite to Ger. 7 will elect other courses as substitutes.

THE CURRICULUM IN CIVIL ENGINEERING

Civil Engineering, the original stem from which have branched the other types of engineering, continues to meet the demands of those branches of industry which prefer a broad, fundamental education to a more specialized training. The curriculum, however, develops depth in the various professional areas of civil engineering.

The field of civil engineering includes the conception, design, construction, operation, and maintenance of private and public projects, including bridges, buildings, highways, airports, railroads, harbors, docks, subways, tunnels, water supply and purification systems, sewage collection and treatment facilities, water power developments, the making of surveys, and research. Many civil engineers are associated with consulting engineering firms, contractors, industrial concerns, or various governmental subdivisions.

The work of the first three years deals chiefly with the scientific and mathematical basis of engineering practice, with emphasis upon the application of these principles during the fourth year. All students receive instruction in surveying, highway engineering, geology, soil mechanics, structural theory and design, foundation engineering, fluid mechanics, and sanitary engineering. Opportunity is provided through an elective for a student to determine whether he has an interest in and aptitude for research. Development of abilities in self-expression are stressed throughout the curriculum.

Special five-year combined programs leading to the degrees B.S. in C.E. and either B.A., B.S. in M.E., or E.M. can be arranged. Also a special five and one-half year combined program leading to B.S. in Bus. Adm. can be arranged.

Engineers, through their professional societies, have insisted that the engineering student be trained as a professional man rather than a technician, with a sound understanding of his place in society. This training is provided by the humanistic-social courses extending through the four years and selected with the advice and approval of the curriculum director.

THE CURRICULUM IN CIVIL ENGINEERING

FRESHMAN YEAR

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	C.E.	40	Prin. of Surveying	3
Math.	13	Anal. Geom. & Calc. III	3	Eco.	4	Economics	3
Mech.	1	Statics	3	Math.	14	Anal. Geom. & Calc. IV	3
MS/AS	3	Mil./Air Science	2	Mech.	11	Mech. of Materials	3
Phys.	3	Heat & Electricity	4	Mech.	13	Materials Testing Lab.	1
		†General Study	3	MS/AS	4	Mil./Air Science	2
P.E.	3	Physical Education	—	Phys.	4	Electricity, Light, & Atomic Physics	4
			18	P.E.	4	Physical Education	—
							19

SUMMER

C.E. 41 Engineering Surveys (3)

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
C.E.	112	Adv. Mech. of Mat.	3	C.E.	111	Mat. of Constr.	1
C.E.	121	Mech. of Fluid	3	C.E.	124	Appl. Hydrology	2
C.E.	123	Fluid Mech. Lab.	1	C.E.	139	Soil Mechanics	3
C.E.	150	Structural Anal. I	3	C.E.	154	Structural Anal. II	3
Math.	206	Applied Math. I	3	Geol.	6	Eng. Geology	4
Mech.	102	Dynamics	3	Met.	61	Eng. Metallurgy	2
		†General Study	3			†General Study	3
			19				18

SUMMER

C.E. 100 Industrial Employment (–)

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
C.E.	101	Foundation Engrg.	2	C.E.	155	Structural Design	3
C.E.	102	Proseminar	1	C.E.	162	Sanitary Engrg.	3
C.E.	125	Hydraulic Eng.	2			*Adv. C.E.	3
C.E.	145	Transport. Engrg. I	3	M.E.	160	Thermodynamics	3
C.E.	151	Structural Theory	3			Approved Elective	3
C.E.	153	Reinf. Conc. Theory	3			†General Study	3
E.E.	160	Elec. Cir. & Appar.	3				
E.E.	161	Elec. Problems	1				
E.E.	162	Dynamo Lab.	1				
			19				18

*Any advanced civil engineering course approved by curriculum director.

†For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN ELECTRICAL ENGINEERING

The electrical engineer is one who practices the science and art of economically "directing the sources of electrical energy in nature for the uses and conveniences of man." He may design, manufacture, install, or operate electrical machinery and equipment, manage plants and electric systems, or engage in the promotion of engineering projects. He may design, manufacture, or control communication systems, computer systems, or automatic control systems.

The object of this curriculum is to give instruction in those general and scientific subjects which underlie all the branches of engineering, and to give special training in those technical subjects which experience shows are more essential in the equipment of the electrical engineer. In seeking to accomplish this object the department puts chief emphasis upon mastery of the mathematical-physical principles and thoroughness in the analysis of problems.

The curriculum provides a balanced allotment of time in each of four principal divisions: (1) mathematics and the basic sciences, (2) electrical engineering, (3) allied branches of engineering, and (4) general studies. In order to make maximum use of the available time, the electrical courses are highly coordinated with respect to classroom and laboratory work; concurrent courses are designed to augment and supplement each other; and consecutive courses to extend and build upon the previous courses.

In recognition of different talents and inclinations among individuals, and of specialization in industry, two separate options are offered in the senior year: (1) the Power Option for those interested in the design, operation, and development of electrical machinery and power systems; (2) the Electronics Option for those interested in the field of electrical communication or electronics. The work for the first three years and some of that in the senior year is identical for each option, so that all graduates will have had the same basic work. Thus, although a student elects a particular option, he has a foundation sufficiently fundamental to enable him to engage in any branch of electrical engineering.

THE CURRICULUM IN ELECTRICAL ENGINEERING

FRESHMAN YEAR

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Calculus III	3	Math.	14	Calculus IV	3
Mech.	1	Statics	3	Mech.	11	Mech. of Materials	3
Met.	63	Engr. Mat. & Proc.	3	Mech.	13	Materials Testing Lab.	1
MS/AS	21	Mil./Air Science	2			*General Study	3
Phys.	3	Heat & Electricity	4	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	Phys.	4	Electricity, Light, & Atomic Physics	4
				P.E.	4	Physical Education	—
			18				19

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
E.E.	104	Circuit Analysis	5	E.E.	106	Electrical Machinery	5
Phys.	266	Atomic and Nuclear Physics	3	E.E.	110	Electronics	4
Phys.	110	Electrical Meas. Lab.	1	Phys.	111	Electronics Lab	1
Math.	206	Applied Mathematics I	3	M.E.	104	Thermo I	4
Mech.	102	Dynamics	3	C.E.	121	Mech. of Fluids	3
		*General Study	3	C.E.	123	Fluid Mechanics Lab	1
			18				18

SUMMER

E.E. 100 Industrial Employment

SENIOR YEAR

Electronics Option

FIRST SEMESTER				SECOND SEMESTER			
E.E.	108	A.C. Machines	3	E.E.	111	Proseminar	1
E.E.	232	Electric Transients	3	E.E.	331	Elec. & Mag. Fields	3
E.E.	141	Electronic Circuits	4	E.E.	142	Electronic Circuits	4
E.E.	143	Commun. Networks	4	E.E.	144	Commun. Networks	4
M.E.	161	M.E. Laboratory	1	E.E.	345	Electromagnetic Theory	3
		*General Study	3			*General Study	3
			18				18

Power Option

E.E.	108	A.C. Machines	3	E.E.	111	Proseminar	1
E.E.	109	A.C. Mach. Lab.	1	E.E.	331	Elec. & Mag. Fields	3
E.E.	232	Electric Transients	3	E.E.	334	Trans. Line Transients	3
E.E.	133	Power System Analysis I	4	E.E.	336	Power System Analysis II	4
M.E.	105	Thermo II	4	E.E.	337	Adv. Mach. Theory	3
		*General Study	3	E.E.	338	Transients Lab.	1
				M.E.	161	M.E. Laboratory	1
						*General Study	3
			18				19

*For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN ENGINEERING MECHANICS

The curriculum in engineering mechanics is designed to prepare men for careers in engineering research and development. There is an increasing demand in industry and government service for men with a broad training in the fundamentals of engineering, rather than in a given specific field. Such a training, in which engineering mechanics and applied mathematics play an important part, is provided by this curriculum. It emphasizes the analytical approach to engineering problems and the application to their solution of the basic methods and principles of mechanics.

The first two years of work are the same as those in most of the other engineering curricula. During the junior and senior years, time is about equally divided between (1) engineering mechanics, (2) mathematics, (3) allied branches of engineering and general studies, and (4) technical electives. The major areas of study in engineering mechanics are statics and strength of materials, dynamics and vibrations analysis, elasticity, plasticity, and fluid mechanics. The technical electives should be used to form one of the suggested group options. They are intended to enable the student to correlate his theoretical training with engineering practice in a specific field. They may also be used by those men more theoretically inclined to carry an intensive study of applied mathematics.

Only those men who have achieved high standing in mathematics, mechanics, and physics during the first two years of college and who have shown definite analytical ability are encouraged to proceed toward the degree of bachelor of science in engineering mechanics. Graduates in engineering mechanics are equipped for immediate work in research and development in government service or in aircraft, automotive, and similar industries. They are also eligible for admission to the Graduate School for advanced work in applied mechanics or in some related engineering field.

THE CURRICULUM IN ENGINEERING MECHANICS

FIRST SEMESTER — FRESHMAN YEAR — SECOND SEMESTER

See page 122

FIRST SEMESTER — SOPHOMORE YEAR — SECOND SEMESTER

Course No.	*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Eco. 3	Economics	3	Eco. 4	Economics	3
Math. 13	Calculus III	3	Math. 14	Calculus IV	3
Mech. 1	Statics	3	Mech. 11	Mech. of Materials	3
Phys. 3	Heat & Electricity	4	Mech. 13	Materials Testing Lab.	1
Met. 63	Eng. Materials	3	Phys. 4	Electricity, Light, & Atomic Physics	4
MS/AS		2		*General Study	3
P.E. 3		—	MS/AS		2
			P.E. 4		—
		18			19

FIRST SEMESTER — JUNIOR YEAR — SECOND SEMESTER

Math. 221	Diff. Equations	3	Math. 322	Diff. Eq. & Harm. Ana.	3
Math. 301	Vector Analysis	3	Mech. 302	Adv. Dynamics	3
Mech. 102	Dynamics	3	C.E. 121	Mech. of Fluids	3
Mech. 301	Adv. Mech. of Mat.	3	C.E. 123	Hydraulic Lab.	1
	Elective	3-4	E.E. 160	Elec. Cir. & Appar.	3
	*General Study	3	E.E. 161	Elec. Problems	1
			E.E. 162	Dynamo Lab.	1
				Elective	3-4
		18-19			18-19

SUMMER

Mech. 100 Summer Employment

FIRST SEMESTER — SENIOR YEAR — SECOND SEMESTER

Math. 315	Func. of Comp. Var.	3	Math. 324	Prob. & Num. Anal.	3
Mech. 303	Mech. of Continua I.	3	Mech. 304	Mech. of Cont. II	3
Phys. 340	Heat, Thermodynamics	4	M.E. 342	Elem. Vibra. Anal.	3
	Electives	3-6		Electives	6
	*General Study	3		*General Study	3
		16-19			18

Electives in junior and senior years consist of 17-19 hours and should include (a) a group option (11-17 hrs.), such as listed below, intended to enable the student to correlate his theoretical training with engineering practice in a specific field, or to carry a more intensive study of mathematics, (b) additional approved technical electives or an approved foreign language.

Typical Group Options

A. STRUCTURAL ENGINEERING

C.E.	150	Structural Analysis I	(3)
C.E.	154	Structural Analysis II	(3)
C.E.	151	Structural Theory	(3)
C.E.	153	Reinf. Concrete Theory	(3)
			12

B. MACHINE DESIGN

M.E.	101	Machine Design I	(3)
M.E.	102	Machine Design II	(3)
M.E.	103	Machine Design III	(5)
			11

*For an elucidation of this requirement see pages 120-122.

C. HEAT AND FLUID FLOWS

M.E.	104	Thermodynamics I	(4)
M.E.	105	Thermodynamics II	(4)
M.E.	322	Gas Dynamics	(3)
Mech.	325	Aerodynamics	(3)
Mech.	326	Aerodynamics	(3)
			17

Note: Students electing this group option will replace Phys. 340 by four additional hours of electives.

D. METALLURGICAL ENGINEERING

Met.	230.	Physical Metallurgy I	(4)
Met.	231.	Physical Metallurgy II	(4)
Met.	323.	Mechanical Metallurgy	(3)
Met.	352.	Ferrous Metallurgy	(3)
			14

E. MATHEMATICS

Math.	219	Principles of Analysis	(3)
Math.	220	Principles of Analysis	(3)
Math.	340	Higher Algebra	(3)
Math.	305.	Computer Programming	(3)
			12

THE CURRICULUM IN ENGINEERING PHYSICS

The curriculum in engineering physics is designed to prepare men for careers in scientific work. Primary emphasis is placed on the fundamental principles of physics, and this is carefully coordinated with thorough laboratory training. The first two years of work are similar to those in any of the engineering curricula, and some further engineering study is required in addition to the work in physics during the final two years. The training is thus consciously practical.

The complete curriculum is not dictated. A liberal number of electives, particularly in the senior year, provides unusual flexibility in allowing the curriculum to be adapted to the needs and interests of the individual student. Those whose interests lie in the theoretical or analytical phases of their science, or who are preparing for graduate study, usually elect additional courses in mathematics and physics. Many others elect additional work in chemistry, engineering, geophysics, education, or business, or further studies in the social sciences and the humanities.

Graduates are prepared to start their professional careers as physicists. They are equipped for work in pure or applied science: their primary function is the solution of problems which have not yet been reduced to standard engineering practice.

THE CURRICULUM IN ENGINEERING PHYSICS

FIRST SEMESTER — FRESHMAN YEAR — SECOND SEMESTER

See page 122

FIRST SEMESTER — SOPHOMORE YEAR — SECOND SEMESTER

Course No.	*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Eco. 3	Economics	3	Eco. 4	Economics	3
†Ger. or	German 3	3	†Ger. or	German 3	3
	Approved Elec. 3			Approved Elec. 3	
Math. 13	Calculus III	3	Math. 14	Calculus IV	3
Mech. 1	Statics	3	Phys. 4	Electricity, Light, & Atomic Physics	4
Phys. 3	Heat & Electricity	4	Phys. 32	Electricity and Electronics	3
MS/AS 3	Mil./Air Science	2	MS/AS 4	Mil./Air Science	2
P.E. 3	Physical Education	—	P.E. 4	Physical Education	—
		18			18

FIRST SEMESTER — JUNIOR YEAR — SECOND SEMESTER

E.E. 104	Circuit Analysis	5		Appr. Math. Elect.	3
Math. 206	Applied Math I	3	Mech. 102	Dynamics	3
Phys. 110	Elect. Measurements	1	Phys. 111	Electronics Lab.	1
Phys. 213	Theo. Elec. & Mag.	3	Phys. 191	Lab. Techniques	1
	Elective	3	Phys. 252	Optics	4
	*General Study	3		*General Study	3
			E.E. 110	Electronics	4
		18			19

SUMMER

Phys. 100 Industrial Employment

FIRST SEMESTER — SENIOR YEAR — SECOND SEMESTER

Phys. 340	Heat and Thermo	4	Phys. 269	Modern Theories	3
Phys. 268	Modern Theories	3	Phys. 270	Atom. & Nucl. Lab.	1
Phys. 192	Advanced Lab.	1	Phys. 171	Proseminar	1
	*General Study	3	Phys. 363	Mod. Th. Solids	3
	Electives	7		Appr. Phys. Elect.	2
				*General Study	3
				Electives	5
		18			18

*For an elucidation of this requirement see pages 120-122.

†Students planning graduate study should elect German. A selection from Chem. 38, Met. 63, and Mech. 11, 13 is suggested for others.

THE COMBINED FIVE-YEAR CURRICULUM IN ELECTRICAL ENGINEERING AND ENGINEERING PHYSICS

This curriculum is designed to meet the needs of those who plan a career in electronics and communications research and development. It differs from the standard four-year Electronics Option in Electrical Engineering in that the five-year two-degree program includes additional courses in mathematics and physics. It differs from the standard four-year curriculum in Engineering Physics in that it includes additional courses in electronic circuits, microwaves, and communication networks.

For men planning careers in the electronics communications area, it is believed that the greater breadth of training afforded by this combined program is preferable to early specialization in either field alone. It should be particularly noted that this program lays a solid foundation for graduate study in either physics or electrical engineering.

It is expected that students undertaking this combined program will make every effort to complete the five years. The E.E. degree is conferred on the successful completion of the fourth year, and the E.P. degree at the end of the fifth year.

THE COMBINED FIVE-YEAR CURRICULUM IN ELECTRICAL ENGINEERING AND ENGINEERING PHYSICS

FRESHMAN AND SOPHOMORE YEARS

See E.E. Curriculum

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
E.E.	104	Circuit Analysis	5	E.E.	106	Electrical Machinery	5
Math.	206	Applied Math. I	3	E.E.	110	Electronics	4
Mech.	102	Dynamics	3	Phys.	111	Electronics Lab	1
Phys.	110	Electrical Measurements Lab.	1	Phys.	252	Geometrical and Physical Optics	4
M.E.	104	Thermo I	4	M.E.	161	M.E. Laboratory	1
		*General Study	3			*General Study	3
			19				18

SUMMER

Industrial Employment

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
E.E.	232	Electric Transients	3	E.E.	331	Elec. & Mag. Fields	3
E.E.	141	Electronic Circuits	4	E.E.	142	Electronic Circuits	4
E.E.	143	Commun. Networks	4	E.E.	144	Commun. Networks	4
E.E.	108	A.C. Machines	3	E.E.	345	Electromagnetic Theory	3
Phys.	213	Theory of Electricity and Magnetism	3	E.E.	111	Proseminar	1
						*General Study	3
			17				18

FIFTH YEAR

FIRST SEMESTER				SECOND SEMESTER			
Math.	301	Vector Analysis	3	Math.	322	Diff. Eq. & Harm. Ana.	3
Math.	221	Diff. Equations	3			Elective	3
Math.	315	Th. Func. Comp. Var.	3	Phys.	363	Modern Th. of Solids	3
Phys.	268	Modern Theories	3	Phys.	269	Modern Theories	3
Phys.	192	Advanced Lab.	1	Phys.	270	Atom. & Nucl. Lab.	1
†Ger.		German or Approved Elective	3	†Ger.		German or Approved Elective	3
		Elective	2	Phys.	171	Proseminar	1
			18				17

*For an elucidation of this requirement see pages 120-122.

†Students planning graduate study should elect German. For others Math. 324 and Mech. 302 are suggested.

THE CURRICULUM IN INDUSTRIAL ENGINEERING

The curriculum is designed with the principal aim of industrial engineering in view, which is the design, improvement, and installation of integrated systems of men, materials, and equipment for manufacturing by the application of the principles of the mathematical, physical, and social sciences.

Throughout the program there is an integrated series or sequence in the major field which includes not only basic and fundamental courses but specialized courses as well, in the fields of production planning and control, quality control, production engineering, work simplification, wage and salary administration, and industrial relations. These specialized courses reflect the impact of recent developments in operations research, data processing, and automation.

There is a growing tendency on the part of industries to select young men from their engineering departments for managerial positions. Because of this the industrial engineering courses are oriented to the principles of scientific management to enable the industrial engineering graduate to accept and succeed in these opportunities.

It is the aim of the industrial engineering program to develop for industry a potential manager, a graduate well grounded in the fundamentals of science, trained in the principles and methods of engineering analysis and design, and adequately prepared to practice the profession of industrial engineering.

THE FIVE-YEAR COMBINED CURRICULUM IN INDUSTRIAL ENGINEERING AND BUSINESS ADMINISTRATION

Students with definite objectives in mind which require more concentration in business administration may elect to pursue a five-year program which combines the two curricula of industrial engineering and business administration. This combined curriculum will lead to the degree B.S. in Industrial Engineering at the end of the fourth year and B.S. in Business Administration at the end of the fifth year. The first four years are essentially the standard industrial engineering curriculum. For the fifth year please see page 113 under Business Administration.

THE CURRICULUM IN INDUSTRIAL ENGINEERING

FRESHMAN YEAR
See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Calculus III	3	Math.	14	Calculus IV	3
Met.	63	Engr. Mat. & Proc.	3	Mech.	11	Mech. of Materials	3
Phys.	3	Heat & Electricity	4	Mech.	13	Materials Testing Lab.	1
MS/AS	2	Mil./Air Science	2	Psych.	1	Elem. Psychology	3
Mech.	1	Statics	3	Phys.	4	Electricity, Light, & Atomic Physics	4
P.E.	3	Physical Education	—	MS/AS		Mil./Air Science	2
				P.E.	4	Physical Education	—
			18				19

SUMMER
I.E. 40 Machine Shop Practice (3)

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
I.E.	110	Engrg. Economy	3	I.E.	115	Personnel Admin.	3
I.E.	114	Plant Administration	3	I.E.	116	Plant Administration	3
Math.	233	Math. Statistics	3	Math.	234	Math. Statistics	3
M.E.	101	Machine Design I	3	M.E.	102	Machine Design II	3
Mech.	102	Dynamics	3	E.E.	160	Elec. Cir. & Appar.	3
		*General Study	3	E.E.	161	Elec. Problems	1
				E.E.	162	Dynamo Lab.	1
				I.E.	140	Mfg. Proc. Lab.	1
			18				18

SUMMER
I.E. 100 Industrial Employment

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Acctg.	104	Fund. of Acctg.	3	Acctg.	106	Fund. Cost Acctg.	3
M.E.	160	Thermodynamics	3	I.E.	350	Ind. Engrg. Problems	2
		Approved Elective	3	M.E.	161	Engineering Lab.	1
†I.E.			3	Ch.E.	160	Unit Oper. Survey	3
†I.E.			3	†I.E.			3
		*General Study	3	†I.E.			3
						*General Study	3
			18				18

*For an elucidation of this requirement see pages 120-122.

†I.E.	325	Production Control	3	†I.E.	329	Wage & Salary Admin.	3
†I.E.	326	Quality Control	3	†I.E.	330	Industrial Relations	3
†I.E.	328	Work Simplification	3	†I.E.	340	Production Eng.	3

THE FIVE-YEAR COMBINED CURRICULUM IN INDUSTRIAL ENGINEERING AND BUSINESS ADMINISTRATION

SUMMER
I.E. 40 Machine Shop Practice (3)

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
I.E.	110	Engrg. Economy	3	I.E.	115	Personnel Admin.	3
I.E.	114	Plant Administration	3	I.E.	116	Plant Administration	3
Math.	233	Math. Statistics	3	Math.	234	Math. Statistics	3
M.E.	101	Machine Design I	3	M.E.	102	Machine Design II	3
Mech.	102	Dynamics	3	E.E.	160	Elec. Cir. & Appar.	3
Eco.	333	Labor Problems	3	E.E.	161	Elec. Problems	1
				E.E.	162	Dynamo Lab.	1
				I.E.	140	Mfg. Proc. Lab.	1
			18				18

NOTE A: Those students who will major in Accounting in the fifth year will take Acctg. 104 and Acctg. 106 in the junior year in place of Eco. 333 and M.E. 102; and Eco. 333 and M.E. 102 will be taken in the senior year in place of Mkt. 111 and Fin. 125; and Acctg. 13 and Acctg. 14 will be taken in place of Acctg. 104 and Acctg. 106; and Mkt. 11 and Fin. 125 will be taken in the fifth year.

SUMMER
I.E. 100 Industrial Employment

FIRST SEMESTER				SENIOR YEAR			SECOND SEMESTER	
Acctg.	104	Fund. of Acctg.	3	Acctg.	106	Fund. Cost Acctg.	3	
M.E.	160	Thermodynamics	3	I.E.	350	Ind. Engrg. Problems..	2	
Mkt.	11	Marketing	3	M.E.	161	Engineering Lab.	1	
*I.E.			3	Fin.	125	Corporation Finance....	3	
*I.E.			3	*I.E.			3	
		English Elective	3	*I.E.			3	
						English Elective	3	
			18					18

Note B: Those students who will major in Economics, Economic Statistics, or Management in the fifth year will take E.S. 346 in the senior year in place of Fin. 125, and Fin. 125 will be taken in the fifth year.

*I.E.	325	Production Control	3	*I.E.	329	Wage & Salary Admin.	3
*I.E.	326	Quality Control	3	*I.E.	330	Industrial Relations	3
*I.E.	328	Work Simplification	3	*I.E.	340	Production Eng.	3

THE CURRICULUM IN MECHANICAL ENGINEERING

Mechanical engineering deals with the design, construction, installation, and operation of machinery necessary for the economical and advantageous use of power and with the management of industries and organizations manufacturing and using power-driven equipment. The high degree of technical skill and efficiency essential to the work of research, design, construction, and operation, which underlies mechanical engineering practice, necessarily prescribes a training based on the fundamental sciences of chemistry, physics, and mathematics.

Aptitude and skill in the interpretation and application of the basic technical sciences are, however, not sufficient. In addition the engineer must acquire an understanding of the influences of his profession on social institutions and traditions. To this end the curriculum requires the student to register for courses in the College of Arts and Science or the College of Business Administration, or both, during each of the four years.

The curriculum is broad and designed to meet the needs of young men interested in the scientific and technical aspects of industry. During the first three years emphasis is placed on the fundamental principles underlying the numerous fields of mechanical engineering. In the senior year opportunity is provided for concentration in one of three broad fields: power, design, or basic sciences underlying mechanical engineering. The young graduate ordinarily enters a graduate apprenticeship in a public utility, manufacturing, or operating organization where opportunity is provided for his development in research, design, construction, and operation, depending upon his interests and aptitudes and the opportunities available.

THE CURRICULUM IN MECHANICAL ENGINEERING

FIRST SEMESTER — FRESHMAN YEAR — SECOND SEMESTER

See page 122

FIRST SEMESTER — SOPHOMORE YEAR — SECOND SEMESTER

Course No.	*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Eco. 3	Economics	3	Eco. 4	Economics	3
Math. 13	Calculus III	3	Math. 14	Calculus IV	3
Mech. 1	Statics	3	Mech. 11	Mech. of Materials	3
	*General Study	3	Mech. 13	Materials Testing Lab.	1
Phys. 3	Heat & Electricity	4	Phys. 4	Electricity, Light, & Atomic Physics	4
MS/AS	Mil./Air Science	2	Met. 64	Engr. Mat. & Proc.	3
P.E. 3	Physical Education	—	MS/AS	Mil./Air Science	2
		18	P.E. 4	Physical Education	—
					19

SUMMER

I.E. 40 Machine Shop Practice (3)

FIRST SEMESTER — JUNIOR YEAR — SECOND SEMESTER

Math. 206	Applied Math. I	3			Business Elective	3
M.E. 104	Thermodynamics I	4	M.E. 105		Thermodynamics II	4
M.E. 101	Machine Design I	3	M.E. 102		Machine Design II	3
Mech. 102	Dynamics	3	E.E. 160		Elec. Cir. & Appar.	3
Met. 67	Met. Lab.	2	E.E. 161		Elec. Problems	1
C.E. 121	Mech. of Fluids	3	E.E. 162		Dynamo Lab.	1
C.E. 123	Fluid Mechanics Lab	1			*General Study	3
		19				18

SUMMER

I.E. 100 Summer Employment

FIRST SEMESTER — SENIOR YEAR — SECOND SEMESTER

M.E. 108	Laboratory I	2	M.E. 109		Laboratory II	2
M.E. 320	Thermodynamics III	4	M.E. 310		Projects	6
M.E. 103	Machine Design III	5			**Approved Tech. Electives	6
	**Approved Tech. Elective	3			*General Study	3
	*General Study	3				
		17				17

*For an elucidation of this requirement see pages 120-122.

**These technical electives must represent a coherent group of approved courses such as 200 or 300-level courses in Mechanical Engineering, Mechanics, Mathematics, Physics, and Chemistry, and a limited number of courses in other fields of engineering.

THE COMBINED FIVE-YEAR CURRICULUM IN MECHANICAL-ELECTRICAL ENGINEERING

This curriculum is designed to meet the needs of the power engineer engaged in the operation of large public utilities for the generation and distribution of electrical energy, as well as for those concerned with the design of electrical machines and apparatus. It is generally recognized that the engineering work of the electrical manufacturers and public utilities in the power field encounters as many mechanical as electrical problems. These two types of problems are equally important and equally interesting. In order to carry out the design of electrical machinery and power plants it is now generally necessary to employ both mechanical and electrical engineers on the same job because, with rare exceptions, one engineer is not proficient in both fields.

This combined five-year curriculum in M.E. and E.E. is intended to circumvent this deficiency in the present training of power engineers by offering a highly integrated, comprehensive, and balanced program which is devised to turn out graduates equally proficient in mechanical and electrical engineering and who in addition will have some grounding in those business courses which are deemed essential to the engineer when he eventually takes on executive and administrative responsibilities.

It is the intent of this curriculum that anyone undertaking it will make every effort to complete the five years. The B.S. (M.E.) degree will be conferred at the end of the fourth year and the B.S. (E.E.) at the end of the fifth year.

THE COMBINED FIVE-YEAR CURRICULUM IN MECHANICAL-ELECTRICAL ENGINEERING

FRESHMAN YEAR

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Math.	13	Calculus III	3	Math.	14	Calculus IV	3
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Mech.	1	Statics	3				
		*General Study	3	Met.	64	Engr. Mat. & Proc.	3
Eco.	3	Economics	3	Mech.	11	Mech. of Materials	3
MS/AS		Mil./Air Science	2	Mech.	13	Materials Testing Lab.	1
P.E.	3	Physical Education	—	Eco.	4	Economics	3
				MS/AS		Mil./Air Science	2
				P.E.	4	Physical Education	—
			18				19

SUMMER

I.E. 40 Machine Shop Practice (3)

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
M.E.	104	Thermodynamics I	4	M.E.	105	Thermodynamics II	4
E.E.	104	Circuit Analysis	5	E.E.	106	Electr. Mach.	5
Mech.	102	Dynamics	3	Mech.	302	Adv. Dynamics	3
Math.	206	Applied Math. I	3	Met.	67	Met. Lab.	2
		*General Study	3	C.E.	121	Mech. of Fluids	3
				C.E.	123	Fluid Mech. Lab.	1
			18				18

SUMMER

I.E. 100 Summer Employment

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
M.E.	101	Machine Design I	3	M.E.	102	Machine Design II	3
M.E.	108	Laboratory I	2	M.E.	109	Laboratory II	2
M.E.	320	Thermodynamics III	4	E.E.	110	Electronics	4
E.E.	108	A.C. Machines	3	E.E.	111	Proseminar	1
E.E.	109	A.C. Mach. Lab.	1	Phys.	111	Electrical Lab.	1
Phys.	110	Electrical Lab.	1	Acctg.	104	Acctg. for Engineers	3
		*General Study	3			*General Study	3
			17				17

FIFTH YEAR

FIRST SEMESTER				SECOND SEMESTER			
M.E.	103	Machine Design III	5	M.E.	342	Mech. Vibr. Anal.	3
E.E.	133	Power Systems Analysis I	4	E.E.	331	Elect. & Mag. Fields	3
				E.E.	334	Trans. Lines Trans.	3
E.E.	232	Electric Transients	3	E.E.	336	Power System Analysis II	4
Math.	315	Funct. of Comp. Var.	3				
Phys.	266	Atomic and Nuclear Physics	3	E.E.	337	Adv. Mach. Theory	3
				E.E.	338	Transients Lab.	1
			18				17

*For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN METALLURGICAL ENGINEERING

The growing importance of metals for industrial and everyday use and for national defense has increased the need for men trained in the metallurgical branch of engineering. Metallurgy includes the production of metals from ores; purifying or refining them; working and fabricating them by such processes as casting, rolling, forging, welding, etc.; development of new alloys; and enhancing the properties of metals through alloying, heat treatment, and other means.

Training for this field of engineering includes the basic studies in mathematics, chemistry, and physics required in all sound engineering education. In addition to fundamental science, it includes certain basic courses from other fields of engineering, required because of their usefulness to the metallurgical engineer as well as to give him a broad engineering background. It provides the essential courses in metallurgy to facilitate entrance of the graduate into the metallurgical industry and his initial progress therein. Finally, it gives the student an introduction to humanistic and social studies which will broaden his outlook and lead to furthering his professional development after graduation.

The curriculum is designed to fulfill the essential requirements of the industry in a four-year course, to give the necessary foundation for those who can pursue graduate work, and to constitute the basis for well-rounded engineering education at the professional level. The "general studies" provide for selected non-technical courses from the College of Arts and Science or the College of Business Administration; the "electives" permit further study in the non-technical field, or additional work in science or foreign language in preparation for research, or additional engineering or business courses in accordance with the special interests or needs of the individual. The latter may include optional preparation in research or metallurgical plant practice. The general studies and elective courses are chosen by the student subject to the approval of the curriculum director.

Metallurgical Practice Option

A Metallurgical Practice Option is offered by the Department of Metallurgical Engineering in cooperation with the Bethlehem Steel Co. In this option, a special course, Met. 325, Metallurgical Practice (6) is taken in the second semester of the senior year in place

of an equivalent number of other specified courses. In Met. 325 three days per week are spent in the Bethlehem Plant, during which investigations of a development and plant test nature are carried out. The option is limited to a small group of seniors selected by the department from those who apply.

Research Option

For those students whose interests lie in the fields of theoretical metallurgy or research and, in particular, for those students planning to pursue graduate work in metallurgy a Research Option is offered in the senior year. In this option the students are required to take Met. 318, Theoretical Physical Metallurgy (3); Met. 340, Research Techniques (2); and Met. 191, Experimental Metallurgy (3). The option is limited to a small group of selected students.

THE CURRICULUM IN METALLURGICAL ENGINEERING

FIRST SEMESTER — FRESHMAN YEAR — SECOND SEMESTER

See page 122

FIRST SEMESTER — SOPHOMORE YEAR — SECOND SEMESTER

Course No.	*Course Title*	*Cr. Hrs.*	*Course No.*	*Course Title*	*Cr. Hrs.*
Chem. 38	Analytical Chem.	5	Eco. 4	Economics	3
Eco. 3	Economics	3	Math. 14	Calculus IV	3
Math. 13	Calculus III	3	Mech. 11	Mech. of Materials	3
Mech. 1	Statics	3	Met. 1	Intro. to Met.	3
Phys. 3	Heat & Electricity	4	Phys. 4	Electricity, Light, & Atomic Physics	4
MS/AS	Mil./Air Science	2	MS/AS	Mil./Air Science	2
P.E. 3	Physical Education	—	P.E. 4	Physical Education	—
		18			18

FIRST SEMESTER — JUNIOR YEAR — SECOND SEMESTER

Met. 230	Physical Met. I	4	Met. 231	Phys. Metallurgy II	4
Met. 103	Nonferrous Metallurgy	4	Met. 102	Ferrous Metallurgy I	3
Chem. 91	Physical Chem.	3	Chem. 190	Physical Chem.	3
Ch.E. 160	Engrg. in Chem. Mfg.	3	Mech. 102	Dynamics	3
M.E. 166	Proced. of Mech. Des.	2		Elective	3
	*General Study	3		*General Study	3
		19			19

FIRST SEMESTER — SENIOR YEAR — SECOND SEMESTER

Met. 310	Met. Thermodynamics	3	Met. 278	Metallurgical Reports	3
Met. 323	Mechanical Met.	3	Met. 358	Industrial Met.	3
Met. 352	Ferrous Met. II	3	E.E. 160	Elec. Cir. & Appar.	3
	Tech. Elective	3	E.E. 161	Elec. Problems	1
	*General Study	3	E.E. 162	Dynamo Lab.	1
Met. 101	Professional Devel.	1		*General Study	3
				Tech. Elective	3
		16			17

*For an elucidation of this requirement see pages 120-122.

SENIOR YEAR RESEARCH OPTION

Met.	323	Mechanical Met.	3	Met.	358	Industrial Met.	3
Met.	310	Met. Thermodynamics	3	Met.	338	Met. Colloquium	2
Met.	352	Ferrous Met. II	3	Met.	191	Experimental Met.	3
Met.	318	Theoret. Phys. Met.	3	E.E.	160	Elec. Cir. & Appar.	3
Met.	340	Research Techniques	2	E.E.	161	Elec. Problems	1
		*General Study	3	E.E.	162	Dynamo Lab.	1
Met.	101	Professional Devel.	1			*General Study	3
			18				16

SENIOR YEAR PRACTICE SCHOOL

Met.	323	Mechanical Met.	3	Met.	358	Industrial Met.	3
Met.	310	Met. Thermodynamics	3	Met.	338	Met. Colloquium	2
Met.	352	Ferrous Met. II	3	Met.	325	Met. Practice	6
Met.	318	Theoret. Phys. Met.	3			*General Study	6
E.E.	160	Elec. Cir. & Appar.	3				
E.E.	161	Elec. Problems	1				
E.E.	162	Dynamo Lab.	1				
Met.	101	Professional Devel.	1				
			18				17

*For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN MINING ENGINEERING

Mining engineering concerns itself with the exploration, development, extraction, and the initial preparation of the minerals and rocks that are needed to meet the demands of our modern civilization. So basic is the mining industry, so dependent on it are all individuals and industries, that ours has been called a "mineral civilization." Three great classes of materials are provided by the mining engineer: mineral fuels, including coal, petroleum, and natural gas; ores of the metals; non-metallic, such as slate, limestone, sand, and gravel.

Two options are offered in the curriculum in mining engineering: (1) mining engineering, (2) engineering geophysics. The curriculum includes the basic science common to all branches of engineering — mathematics, physics, chemistry, and mechanics. The curriculum for the first two years is identical for both options. A thorough and progressive training is provided in the specialized fields of each option.

Mining Engineering Option

The option in mining engineering provides a training in the principles of mining and the methods used in extraction. Special attention is directed to the mechanization of mining operations; to mine ventilation, transportation, economics, and administration; to mineral preparation. Technical courses in civil, electrical, and mechanical engineering form a part of this advanced work. All

the operations at the mine are within the responsibility of the mining engineer. The actual work of extraction may be only one of his activities, for he may also have to deal with exploration, construction, transportation, preparation, and processing, and all phases of mine administration. Modern mining has become, in many cases, a mass-production industry. The mechanization of mines has gone forward with startling rapidity. The need for engineering training was never more important.

Engineering Geophysics Option

The option in engineering geophysics has been developed to provide a more extensive training in prospecting and exploration. In this option courses in geophysics, advanced mathematics, advanced physics, and in geology provide the training necessary for this advanced work. While many of the graduates in this option seek employment with the oil companies or geophysical contracting companies, they are equally prepared to pursue geophysics in mining or civil engineering.

THE CURRICULUM IN MINING ENGINEERING

FRESHMAN YEAR

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Eco.	3	Economics	3	C.E.	40	Princ. of Surveying	3
Geol.	1	Princ. of Geology	3	Eco.	4	Economics	3
Math.	13	Anal. Geom. & Calc. III	3	Math.	14	Anal. Geom. & Calc. IV	3
Mech.	1	Statics	3	Mech.	11	Mech. of Materials	3
MS/AS	21	Mil./Air Science	2	Mech.	13	Materials Testing Lab.	1
Phys.	3	Heat & Electricity	4	MS/AS	22	Mil./Air Science	2
P.E.	3	Physical Education	—	Phys.	4	Electricity, Light, & Atomic Physics	4
				P.E.	4	Physical Education	—
			18				19

SUMMER

Min. 3 Mine Surveying, Field Work (3)

MINING ENGINEERING OPTION

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Chem.	38	Analytical Chem.	3	C.E.	121	Mech. of Fluids	3
Geol.	23	Structural Geology	3	C.E.	123	Fluid Mech. Lab.	1
		*General Study	3	E.E.	160	Elec. Circ. & Appar.	3
Mech.	102	Dynamics	3	E.E.	161	Elec. Problems	1
M.E.	160	Heat Power	3	E.E.	162	Dynamo Lab.	1
Min.	101	Mining Fundamentals	3	Geol.	34	Mineralogy	3
						*General Study	3
				Min.	202	Methods of Mining	3
				Min.	208	Mining Lab.	1
			18				19

*For an elucidation of this requirement see pages 120-122.

SUMMER

Min. 100 Industrial Employment (–)

FIRST SEMESTER		SENIOR YEAR			SECOND SEMESTER	
Acctg.	104	Fund. of Acctg.	3	C.E. 106	Structural Design	3
		*General Study	3	Met. 61	Engrg. Metallurgy	2
Min.	203	Mine Ventilation	3	Met. 68	Met. Problems	1
Min.	205	Mining Economics	3	Min. 102	Seminar	1
Min.	207	Mineral Preparation	3	Min. 204	Materials Handling	3
		Technical Elective	3	Min. 206	Mine Administration	2
					Technical Electives	6
			18			18

ENGINEERING GEOPHYSICS OPTION

FIRST SEMESTER		JUNIOR YEAR			SECOND SEMESTER	
Chem.	91	Physical Chem.	3	C.E. 121	Mech. of Fluids	3
E.G.	201	Geophysical Methods	3	C.E. 123	Fluid Mech. Lab.	1
Geol.	23	Structural Geology	3	E.G. 202	Geophys. Applications	3
Math.	206	Applied Math. I	3	Geol. 12	Historical Geol.	3
Mech.	102	Dynamics	3	Geol. 34	Mineralogy	3
Min.	101	Mining Fundamentals	3		*General Study	3
				Min. 202	Methods of Mining	3
			18			19

SUMMER

Min. 100 Industrial Employment (–)

FIRST SEMESTER		SENIOR YEAR			SECOND SEMESTER	
E.E.	104	Circuit Analysis	5	E.E. 110	Electronics	4
E.G.	301	Seismic Prosp.	3	E.G. 302	Electrical Prosp.	3
E.G.	305	Mag. & Grav. Prosp.	3		*General Study	6
Min.	205	Mining Economics	3	Min. 102	Seminar	1
Phys.	110	Electrical Measurement	1	Min. 206	Mine Administration	2
		Technical Elective	3	Phys. 111	Electronics Lab.	1
			18			17

*For an elucidation of this requirement see pages 120-122.

THE CURRICULUM IN GENERAL SCIENCE AND MATHEMATICS

The curriculum in general science and mathematics is designed to qualify men for teaching careers in biology, chemistry, physics, and mathematics in secondary schools. In recognition of the increasing need for teachers whose teaching backgrounds are broad rather than highly specialized, the program is intentionally comprehensive. At the same time, sufficient study is required in the four major subjects to ensure adequate preparation in each.

Work in the major teaching subjects is continuous through all four years. During the freshman year the curriculum is identical with that required of all engineering students. The sophomore year includes those liberal arts courses common to other engineering curricula plus courses introductory to teaching. The junior

year provides for the study of educational fundamentals and for practical experience in nearby public high schools. Nine hours of approved electives and a three-hour general-study elective are scheduled for the junior and senior years. One or more periods of summer employment in work with adolescents is required.

Graduates in this curriculum will be qualified for teaching certificates in the public high schools of Pennsylvania, New Jersey, and other states. They will be prepared to enter graduate study in education with a view to certification for supervisory and administrative positions in the public schools. Should a student take all nine hours of approved electives in one of his four major teaching fields, he will, in most cases, need little additional preparation to qualify for graduate study in that field.

THE CURRICULUM IN GENERAL SCIENCE AND MATHEMATICS

FRESHMAN YEAR

See page 122

SOPHOMORE YEAR

FIRST SEMESTER				SECOND SEMESTER			
Course No.		*Course Title*	*Cr. Hrs.*	*Course No.*		*Course Title*	*Cr. Hrs.*
Phys.	3	Heat & Electricity	4	Phys.	4	Electricity, Light, & Atomic Physics	4
Math.	13	Calculus III	3				
Chem.	35	Analytical Chem.	4	Math.	14	Calculus IV	3
Eco.	3	Economics	3	Psych.	1	Elem. Psychology	3
Hist.	13	U.S. History	3	Eco.	4	Economics	3
MS/AS	3	Mil./Air Science	2	Educ.	1	Intro. to Education	3
P.E.	3	Physical Education	—	MS/AS	4	Mil./Air Science	2
				P.E.	4	Physical Education	—
			19				18

JUNIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Biol.	31	Zoology	3	Biol.	32	Zoology	3
Math.	51	Adv. Algebra	3	Math.	54	Higher Geometry	3
Chem.	150	Organic Chemistry	3	Speech	30	Fund. Speech	3
Educ.	20	Educ. Psychology	3	Educ.	352	Prin. H. S. Teach.	3
Educ.	353	Obs. Sec. Sch. Teach.	3	Educ.	354	Pract. Teaching	3
		Approved Elective	3			Approved Elective	3
			18				18

Eight weeks summer employment.

SENIOR YEAR

FIRST SEMESTER				SECOND SEMESTER			
Biol.	3	Comparative Anatomy	3	Biol.	6	Botany	3
Biol.	61	Bacteriology	3	Biol.	206	Nat. Hist. & Ecol.	3
Chem.	91	Phys. Chemistry	3	Phys.	269	Mod. Phys. Theories..	3
Chem.	92	Phys. Chem. Lab.	1	Educ.	350	Prin. Sec. Educ.	3
Phys.	268	Mod. Phys. Theories..	3			*General Study	3
Educ.	331	Hist. Educ. in U. S.	3			Approved Elective	3
			16				18

*For an elucidation of this requirement see pages 120-122.

The Graduate School

The Graduate School

Administrative Officers

Martin Dewey Whitaker, *President*
Harvey Alexander Neville, *Vice-President and Provost*
Earl Kenneth Smiley, *Vice-President*
Wray Hollowell Congdon, *Dean of the Graduate School*
Charles Augustus Seidle, *Director of Admission*
James Harold Wagner, *Registrar*
James Decker Mack, *Librarian*

Executive Committee of the Graduate Faculty

Dean Congdon, *Chairman,* President Whitaker and Vice-Presidents Neville and Smiley *(ex officiis),* Professors Karakash, Strauch, Bradford, Havas, and Gault.

Graduate study was a part of the original plan of the University and was announced in its first Register in 1866. More definite organization of the work along lines that are now generally accepted dates from 1883. Since that time the degrees of Master of Arts and Master of Science have been offered without interruption. The degree of Doctor of Philosophy was also announced for a time and twice conferred. In the middle nineties this degree was withdrawn; and doctoral work was not again offered until 1936, when it was once more authorized by the trustees. In the same year the Graduate School was organized with a Graduate Faculty which has full power to enact the necessary legislation governing the work of the school. In 1952 a program of studies leading to the degree of Master of Business Administration was first offered, and in 1959 programs leading to the degrees of Doctor of Education and Master of Education were approved. The faculty is composed of the administrative officers of the Graduate School, the Deans of the Colleges, and all professors, associate professors, and assistant professors who offer work for graduate credit. The rules and regulations of the faculty are administered by an Executive Committee composed of the President and Vice-Presidents of the University, the Dean of the Graduate School, and five elected members of the Graduate Faculty.

The Graduate School, in certain areas, offers to students with adequate preparation and ability opportunity for advanced study

of an intensive kind and for training in the methods of investigation and research with a view to their development as scholars, college teachers, and independent investigators in the fields of their choice. The school also aims to serve the needs of teachers and prospective teachers in elementary and secondary schools by providing opportunities for advanced professional training and by preparing them for administrative positions.

Major work leading to the master's degree may be taken in the following fields: applied mechanics, biology, business administration, chemical engineering, chemistry, civil engineering, education, electrical engineering, English, geology, history and government, industrial engineering, international relations, mathematics, mechanical engineering, metallurgical engineering, mining engineering, physics, political science, and psychology. In the fields of Greek, Latin, German, French, philosophy, sociology, and Spanish, major work is not offered; but students majoring in other fields may take collateral work in these fields from the list of courses acceptable for graduate credit ("200" courses).

Work leading to the doctor's degree is offered in the following fields: biology, chemical engineering, chemistry, civil engineering, education, electrical engineering, English, geology, history, mathematics, mechanical engineering, metallurgical engineering, physics, and psychology.

Prospective students who are interested in taking graduate work in particular fields are advised to get in touch with the heads of the departments concerned before attempting to register. Such consultation will be to their benefit, in that they will get a definite understanding as to the adequacy of their preparation, as well as of the facilities the University has to offer for the work which they desire.

Admission to Graduate Standing

A student who has taken the bachelor's degree or a degree in technology at a recognized college, university, or technical institution is eligible for consideration for admission to the Graduate School. Actual admission is subject to enrollment limitations in each department and is therefore competitive. Each candidate must file at the Office of Admission, on a form provided for the purpose, a statement of his collegiate experience and of his graduate objectives, and an official transcript of his academic record. The

submission of Graduate Record Examination scores by a student applying for admission is urged and sometimes required. (For information about this examination, write to the Educational Testing Service, 20 Nassau St., Princeton, New Jersey.) If a student is applying for admission to graduate work in the Department of Education, scores may be submitted for the Graduate Record Examination. Candidates for the master's degree in business administration take the Admission Test for Graduate Study in Business.

Admission to graduate standing permits the student to take any course for which he has the necessary qualifications. It does not imply admission to candidacy for a degree. Admission to candidacy for an advanced degree is granted in accordance with the provisions set forth below under "Degrees."

Women are admitted as graduate students on the same terms as men. Except during a summer session, however, they are not ordinarily permitted to attend, either as registered students or as listeners, courses intended only for undergraduates.

A graduate student who is absent from the University for a semester or more must obtain the written approval of the head of his major department in order to be readmitted to graduate standing. If the student has not established a major, he must obtain the approval of the Dean of the Graduate School.

Students of Lehigh University who are within a few hours of meeting the requirements for the bachelor's degree may, if given permission by the Graduate Faculty, enroll for a limited amount of work for graduate credit.

Registration

Several days are set aside for graduate registration just prior to the beginning of the semester as indicated in the calendar. However, a student can complete advance registration anytime in January, June, or September, as the case may be, by obtaining a registration ticket in the office of the Registrar and arranging an interview with his advisor. Anyone who can register in advance is urged to do so. Normally students are expected to complete their registration before the close of the third day of instruction. Registration after the tenth day of instruction in a regular semester or the fifth day in a summer session is permitted only when the express consent of the Dean of the Graduate School has been obtained.

It should be noted that graduate work itself starts promptly at the beginning of the term, and it is frequently true that graduate courses can be given only if there is a certain minimum demand for them. Delay in enrolling for a given course may therefore cause the course to be withdrawn.

A graduate student in residence must register each semester. A graduate student who is a degree candidate in absentia must register for that semester in which he expects to complete the degree requirements.

Tuition and Fees

The tuition in the Graduate School is $400 per semester or $35 per semester hour, whichever amount is lower. The maximum full-time roster of graduate courses is fifteen semester hours.

A listener's fee of $35 is charged for each course audited. (See miscellaneous regulations on page 165.)

Where the major department requires a master's thesis, the student registers for the thesis and pays at the rate of the regular semester hour charge, the minimum fee being $50.

Graduate students in residence must register and pay a minimum tuition or dissertation fee of $50 per semester.

For a doctoral dissertation prepared in absentia a reading fee of $50 is charged to those graduate students who have not paid a dissertation fee of at least $50 while in residence.

Identification cards, entitling the holder to attend various campus events, are issued to graduate students at a fee of $10 for the full academic year, and $5 for the period from January to June.

Refunds

A graduate student who formally withdraws from the University or who, on the advice of his department head and with the approval of the dean, finds it neccesary to reduce his roster below twelve hours, may qualify for a tuition refund. The amount of refund will be equal to the tuition paid for the course being dropped, less a service charge of $5 for each semester hour dropped and less ten per cent of the tuition charge for each full or fractional week of the semester, the time being counted from the first meeting of the course dropped. During summer sessions, the ten per cent charge per week is increased to twenty per cent.

Health and Accident Insurance

The University offers graduate students a choice between two types of insurance policies covering accident or illness. One type covers both accident and illness, and the other covers accident only. Either type is available at nominal cost.

The Health Service of the University recommends these policies highly to present and prospective students. All foreign students and others who, in the opinion of the administrative officers of the University, may not be in a position to meet the costs of sickness or injury are usually required to carry both health and accident insurance.

Filing of Application for Degrees

Candidates for degrees to be conferred in June file with the Registrar, on a form provided for the purpose, on or before April 15, a written notice of their candidacy; candidates for degrees to be conferred in October file a similar notice on or before September 10. Failure to file such notice by the dates mentioned bars the candidate from receiving the degree at the ensuing graduation exercises.

DEGREES

In addition to the general regulations set forth below, more detailed instruction for procedures may be obtained from the Office of the Graduate School.

Students desiring to qualify for graduate degrees in the minimum time should have pursued an undergraduate major in the subject equivalent to that offered at Lehigh. At the discretion of the head of the department, a limited number of credits in closely allied subjects may be accepted in lieu of courses in the undergraduate major. Those with undergraduate deficiencies who are admitted because otherwise well qualified will be expected to make up such deficiencies in addition to satisfying the minimum requirement for the degree sought.

In addition to the degree requirements set forth below, there may be departmental requirements in the field of the major. These requirements appear in the separate departmental statements before the lists of course offerings.

Master of Arts, Master of Education, Master of Science, and Master of Business Administration

The master's degree is granted to properly qualified students who complete satisfactorily at least two full semesters of advanced work. In meeting the requirements for the degree, the student must comply with the following regulations:

1. Each candidate for the master's degree must submit for the approval of the Graduate Faculty the program of courses he proposes to take to satisfy the requirements. This program must have the approval of the head of the student's major department, and all courses included which are not offered by the student's major department must also be approved by the heads of the departments concerned. Approval of the program by the Graduate Faculty signifies that the student has formally been admitted to candidacy for the degree.

2. The *minimum* program for the master's degree must include:
   a. Not less than thirty semester hours of graduate work.
   b. Not less than twenty-four hours of "300" and "400" level course work of which at least eighteen hours shall be from the "400" group (see page 169 for classification of courses).
   c. Not less than eighteen hours in the major field.
   d. Not less than fifteen hours of "400" courses in the major field.

3. The eighteen hours required in the major field are ordinarily taken in one department. Specific exceptions to this rule are mentioned in the departmental statements at the head of course listings. The remaining twelve hours of a *minimum* program, or any part of them, may also be taken in the major department; or they may be taken in any other field in which courses for graduate credit are offered, as the needs or interests of the student may indicate, subject to the approval of the head of the major department. In all cases the work for the master's degree must be taken under at least two instructors.

4. Graduate students registered in "200" and "300" courses may be assigned additional work at the discretion of the instructor.

5. A thesis may be required by the major department. If required, the thesis shall not count for more than six semester hours.

The credit to be allowed shall be fixed by the head of the major department. Two bound typewritten copies of the thesis (one of which shall be an original copy), approved by the faculty members under whom the work was done and by the head of the major department, shall be placed in the hands of the Dean of the Graduate School at least two weeks before the day on which the degree is to be conferred. Information as to the form in which the thesis must be presented may be obtained from the Office of the Graduate School.

6. The master's degree is not granted unless the candidate has earned the grades A or B in at least eighteen hours of the work on his program and in all "300" courses in his major field. No course in which the grade earned is less than C is credited toward the degree.

7. All work which is to be credited toward a master's degree must be done in actual and regular attendance at Lehigh University.

8. All work on a program for the master's degree must be completed within a six-year period.

When all requirements have been met, the candidate is recommended by the faculty to the trustees for the master's degree appropriate to the work pursued.

Doctor of Philosophy

The degree of Doctor of Philosophy is conferred on candidates who have demonstrated general proficiency and high attainment in a special field of knowledge and capacity to carry on independent investigation in that field as evidenced by the presentation of an acceptable dissertation embodying the results of original research. The requirements for the degree are more specifically set forth in the following regulations:

1. Time Requirements. A candidate ordinarily is expected to devote three or more academic years to resident graduate study. In no case is the degree awarded to one who has spent less than two full academic years in resident graduate work. Study for any specified period of time, however, is not in itself regarded as sufficient ground for the award of the degree.

Graduate work done in residence at other institutions will be accepted in partial fulfillment of the time requirements, provided

such work is approved by the Graduate Faculty and by the departments concerned.

Work of fragmentary character scattered over a long period of years, or work completed many years before the student becomes a candidate for the degree is subject to special review by the Graduate Faculty. The extent to which such work may be credited towards the fulfillment of the time requirements will be decided by the faculty. All work on a program for the Ph.D. degree must be completed within a ten-year period.

2. Residence Requirements. A candidate for the degree must complete at least one full academic year of resident graduate study at Lehigh University.

3. Admission to Candidacy. Candidates for the doctorate are accepted in a limited number of departments only, and a department may limit the number of candidates accepted in any year. In exceptional cases, new students may be admitted to candidacy immediately upon registration in the Graduate School. Ordinarily, however, they are required to spend at least one semester in residence before they are accepted as candidates. Admission to candidacy is at the discretion of the Graduate Faculty and is granted only upon written application by the student. The applicant must have the endorsement of the departments concerned. The proposed major department may require a qualifying examination. In passing upon a student's application, the faculty will take into consideration the applicant's general education, as well as his special qualifications for work in his chosen field. Each applicant is notified by the Dean of the Graduate School, in writing, of the action of the faculty upon his application.

The application of a foreign student must be accompanied by a statement from the department in which he intends to specialize, certifying that he has a satisfactory command of English.

At the time of admission to candidacy a special committee is appointed by the Executive Committee of the Graduate Faculty to direct the work of the candidate.

4. Plan of Work. Preparation for the degree is based on the study of a major subject, to which one or two minors may be added. The program of work, to be formulated by the candidate, his special committee, and the head of his major department,

should be planned to lead to a general mastery of the major field and to a significant grasp of any minor that may be added. The program must be approved by the Executive Committee of the Graduate Faculty.

While there is no definite requirement as to the number of courses to be taken, two years devoted to formal courses is the customary minimum. In no instance, however, is the degree awarded merely for the faithful completion of any program of courses.

5. Language Requirements. The candidate must give evidence, through examinations, of a reading knowledge, sufficient for the purposes of his special studies, of at least two foreign languages (in addition to any language which may constitute his major subject). In each case the required languages are designated by the candidate's major department and approved by the Graduate Faculty. The language requirements must be satisfied before the student presents himself for the general examination, described below.

Language examinations are in charge of a committee consisting of representatives of the language department concerned and of the candidate's major department.

Permission to take the language examinations does not imply admission to candidacy for the degree.

6. General Examination. The general examination for the doctorate is designed to test both the student's capacity and his proficiency in his field of study. The examination is not necessarily confined to the content of courses that have been taken at Lehigh University or elsewhere. It is held ordinarily not earlier than toward the close of the second year of work, not later than seven months prior to the time when the candidate plans to receive the degree. The student's special committee is in charge of the examination, which may be both written and oral.

The Dean of the Graduate School should be notified in advance when the general examination has been scheduled by the candidate's department head. No student is permitted to take this examination who has not been admitted to candidacy for the doctorate or who has not satisfied the language requirements.

Should a candidate fail in the general examination, he may be permitted by the Graduate Faculty to present himself for a second

examination not earlier than five months after the first. If the results of the second trial are also unsatisfactory, no further examination is set.

7. Dissertation. The candidate is required to present a dissertation prepared under the general direction of a professor at Lehigh University. The dissertation shall treat a topic related to the candidate's major subject, embody the results of original research, give evidence of high scholarship, and constitute a contribution to knowledge. It must be approved by the professor under whose direction it was written, by the candidate's special committee, and by the Graduate Faculty. A copy bearing the written approval of the professor in charge must be presented to the Dean of the Graduate School for transmission to the student's special committee not later than May 1, if the degree is to be conferred in June; not later than September 1, if the degree is to be conferred in October.

The candidate shall deposit with the Dean of the Graduate School at least one week before the degree is to be conferred: (1) the original typescript of the accepted dissertation, unbound, in standard form, and suitable for microfilming; (2) the first carbon copy of the accepted dissertation in standard form and binding; (3) two copies of an abstract, not exceeding 600 words, of the dissertation with letter of approval for publication from the supervisor of the dissertation; (4) a receipt from the Bursar for the payment of the publication fee of twenty-five dollars ($25). The publication fee is used by the University to defray the cost of publishing the dissertation on microfilm (through University Microfilms) and the abstract in *Dissertation Abstracts*. If the candidate wishes to copyright his dissertation, he may do so by paying the copyright fee of ten dollars ($10) to the Bursar at the time the publication fee is paid. Arrangements for copyright in the author's name will then be made by the University through University Microfilms.

8. Final Examination. After the dissertation has been accepted by his special committee, the candidate will be examined orally by the officers of professorial rank in the departments concerned and such other persons as may be selected by the candidate's special committee.

9. Conferring of Degree in Absentia. The degree of Doctor of Philosophy will not be conferred in absentia unless the candidate is excused by the President of the University.

Doctor of Education

The degree of Doctor of Education is intended for a limited number of carefully selected students engaged in the fields of administration, counseling, and teaching. At least four years of successful professional experience are required for admission to candidacy for this degree. The plan for the Ed.D. degree includes a sixth-year program with a certificate given for its successful completion, and the final work for the doctorate which will emphasize the application of knowledge to an educational problem.

In general, the requirements for the Ed.D. degree will parallel those already stated for the Ph.D. degree with modifications appropriate to the specific objectives of the candidates. For further information consult the Head of the Department of Education.

Postdoctoral Work

Students who have completed the requirements for the doctorate may enroll for postdoctoral individualized study under the guidance of selected members of the faculty. Such a program of study contemplates a broad educational and research deveolpment at advanced and matured levels and provides opportunities to prepare for specific positions. A formal certification of such work as may be accomplished by the student will be made.

Miscellaneous Regulations

The maximum roster of a full-time graduate student is fifteen semester hours. Graduate students who are employed and can give only part of their time to graduate work should restrict the size of their rosters accordingly.

Graduate students who hold University appointments of any kind are permitted to enroll for only a limited amount of graduate work. Full-time employees of the University may not take more than six semester hours of graduate work in any one semester; half-time employees may not take more than ten semester hours.

With the consent of the head of his major department and of

the head of the department concerned, a graduate student may be admitted as a regular listener in one or more courses, which course or courses shall be outside his approved program of studies for the degree, provided that the total number of hours in which he is registered and in which he is a listener shall not exceed the limits set forth above. In no case shall a student who has attended a course as a listener be given an examination for credit in that course. A listener's fee is charged for each course audited.

Evening Classes and Summer Session

For the benefit of graduate students who by reason of employment in the fields of teaching or industry cannot attend classes during the day, a certain number of courses are generally offered in the evening and on Saturday morning. It cannot be announced in advance which courses these will be, but a student who is interested may receive the necessary information by communicating, before the beginning of each semester, with the head of the department in the field in which he is interested. During the 1959-1960 academic year, evening and Saturday classes were held in accounting, business law, chemical engineering, civil engineering, economics, economic statistics, education, English, finance, government, history, industrial engineering, international relations, marketing, mechanical engineering, and psychology. It is expected that in the future such courses will be offered in additional subjects as the demand warrants.

The University offers each summer a limited number of courses which may be taken for graduate credit. The courses offered vary from year to year. Information as to the offerings for any particular year may be obtained by writing to the Director of the Summer Session for the *Summer Session Announcement.*

Description of Courses

Description of Courses

Following is a list of undergraduate and graduate courses offered by Lehigh University. For purposes of record, all approved courses are listed. It must be understood, however, that the offerings in any given semester are contingent upon a number of factors, including student needs as determined at the time of preregistration.

Credit Hours

The number in parentheses following each course title indicates the credit value of the course in terms of semester hours. Three hours of drawing, of work in the laboratory, or of practice in the field are regarded as the equivalent of a recitation or lecture of one hour's duration.

Course Numbering

Courses are numbered according to the following system:

0-99	Undergraduate courses, primarily for underclassmen. Not available for graduate credit.
100-199	Advanced undergraduate courses. Not open to freshmen and sophomores except on petition. Not available for graduate credit.
200-299	Courses open to advanced undergraduates and graduates. Not available for graduate credit in the major field.
300-399	Courses open to advanced undergraduates and graduates. Available for graduate credit in the major field.
400-499	Courses open to graduate students only.

Prerequisites

Academic preparation required for admission to courses is indicated under "Prerequisites" following course descriptions stated in most cases for purposes of convenience in terms of Lehigh courses. Status required for admission, where numbering does not fully describe this status, is also indicated under "Prerequisites."

A student who does not have the status or the academic preparation set forth as prerequisites must, in order to be admitted to a course, file with the Registrar at the time of registration and on a standard form provided by the Registrar a waiver of prerequisites signed by the instructor teaching or in charge of the course, the

head of the teaching department, and the student's curriculum director. Academic work completed elsewhere must be attested in this manner as being substantially equivalent to prerequisites listed, unless the student's records in the Office of the Registrar show that the proper officers have so evaluated this preparation previously.

ACCOUNTING

Professors Allen, Trumbull
Associate Professors Koch, Kubelius, Moore
Assistant Professor Brady
Messrs. Noll, Harding, Miller, Muhr

ACCOUNTING

Acctg. 1. Accounting (3)

The elementary principles of accounting with problem work to develop a knowledge of accounting method and practice. Financial statements and their preparation, analysis and recording of transactions, journalizing and posting, use of special ledgers and journals, adjusting and closing accounts. First and second semesters.

Acctg. 2. Accounting (3)

Elementary accounting problems peculiar to proprietorships, partnerships, and corporations; manufacturing enterprises; depreciation; and a more detailed consideration of financial statements than is possible in Acctg. 1. *Prerequisite: Acctg. 1.* First and second semesters.

Acctg. 13. Intermediate Accounting (3)

Problems of the balance sheet, its form and content. The nature of assets, liabilities, and capital stock. Criteria of income and the matching of income and expense. Statement analysis. *Prerequisite: Acctg. 2.* First semester.

Acctg. 14. Intermediate Accounting (3)

A continuation of Acctg. 13. *Prerequisite: Acctg. 13.* Second semester.

Acctg. 104. Fundamentals of Accounting (3)

An intensive course in the principles and practices of accounting, covering the fundamentals in one semester. Especially designed for engineering and other non-business students. First and second semesters.

Acctg. 105. Financial Statements and Reports (3)

The use of financial statements and reports by high level management, investors, creditors, and others. Factors essential to the interpretation and evaluation of reported earnings, financial position, capital structure, etc. *Prerequisite: Acctg. 2 or 104.* First and second semesters.

Acctg. 106. Fundamentals of Cost Accounting (3)

A one semester course in cost finding and cost analysis. Emphasis upon costing methods and the use of cost data for purpose of cost control. Designed especially for engineering students and other students not specializing in accounting. *Prerequisite: Acctg. 2 or 104.* Second semester.

Acctg. 115. Cost Accounting (3)

The principles and methods used to determine unit costs of product or services. Material, labor, and overhead costs, methods of distributing overhead, and the application of cost principles to job order and process production. *Prerequisite: Acctg. 2 or 104.* First semester.

For Advanced Undergraduates and Graduates

Acctg. 203. Federal Tax Accounting (3)

The most recent revenue acts; procedures in using the law and regulations to determine the amount of the tax liability for individuals, partnerships, trusts, and corporations. *Prerequisite: Acctg. 2 or 104.* First semester. Mr. Koch

Acctg. 204. Federal Tax Accounting (3)

A continuation of Acctg. 203. *Prerequisite: Acctg. 203.* Second semester. Mr. Koch

Acctg. 218. Advanced Cost Accounting (3)

Special cost problems such as standard cost, distribution costs, joint costs, the managerial use of cost data, control of cost, and design of cost accounting systems. *Prerequisite: Acctg. 115 or Acctg. 106.* Second semester. Mr. Koch

Acctg. 219. Specialized Accounting Systems (3)

Charts of accounts, methods of internal control, and application of accounting principles to business enterprises in various industries. *Prerequisite: Acctg. 13, and Acctg. 115 concurrently.* First semester.

Acctg. 304. Governmental and Institutional Accounting (3)

Application of accounting principles and procedures to problems of budgets, appropriations, and funds in governmental units, educational institutions and hospitals. *Prerequisite: Acctg. 14.* Second semester.

Acctg. 315. Advanced Accounting (3)

Problems of partnerships, branches and agencies, consignments and installment sales, consolidations and mergers. Accounting for estates, trusts, and insolvent concerns. Second semester. *Prerequisite: Acctg. 14.* Messrs. Moore, Trumbull

Acctg. 320. Auditing (3)

The different types of audits and special investigations. Problems involving audit principles and procedure; methods of detecting and preventing fraud; the writing of audit reports; the ethics and the legal responsibilities of accountants. *Prerequisite: Acctg. 14.* First semester. Messrs. Brady, Moore

Acctg. 371. Readings in Accounting (3)

An unrostered course designed for students having special interest in some phase of accounting not covered by the rostered courses. The study may be in the history of accounting, accounting theory, municipal or public utility accounts, or any special subject approved by the instructor. *Prerequisite: Consent of the head of the department.* First and second semesters. Messrs. Allen, Koch, Moore, Trumbull

LAW

Law 1. Business Law (3)

The law of contracts and bankruptcy, agency bailments and sales. First and second semesters. Messrs. Barrett, Kubelius

Law 102. Business Law (3)

The law of negotiable instruments, partnership, corporations, real property, insurance, and security devices. *Prerequisite: Law 1.* Second semester. Messrs. Barrett, Kubelius

Law 103. Business Law for Engineers (3)

The law of contracts, agency, partnerships, corporations, and property rights with special emphasis upon the legal problems of the engineering profession. First semester. Mr. Kubelius

Law 204. Wills, Estates, and Trusts (3)

A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. Second semester. *Prerequisite: Law 1 or Law 103.* Mr. Kubelius

For Graduate Program See Business Administration

ASTRONOMY

See Mathematics and Astronomy

ATHLETICS

See Division of Athletics and Physical Education

BIOLOGY

Professors Parker, Trembley
Associate Professors Owen, Benz
Assistant Professors Barber, Freeberg, Malsberger

No student may take for credit more than one of the following courses: Biol. 1. Biology (3), Biol. 13. Human Biology (3).

Biol. 1. Elementary Biology (3)

A general survey of biological types and principles for students who do not intend to major in biology. Two lectures and one laboratory period per week. First semester.

Biol. 2. Elementary Biology (3)

A continuation of Biol. 1. *Prerequisite: Biol. 1.* Second semester.

Biol. 11. General Biology (4)

A foundation course for majors in biology. A comprehensive survey of biological types and principles. Three lectures and one laboratory period per week. *Prerequisite: Chem. 4, previously or concurrently.* First semester.

Biol. 12. General Biology (4)

A continuation of Biol. 11. *Prerequisite: Biol. 11.* Second semester.

Biol. 13. Human Biology (3)

A lecture course in biological principles as illustrated by man. Man in relation to his environment, the organ systems of man, population biology, parasitism, elements of human inheritance, and human evolution. *Prerequisite: Chem. 4.* First and second semesters.

Biol. 14. Comparative Vertebrate Anatomy (3)

A course in vertebrate zoology with emphasis on the study of homologous body structures in the various vertebrate classes and their relationship to the functional demands of habit and environment in each class. Detailed dissections of representative vertebrates are made in the laboratory. One lecture and two laboratory periods each week. *Prerequisite: Biol. 12 or equivalent.* Second semester.

Biol. 18. Genetics (2)

A study of the basic laws governing inheritance in plants and animals, chromosome behaviour, nature of genes. The relation of environmental modifications, hybrid variation, and mutations to the mechanics of evolution. *Prerequisite: One semester of biology.* First semester.

Biol. 35. Microbiology (3)

A basic course for students majoring in biology. A study of the physiology, biochemistry, and morphology, including staining methods, of representative heterotrophic microorganisms. Recitations, lectures, and laboratory work. *Prerequisite: A laboratory course in biology.* Second semester.

For Advanced Undergraduates and Graduates

Biol. 221. Undergraduate Research (3)

Laboratory work, field work, or both depending upon the interest and competence of the student. *Prerequisites: Senior standing and consent of the head of the department.* First semester. Staff

Biol. 306. Ecology (3)

The basic principles of ecological relationships: training in the use of analytical keys and reference collections for the identification of plants and animals. Field trips for the study of interrelationships of living organisms. Two lectures and one laboratory period or field trip per week. *Prerequisite: Consent of the head of the department.* Second semester.

Mr. Trembley

Biol. 313. General Histology (3)

The techniques of preservation and preparation of animal and plant tissues for microscopical study; comparative studies of fresh and preserved tissues. One lecture and two laboratory periods per week. *Prerequisite: Biol. 12 or equivalent.* First semester. Mr. Owen

Biol. 314. Vertebrate Embryology (3)

A study of reproduction from germ cell formation through establishment of the principal organ systems of the vertebrate body. Various mechanical and physiological problems confronting the growing embryo are considered, and direct observation of whole mounts, sections, and living material are made in the laboratory. Two lectures and one laboratory period each week. *Prerequisite: Biol. 14 or equivalent.* Second semester. Mr. Owen

Biol. 320. Physiology (3)

Lectures and laboratory work covering the principles underlying the operation of life processes. The subject matter is not limited to any one group of organisms, but is derived from living things in general. Two lectures and one laboratory period per week. *Prerequisite: Consent of instructor.* Second semester. Mr. Barber

Biol. 322. Advanced Botany (3)

A general survey of the morphology, anatomy, and phylogeny of the vascular plants. Two lectures and one laboratory period per week. *Prerequisite: A laboratory course in biology.* Second semester. Mr. Freeberg

Biol. 353. Virology (3)

A lecture course on Rickettsiales, Virales, and bacterial viruses including taxonomy, physical and chemical properties, immunological characteristics, and evolution. *Prerequisite: A course in microbiology or bacteriology.* First semester. Mr. Malsberger

Biol. 356. Industrial Microbiology (3)

An advanced course in the commercial utilization of microorganisms in industrial processes such as the production of organic solvents and organic acids. Two lectures and one laboratory period per week. *Prerequisites: One semester each of microbiology and analytical chemistry.* First semester.

Mr. Parker

Biol. 361. Sanitary Microbiology (3)

Laboratory, field work, and reports on the microbiology of water supplies, waste disposal, and food processing. *Prerequisites: One semester each of microbiology and analytical chemistry.* First or second semester.

Messrs. Parker, Malsberger

For Graduates

The prerequisite for graduate work in biology is preliminary work substantially equivalent to the amount of biology usually taken by an undergraduate majoring in the field. Students who desire to do graduate work in microbiology must offer as a prerequisite satisfactory undergraduate preparation and sufficient preparation in analytical chemistry and organic chemistry. Ability to undertake graduate work must be demonstrated by previous scholastic record, an examination, or both. Many of the following graduate courses are given irregularly upon demand. Consultation with the instructor is advised to assure suitable preparation.

Biol. 404. Advanced General Physiology (3)
A seminar on the recent advances in general physiology; including an introduction to current literature on selected topics as contractility, permeability, and excitation. Laboratory experiments in metabolism and electrophysiology. *Prerequisite: Biol. 320 or equivalent.* First semester.
Mr. Barber

Biol. 405. Special Topics in Biology (1-3)
Research, conferences, and reports on selected topics not covered in the general graduate offerings. Staff

Biol. 406. Biological Seminar (1)
An advanced seminar in current developments including departmental research. Required for all candidates for graduate degrees in the department. Second semester. Staff

Biol. 407. Biological Research (3)
Investigations in any phase of the biological sciences according to the student's preparation and interests. First semester. Staff

Biol. 408. Biological Research (3)
Continuation of Biol. 407. Second semester. Staff

Biol. 409. Advanced Morphology (3)
A laboratory course in special phases of morphology, such as comparative osteology, comparative morphology or embryology of the vertebrates, etc., to meet the individual interest of the student. Mr. Owen

Biol. 410. Topics in Modern Biology (3)
A seminar in genetics, evolution, and current developments in biological sciences. Required of all candidates for advanced degrees in the department. First semester. Staff

Biol. 411. General Cytology (3)
Conferences, assigned readings, and laboratory work on the structural features of the cell in relation to cellular functions and on modern methods

of preparing living and fixed tissues for cytological study. Included are special studies of the general cytology and nuclear problems of microorganisms. *Prerequisite: Biol. 313 or its equivalent.* Mr. Owen

Biol. 412. Field Zoology (3)

Methods of biological survey work; animal censuses; collection, preparation, and care of zoological specimens; use of keys; study of the interrelationships existing between the groups of local animals, especially the vertebrates, and of their habitat preferences. Lectures, laboratory work, and field trips. Mr. Trembley

Biol. 413. Problems in Field Zoology (3)

Concentrated work in the life history study of one or more local species. To be taken concurrently with or following Biol. 412 depending upon the previous experience and interest of each student. Mr. Trembley

Biol. 414. Advanced Ecology (3)

Conferences and field work with emphasis on such areas as aquatic ecology, limnology, and fisheries biology. Whenever possible this will include participation in research problems conducted by the Water Resources Council of the Lehigh Institute of Research. *Prerequisite: Consent of the instructor.* First and second semesters. Mr. Trembley

Biol. 420. Physiology and Biochemistry of Microorganisms (3)

Fundamentals of microbial physiology such as growth, enzymes, nutrition, respiration, and metabolism. The effects of chemical and physical environments. Selected topics applicable to the bacteria, yeasts, molds, and protozoa. Lectures and laboratory work together with research problems consistent with current interests. *Prerequisite: Chem. 371 or consent of the instructor.* First semester. Mr. Barber

Biol. 424. Plant Anatomy and Morphogenesis (3)

A study of plant cells and tissues with particular emphasis on experimental approaches to plant morphogenesis. *Prerequisite: Consent of the instructor.* Second semester. Mr. Freeberg

Biol. 430. Antibiotic Substances (3)

Fundamentals of the interrelationships among microbial populations; preparation and evaluation of penicillins, streptomycins, and tetracycline antibiotics. Two lectures and one laboratory period per week. Second semester. Mr. Parker

Biol. 432. Laboratory Methods in Virology (3)

Basic methods used in the isolation, identification, and handling of viruses. Practical exercises in the preservation of viruses, chick embryo techniques, tissue culture, staining methods, immunological techniques, and microscopy are included. *Prerequisite: Biol. 353.* Second semester. Mr. Benz

Biol. 462. Microbiology (3)

A detailed consideration of algae, fungi, protozoa, and microorganisms other than the Eubacteriales of concern to the microbiologist or sanitarian. Two lectures and one laboratory period or field trip per week. First semester. Mr. Parker

BUSINESS ADMINISTRATION

A candidate who is a graduate, with a major in business administration of an approved college, and who has had basic courses in accounting, business cycles, business law, corporation finance, economics, labor problems, marketing, money and banking, and statistics, will usually have sufficient background work to enable him to complete the requirements for the M.B.A. degree in one year. For other candidates an additional semester or year devoted to prerequisites and basic courses may be necessary as indicated by the program outlined on page 179.

Law 401. Legal Problems in Business (3)

A course designed to deal with specific legal problems involved in making business decisions. Emphasis is placed on preventive law and the tax consequences of business transactions. *Prerequisite: Consent of the instructor.* First semester. Mr. Kubelius

Fin. 421. Financial Management (3)

A case study of financial management problems of business. Attention is given to the control of current funds, working capital operations, and estimating the need for funds; the problem of long-term capital funds and expansion, and the choice between risk and profitability in the capital structure are also considered. *Prerequisite: Preparation of finance acceptable to the instructor.* First and second semesters. Mr. Schwartz

Acctg. 422. Managerial Accounting (3)

Managerial uses of accounting data stressing the importance of proper interpretation, the features of control, and the planning possibilities. Statement analysis, price level adjustments, budgets, cost controls, direct costing, profit planning, and capital equipment replacement will be emphasized. *Prerequisite: Preparation in accounting acceptable to the instructor.* First and second semesters. Mr. Moore

Eco. 431. Managerial Economics (3)

Problems of business enterprise: Price and output determination an alysis of cost and demand functions in markets of various types and under various conditions of general business. Emphasis will be on the application of economic theory to business practice. *Prerequisite: Consent of the instructor.* First and second semesters. Mr. Urban

Eco. 433. Labor Management Economics (3)

A study of modern industrial relations: including problems of the labor force, hiring policies, the social aspects of modern industry, collective bargaining practices and policies of management and labor organizations, structure, policy and tactics of contemporary unions, problems and policies of United States labor legislation. *Prerequisite: Consent of the instructor.* First and second semesters. Mr. Diamond

Fin. 441. Foreign Trade Management (3)

Current problems of foreign operations: including channels of export in foreign markets, management of exports at home and abroad, export and import financing, foreign investments, policies of government and international agencies as they affect foreign operations. Second semester. Mr. Jensen

Fin. 442. The Money Market (3)

A study of the markets for short-term funds in the United States with particular emphasis on the New York markets for bank acceptances, commercial paper, loans to brokers, and U. S. government obligations. The relation of Federal Reserve policy to interest rates and the supply of funds will also receive detailed attention. First and second semesters. Mr. Bradford

Mkt. 450. Marketing Management (3)

A study of the factors affecting consumer demand and methods of satisfying it; the structure of the market; marketing methods and problems of various agencies; competitive practices; the management of the selling activities of a business, distribution policies, pricing, and the planning of marketing operation. Second semester.

Messrs. Snider, Walters

E.S. 454. Forecasting (3)

The problem of predicting cyclical changes and long-term prospects for growth is of vital importance in most lines of business today. It is desirable that business men in managerial positions have some knowledge of the basic methods used in arriving at such predictions. This course provides a study of the methods of business forecasting with special attention to secular and cyclical forecasting. *Prerequisite: E.S. 346 or equivalent.* Second semester. Mr. Bratt

Eco. 490. Thesis in Business Administration (6)

Subjects for theses may be in the fields of accounting, economics, economic statistics, finance, or marketing. First and second semester. Staff

Of the above courses, all except Law 401, Fin. 441, Fin. 442, and Eco. 490 will normally be required as core courses of all candidates for the M.B.A. degree. In addition, Eco. 306 and E.S. 346 (see pages 203 and 204 for description of these courses) will be required of candidates who have not had equivalent courses in their undergraduate curricula. The remaining twelve hours

(six hours for those candidates who have to take Eco. 306 and E.S. 346) may be elected from a group of courses including Law 401, Fin. 441, Fin. 442, and any appropriate 300-level courses described elsewhere in this catalog under the heads of Accounting, Economics, and Finance, with the approval of the director.

Thesis in Business Administration (six credit hours) is not required, but may be elected by a candidate with the approval of the Graduate Committee. If the thesis is selected, and approved, it will be substituted for six hours of elective courses in consultation with the director of the graduate program. A comprehensive examination will be required of all candidates for the M.B.A. degree.

Program for Graduate Students in Business Administration Who Lack Background Work in Economics and Business

FIRST YEAR

Eco.	3	Principles of Economics	(3)
Fin.	125	Principles of Corporation Finance	(3)
Law	1	Business Law	(3)
Acctg.	104	Fundamentals of Accounting	(3)
E.S.	45	Statistical Method	(3)
Fin.	123	Financial Institutions	(3)
Mkt.	11	Marketing	(3)
E.S.	346	Business Cycles	(3)
Acctg.	106	Fundamentals of Cost Accounting	(3)
Eco.	306	Intermediate Economics	(3)
		or	
Fin.	326	Problems in Financial Management	(3)

SECOND YEAR

Required Courses (18 hours)

Fin.	421	Financial Management	(3)
Acctg.	422	Managerial Accounting	(3)
Eco.	431	Managerial Economics	(3)
Eco.	433	Labor Management Economics	(3)
Mkt.	450	Marketing Management	(3)
E.S.	454	Forecasting	(3)

Elective Courses (12 hours)

Law	401	Legal Problems in Business	(3)
Fin.	441	Foreign Trade Management	(3)
Fin.	442	The Money Market	(3)
Eco.	490	Thesis in Business Administration	(3)

Plus appropriate 300-level courses in Accounting, Economics, and Finance with the approval of the director of the graduate program.

Students who have had some, but not all, of the background work listed in the First Year (above) may have their programs adjusted accordingly. Of the courses listed in First Year (above), Eco. 3, Fin. 125, Acctg. 104, Fin. 123, Mkt. 11, E.S. 45, and Eco. 306 are normally offered in the summer session. A total of twelve hours credit may be acquired by attending both six-week summer sessions.

Evening sections of preparatory First Year courses other than Eco. 3 will be offered for the benefit of part-time candidates who lack background work.

Additional information may be obtained by writing to Professor F. A. Bradford, Director of the Graduate Program, College of Business Administration.

For additional graduate courses in Business Administration, see Accounting, Economics, and Finance.

CHEMICAL ENGINEERING

Professor Foust
Associate Professor Wenzel
Assistant Professors Clump, Schiesser
Messrs. Glomb, McGair, Sabnis, Sacks

Ch.E. 70. Industrial Stoichiometry (3)

Chemical and physical calculations upon which energy and material balances are based, and application of these balances to various industrial processes, involving vaporization and condensation, fuels and combustion. Applications are picked from a wide variety of chemical processes. *Prerequisites: Math. 12; Chem. 35; Phys. 3.* Second semester.

Ch.E. 100. Summer Employment (0)

During the summer following the junior year candidates for the degree of B.S. in Chemical Engineering are required to obtain industrial experience through employment for at least eight weeks in a plant or laboratory or engineering office and submit a report thereon.

Ch.E. 160. Unit Operations Survey (3)

A comprehensive study of the unit operations and equipment common to the chemical and metallurgical process industries. Planned to acquaint non-chemical engineers with the theory and application of heat, mass and momentum transfer operations, including laminar and turbulent flow of real fluids, conduction, convection, radiation, extraction, and distillation. *Prerequisite: Math. 13, Phys. 3 and 4.* Both semesters.

Ch.E. 171. Unit Operations I (3)

Multistage mass transfer operations. Ideal stage concept and calculations. Principles of molecular mass, heat, and momentum transport. *Prerequisite: Ch.E. 70.* First semester.

Ch.E. 172. Unit Operations II (3)

Principles of heat, mass, and momentum transfer in the turbulent regime with particular emphasis upon the similarities of these transfer processes. Applications to heat transfer, mass transfer and humidification. *Prerequisite: Ch.E. 171.* Second semester.

Ch.E. 173. Unit Operations III (2)

Applications of the rate equation to the design of process equipment in which the transfer of momentum or the simultaneous transfer of heat

and mass are the dominant mechanisms. *Prerequisite: Ch.E. 172.* First semester.

Ch.E. 174. Chemical Plant Design (3)

A study of the technical and economic aspects of the design, location, and operation of chemical plants. *Prerequisite: Ch.E. 173.* Second semester.

Ch.E. 175. Chemical Engineering Practice (1)

Seminars on the chemical industry, and visits to chemical manufacturing plants. *Prerequisite: Junior standing in chemical engineering.* Second semester.

Ch.E. 176. Chemical Engineering Projects (2)

Special study of a particular problem involving laboratory and library work. Topics include equipment design, construction, and testing; research in unit operations, unit processes, thermodynamics, and kinetics; data correlation. Weekly conferences and reports. *Prerequisite: Ch.E. 173 previously or concurrently.* First and second semesters. Staff

Ch.E. 177. Unit Operations Laboratory (2)

One six-hour period per week. *Prerequisite: Ch.E. 173, previously or concurrently.* First and second semesters.

For Advanced Undergraduates and Graduates

Ch.E. 200. Chemical Engineering Thermodynamics (3)

Energy relations and their application to chemical engineering. Consideration of flow and non-flow processes, evaluation of the effect of temperature and pressure on thermodynamic properties of ideal and actual fluids: prediction of the heat effects accompanying phase changes and chemical reactions; application to industrial processes. *Prerequisites: Ch.E. 70, Chem. 94, or equivalents.* Second semester.

Ch.E. 261. Applied Chemical Calculations (3)

This course is planned for those students majoring in Chemistry who contemplate an industrial career in chemical manufacturing. It treats the stoichiometry of industrial systems, thermodynamics of real fluids, and the kinetics of constant pressure flow reactors. *Prerequisite: Chem. 190.* First semester.

Ch.E. 301. Process Design (3)

Intensive study of selected or proposed chemical processes with emphasis on optimum order of steps, flow diagrams, energy balances and recycle ratios and their effect on the balance sheet of the operation. Approximation methods of obtaining data. *Prerequisite: Ch.E. 173.* Second semester.

Ch.E. 302. Chemical Engineering Kinetics (3)

The application of chemical kinetics to the design and operation of reactors. Interrelations of kinetics, thermodynamics and unit operations in steady and unsteady states. *Prerequisites: Ch.E. 173 and Ch.E. 200, previously or concurrently.* First semester.

Ch.E. 386. Chemical Engineering Process Control (3)

Response characteristics of units of continuous processes; primary and final control elements for temperature, pressure, flow, and other process variables; modes of control; the closed loop and its equation; dynamic analysis and stability of processes. *Prerequisite: Senior standing in a curriculum of the engineering college, or consent of the instructor.* First semester.

Ch.E. 390. Nuclear Reactor Engineering (3)

A consideration of the engineering problems in nuclear reactor design and operation. Topics include instrumentation and control, reactor fuels and materials, thermal aspects, radiation protection and shielding, fuel processing, and reactor design. *Prerequisites: Phys. 266, or Chem. 303 and 304, or registration in Physics 269.* Second semester.

Ch.E. 391. Nuclear Reactor Engineering Laboratory (3)

Experimental work in nuclear reactor engineering, including neutron diffusion in the sub-critical reactor, liquid-metal heat transfer, nuclear fuel properties and processing. One lecture, six hour laboratory. *Prerequisite: Ch.E. 390 previously or concurrently.* Second semester.

For Graduates

Ch.E. 400. Chemical Engineering Thermodynamics I (3)

Applications of thermodynamics in Chemical Engineering. Topics include prediction of physical and chemical equilibria, heat effects accompanying solution, flow of compressible fluids, refrigeration including solution cycles, vaporization, and condensation processes. *Prerequisite: An introductory course in thermodynamics.* First semester. Mr. Wenzel

Ch.E. 401. Chemical Engineering Thermodynamics II (3)

A study of the methods available for estimating and correlating the thermodynamic properties of non-ideal fluids. Application of these properties to prediction of phase and reaction equilibria in the fields of azeotropic and extractive distillation, liquid-liquid extraction, gas absorption, and chemical reactor design. *Prerequisite: Ch.E. 400.* Second semester, alternate years. Mr. Wenzel

Ch.E. 410. Chemical Engineering Kinetics (3)

A continuation of Ch.E. 302. The application of chemical kinetics to the engineering design and operation of reactors. *Prerequisite: Ch.E. 302* Second semester, alternate years.

Ch.E. 420. Heat and Momentum Transfer (3)

Heat and momentum transfer by molecular and eddy mechanisms in the steady state. Analogies between momentum, heat, and mass transfer. Transient heat transfer. Radiation, vaporization, and condensation. Heat transfer in high velocity flow and flow of rarified gases. Applications. First semester. Messrs. Foust, Clump

Ch.E. 430. Mass Transfer I (3)

Molecular and turbulent diffusion theory. Equilibrium stage and continuous contact equipment for the mass transfer operations. Introductory multicomponent distillation and absorption. Second semester.

Mr. Clump

Ch.E. 431. Mass Transfer II (3)

Multicomponent distillation and absorption, azeotropic and extractive distillation. *Prerequisite: Ch.E. 430.* First semester, alternate years.

Mr. Clump

Ch.E. 435. Simultaneous Heat and Mass Transfer (3)

Unit operations involving simultaneous heat and mass transfer. Emphasis on drying, humidification, dehumidification, and condensation in the presence of non-condensable gases. First semester, alternate years.

Mr. Clump

Ch.E. 440. Process Design (3)

Application of chemical engineering principles to the design of chemical processes. Second semester, alternate years. Mr. Foust

Ch.E. 450. Special Topics (3-12)

An intensive study of some field of chemical engineering not covered in the more general courses. Credit above three hours is granted only when different material is covered. Staff

Ch.E. 455. Seminar (1-3)

Critical discussion of recent advances in chemical engineering. Credit above one hour is granted only when different material is covered. Staff

Ch.E. 460. Chemical Engineering Calculations (3)

Application of ordinary and partial differential equations to the solution of chemical engineering problems with emphasis on chemical reactions and transport processes as they occur in industrial chemical processing. Rigorous and approximate solutions by various applicable techniques. *Prerequisite: A course in advanced calculus.* First semester, alternate years.

Mr. Schiesser

Ch.E. 480. Research (3-4)

Investigation of a problem in chemical engineering. First semester.

Staff

Ch.E. 481. Research (3-4)

Continuation of Ch.E. 480. Second semester. Staff

CHEMISTRY

Professors Amstutz, *Serfass, H. V. Anderson, Zettlemoyer
Associate Professors Billinger, Fish
Assistant Professors Hercules, Sprague, Rouse, Sturm, Daen, Young
Associate Research Professors R. R. Myers, Stubbings
Assistant Research Professor Chessick
Messrs. Eck, Gregorek, Kunkel, LaPara, MacBride, Miller, Mizianty, Neuklis, Norwood, Paolini, Ramer, Stehley

Chem. 4. General Chemistry (4)

The principles and applications of general chemistry; descriptive chemistry of the non-metals and their important compounds. One demonstration lecture, two recitations, one laboratory period. First and second semesters. Mr. Sprague and Staff

Chem. 5. General Chemistry (4)

Continuation of Chem. 4. Principles and applications of general chemistry; descriptive chemistry of the metals and their compounds. One demonstration lecture, two recitations, one laboratory period. *Prerequisite: Chem. 4.* First and second semesters. Mr. Sprague and Staff

Chem. 15. Elementary Chemistry (3)

An abridgment of Chem. 4. For students not majoring in science or engineering. Two lecture-recitations, one laboratory period. First semester. Mr. Anderson

Chem. 16. Elementary Chemistry (3)

Continuation of Chem. 15; an abridgment of Chem. 5. Two lecture-recitations, one laboratory period. *Prerequisite: Chem. 15 or Chem. 4.* Second semester. Mr. Anderson

Chem. 35. Analytical Chemistry (4)

Theory and practice of chemical analysis. The separation and quantitative determination of some common elements by gravimetric and volumetric procedures. One lecture, three laboratory periods. *Prerequisites: Chem. 4 and 5.* First semester. Messrs. Fish, Hercules

Chem. 36. Analytical Chemistry (4)

Continuation of Chem. 35. The analysis of some ores, alloys and other material by methods involving electrometric, electrolytic, calorimetric, and complexometric technique. One lecture, three laboratories. *Prerequisite: Chem. 35.* Second semester. Messrs. Fish, Hercules

Chem. 38. Analytical Chemistry (3)

An abridgment of Chem. 35 for mining and metallurgical engineers. One lecture, two laboratory periods. *Prerequisites: Chem. 4 and 5.* First semester. Mr. Hercules

*Resigned December 31, 1959.

Chem. 91. Physical Chemistry (3)

Introduction to physical chemistry; states of matter, change of state, solutions, surface phenomena; nuclear, atomic, and molecular structure. *Prerequisites: Chem. 4 and 5; Math. 13, previously or concurrently.* First semester. Messrs. Sturm, Zettlemoyer

Chem. 92. Physical Chemistry Laboratory (1)

Physical chemical measurements. To accompany Chem. 91. *Prerequisites: Chem. 35 or 38; Phys. 1; Math. 13, previously or concurrently.* First semester. Mr. Sturm

Chem. 93. Elements of Physical Chemistry (3)

Kinetic theory, change of state, solutions, equilibria, electrochemistry, colloidal phenomena. Especially designed for biology majors. *Prerequisites: Chem. 4 and 5.* First semester. Mr. Sturm

Chem. 94. Physical Chemistry (3)

Designed especially for engineering students with a working knowledge of the perfect gas laws. A study of states of matter, change of state, solutions, surface phenomena; nuclear, atomic, and molecular structure. Introduction to thermochemistry. *Prerequisite: Ch. E. 70 or equivalent.* First semester. Mr. Sturm

Chem. 100. Industrial Employment

During the summer following the junior year candidates for the degree of B.S. in Chemistry are required to obtain industrial experience through employment for at least eight weeks in a plant or laboratory. Proposed employment must be approved in advance by the Director of the Curriculum, and a report covering this experience must be presented to him on or before the following January 8. Staff

Chem. 150. Organic Chemistry (3)

Systematic survey of the typical compounds of carbon, their classification and general relations; study of synthetic reactions. *Prerequisites: Chem. 5 and 35.* First semester. Mr. Amstutz

Chem. 151. Organic Chemistry (3)

Continuation of Chem. 150. *Prerequisite: Chem. 150.* Second semester. Mr. Amstutz

Chem. 165. Organic Chemistry Laboratory (2)

Preparation of pure organic compounds. *Prerequisites: Chem. 5; Chem. 35.* First semester. Messrs. Amstutz, Young, Rouse

Chem. 167. Organic Chemistry Laboratory (2)

Continuation of Chem. 165 with particular emphasis upon aromatic compounds. *Prerequisite: Chem. 165.* Second semester. Messrs. Amstutz, Young, Rouse

Chem. 175. Research Chemistry Laboratory (3)

Advanced study or an investigation involving intensive work in laboratory and library. Topics in active research include absorption, analytical processes, drying oils, industrial chemical processes, heterocylic organic compounds, hydration of inorganic salts, kinetics of combustion, photomicrography, natural and synthetic resins, pigments, aldol syntheses, plastics, surface chemistry, tanning and leather technology, and X-ray technique. Second semester. Staff

Chem. 179. Literature of Chemistry and Chemical Engineering (1)

A systematic study of the reference books, journals, and general treatise with training in the use of the Library. Chronological development of the science with assigned reading and reports. Second semester.

Mr. Billinger

Chem. 190. Physical Chemistry (3)

Continuation of Chem. 91. Study of the laws of thermochemistry, solutions, rates of reaction, and chemical equilibrium in homogeneous and heterogeneous systems based on thermodynamic and kinetic concepts. *Prerequisites: Math. 13, Chem. 91.* Second semester.

Messrs. Zettlemoyer, Sturm, Daen

Chem. 191. Physical Chemistry (3)

Continuation of Chem. 94. Study of the laws of thermochemistry solutions, rates of reaction and chemical equilibrium in homogeneous and heterogeneous systems based on thermodynamics and kinetic concepts. The laws of conductivity, current, electromotive force, and energy relations of electrolytes in solutions. *Prerequisite: Chem. 94.* Second semester.

Mr. Sturm

Chem. 192. Physical Chemistry Laboratory (1)

Continuation of Chem. 92. *Prerequisites: Chem. 91, Phys. 3; Chem. 92.* Second semester. Mr. Sturm

Chem. 194. Physical Chemistry and Electrochemistry (3)

Continuation of Chem. 190. The laws of conductivity; the thermodynamics of electrolytic solutions; photo-chemistry; and recent developments in physical chemistry. *Prerequisites: Math. 13, Chem. 190.* First semester.

Chem. 197. Electrochemistry Laboratory (1)

Experimental study of electrochemical reactions. Measurements of conductivity, current, and electromotive force. *Prerequisites: Chem. 194, previously or concurrently; Chem. 190.* First semester. Mr. Sturm

For Advanced Undergraduates and Graduates

Chem. 210. Instrumentation Principles (3)

A study of the electrical, electronic, optical, and mechanical principles used in modern instrumentation for measurement and control. Principles of vacuum tubes, transistors, and phototubes with associated circuitry, etc.

Optical components of modern instrument systems including visible, infra-red, ultraviolet, x-ray, and far infra-red devices. Mechanical instrumentation principles including kinematic design and mechanical computation. Two lectures and one three hour laboratory. Second semester.

Mr. Stubbings

Chem. 211. Instrumentation-Transducers (4)

A study of the fundamentals of primary sensing elements, electronic and mechanical recording systems, pneumatic and electromatics indicating and controlling elements. The application of transducers of the electronic, optical, and mechanical types to the measurement of temperature, pressure, concentration flow rates, strain, and other variables. Three lecturers and one, three hour laboratory. *Prerequisite: Chem. 210, Instrumentation Principles, or equivalent.* First semester. Mr. Stubbings

Chem. 302. Principles of Inorganic Chemistry (3)

Introductory consideration of atomic and molecular structure, periodic relationships among the elements, chemical bonding, complex ions and coordination compounds, acid-base theory, and chemistry in non-aqueous solvents. Emphasis is placed on the family relationship of the elements and their compounds. *Prerequisite: Eight hours of general chemistry.* First semester. Mr. Myers

Chem. 303. Nuclear and Radiochemistry (3)

A broad survey of nuclear science with particular emphasis on aspects of importance to chemistry. Elementary nuclear theory; the production, separation, and identification of radioactive and stable isotopes; the use of isotopes in the study of chemical systems; and nuclear engineering. Second semester. Mr. Sturm

Chem. 304. Radiochemistry Laboratory (1)

Laboratory practice in the handling and measurement of radioactive isotopes, and the use of isotopes in chemical investigations. *Prerequisite: Prior or concurrent registration in Chem. 303 and consent of instructor.* Second semester. Mr. Sturm

Chem. 305. Systematic Inorganic Chemistry (3)

A systematic survey of the chemistry of the elements and inorganic compounds, based on the periodic table and the principles developed in Chemistry 302. Emphasis is placed on the chemistry of the less familiar elements. *Prerequisite: Chem. 302 or its equivalent.* Second semester.

Mr. Sprague

Chem. 306. Inorganic Preparations (2)

A laboratory course illustrating a variety of techniques for the preparation and purification of inorganic compounds. One discussion period and approximately three hours of laboratory work per week. *Prerequisite: Eight hours of general chemistry and Chem. 35 or its equivalent.* First and second semesters. Mr. Sprague

Chem. 334. X-ray Methods (3)

The application of x-ray diffraction and fluorescence methods to problems of crystal structure and analysis. Lectures and laboratory work. *Prerequisite: Consent of instructor.* First semester. Mr. Sprague

Chem. 337. Instrumental Methods of Analysis (3)

Theory and application of modern optical and electrical instruments to the solution of analytical, organic, and other chemical problems. One conference and two laboratory periods per week. *Prerequisite: Eight hours of analytical chemistry.* Second semester. Mr. Hercules

Chem. 339. Instrumental Methods of Analysis (2)

Similar to Chem. 337. Lecture and conference only. *Prerequisite: Eight hours of analytical chemistry.* Second semester. Mr. Hercules

Chem. 356. Quantitative Organic Analysis (1)

The practice of the common analytical procedures involving the quantitative estimation of carbon, hydrogen, halogen, nitrogen, and sulfur; the iodine number method; the hydroxyl value; the acid value, and the saponification number. One laboratory period per week. *Prerequisite: Eight hours of analytical chemistry; a course in organic chemistry.* Second semester. Mr. Fish

Chem. 357. Qualitative Organic Analysis (3)

The theory and practice of the identification of pure organic compounds; small scale preparation of derivatives and separation of mixtures of organic compounds. One lecture and two laboratory periods per week. *Prerequisite: One year of organic chemistry.* Second semester. Mr. Rouse

Chem. 358. Advanced Organic Chemistry (3)

The study of modern theories of reaction mechanisms and their application to the problems of organic chemistry. *Prerequisite: One year of organic chemistry.* First semester. Mr. Amstutz

Chem. 368. Advanced Organic Laboratory (2)

The synthesis and study of organic compounds, with the experiments illustrating the important techniques and special pieces of apparatus commonly used in organic chemical research. *Prerequisite: One year of organic chemistry and laboratory.* First or second semester. Messrs. Amstutz, Young, Rouse

Chem. 371. Elements of Biochemistry (3)

A general study of carbohydrates, proteins, lipids, minerals and other substances and their importance in life processes. *Prerequisite: One year of organic chemistry.* Second semester. Mr. Young

Chem. 372. Advanced Biochemistry (3)

A study of selected topics in the field of biochemistry. *Prerequisite: One year of organic chemistry.* First semester. Mr. Young

Chem. 390. Physical Chemistry (3)

Chemical thermodynamics, kinetics, colloidal chemistry, valence and structure. Second semester. *Prerequisite: Two semesters of physical chemistry.* Messrs. Daen, Sturm, Zettlemoyer

For Graduates

Chem. 400. Inorganic Chemistry Research (1-4)

Investigation of a problem in inorganic chemistry. Messrs. Myers, Sprague

Chem. 401. Inorganic Chemistry Research (1-4)

Continuation of Chem. 400. Second semester. Messrs. Myers, Sprague

Chem. 402. Advanced Inorganic Chemistry (3)

Atomic structure and theories of valence; classical and quantum mechanical descriptions of chemical bonds, with emphasis on recent developments. Second semester. Mr. Myers

Chem. 403. Advanced Topics in Inorganic Chemistry (3)

Subjects of contemporary interest in inorganic chemistry, including organometallic compounds, metal complexes, co-ordination compounds, and carbonyls; acid-base theory and chemistry in nonequeous solvents; the chemistry of the lanthanides and actinides. *Prerequisite: Chem. 302 or the equivalent.* Second semester. Mr. Sprague

Chem. 429. Seminar in Inorganic Chemistry (1-6)

Reports and discussions of recent developments in inorganic chemistry. Messrs. Sprague, Myers

Chem. 430. Quantitative Analysis Research (1-4)

Investigation of problems in analytic procedures. First semester. Messrs. Fish, Hercules

Chem. 431. Quantitative Analysis Research (1-4)

Continuation of Chem. 430. Second semester. Messrs. Fish, Hercules

Chem. 432. Advanced Analytical Chemistry (3)

Theory of precipitation analysis; physico-chemical methods; microanalysis; chromotography; organic-analytical reagents; accuracy and precision in analysis. *Prerequisite: Eight hours of analytical chemistry.* Second semester. Mr. Fish

Chem. 433. Advanced Topics in Physico-Analytical Chemistry (3)

Consideration of physico-chemical analytical techniques beyond those discussed in Chem. 337. Special topics in electro-chemical, statistical and

optical methods such as electrode kinetics, diffusion phenomena, electronic emission spectroscopy, analysis of infrared spectra of complex molecules, etc. Mr. Hercules

Chem. 436. X-ray Research (3)

The investigation of chemical and industrial problems by X-ray diffraction methods. First semester. Mr. Sprague

Chem. 437. X-ray Research (3)

Continuation of Chem. 436. Second semester. Mr. Sprague

Chem. 439. Seminar in Physical Chemistry (1-6)

Reports and discussions of recent developments in physical chemistry. Messrs. Zettlemoyer, Chessick, Myers, Sturm, Daen

Chem. 440. Advanced Physical Chemistry (3)

Definitions and fundamental laws of thermodynamics, statistical thermodynamics; chemical equilibria in homogeneous and heterogeneous systems; colligative and partial molal properties of solutions; electra-chemistry of solutions. *Prerequisite: One year of physical chemistry.* First semester. Mr. Daen

Chem. 441. Advanced Physical Chemistry (3)

Kinetic theory of gases, liquids, and solutions; reaction rate theory; heterogeneous reactions and catalysis; properties of dispersed systems; phenomena of surface chemistry; preparation and general properties of collodial system. *Prerequisite: One year of physical chemistry.* Second semester. Messrs. Zettlemoyer, Daen

Chem. 449. Seminar in Analytical Chemistry (1-6)

Reports and discussions of recent developments in analytical chemistry. Messrs. Fish, Hercules

Chem. 450. Theoretical Organic Chemistry (3)

A survey of current developments in the mechanisms of organic reactions, covering solvolysis, substitution, rearrangement, and related unstable intermediates. *Prerequisite: Chem. 358.* Mr. Rouse

Chem. 451. Theoretical Organic Chemistry (3)

A survey of current developments in the mechanisms or organic reactions covering free radicals, divalent carbon, and more complex species. *Prerequisite: Chem. 358.* Mr. Rouse

Chem. 452. Organic Chemistry, Heterocyclic Compounds (3)

The chemistry of thiophene, pyrrole, furan, pyridine, and their derivatives, considered from the viewpoint of recent organic theories of structure and reaction mechanisms. Mr. Amstutz

Chem. 458. Topics in Organic Chemistry (3)
An intensive study of limited areas in organic chemistry.
Messrs. Amstutz, Young, Rouse

Chem. 459. Seminar in Organic Chemistry (1-6)
Reports and discussions of recent important developments in theoretical and applied organic chemistry. Messrs. Amstutz, Young, Rouse

Chem. 460. Organic Chemistry Research (1-4)
Investigation of a problem in organic chemistry. First semester.
Messrs. Amstutz, Young, Rouse

Chem. 461. Organic Chemistry Research (1-4)
Continuation of Chem. 460. Second semester.
Messrs. Amstutz, Young, Rouse

Chem. 463. Physical Organic Chemistry (3)
A study of the fundamental properties of organic molecules, including quantum-mechanical resonance, spectroscopy, dipole moments and thermodynamics; the use of these physical measurements in the solution of problems in organic chemistry. Mr. Sturm

Chem. 466. Advanced Organic Preparations (2)
A laboratory course of instruction in advanced techniques of the preparation of organic compounds. First or second semester.
Messrs. Amstutz, Young, Rouse

Chem. 471. The Chemistry of Natural Products (3)
Study of carbohydrates, amino acids, proteins, nucleic acids, enzymes, antibiotics, and similar substances. *Prerequisite: Chem. 358 or its equivalent.* Messrs. Young, Rouse

Chem. 472. The Chemistry of Natural Products (3)
Study of terpenes, vitamins, steroids, fats, alkaloids, etc. *Prerequisite: Chem. 358 or its equivalent.* Messrs. Young, Rouse

Chem. 473. Seminar in Biochemistry (1)
Reports and discussions of the principles of protein chemistry, carbohydrate chemistry, and processes relating to the general field of chemistry.
Messrs. Stubbings, Young

Chem. 490. Physical Chemistry Research (1-4)
Investigation of a problem in physical chemistry. First semester.
Messrs. Zettlemoyer, Myers, Chessick, Sturm, Daen

Chem. 491. Physical Chemistry Research (1-4)
Continuation of Chem. 490. Second semester.
Messrs. Zettlemoyer, Myers, Chessick, Sturm, Daen

Chem. 493. Theoretical Chemistry, Kinetics (3)
Kinetics of explosions of solids; combustion and explosion of hydrogen and hydrocarbons; polymerization; kinetics of organic reactions. *Prerequisite: Chem. 441.* Mr. Zettlemoyer

Chem. 495. Theoretical Chemistry, Thermodynamics (3)

Statistical theory of thermodynamics; heat capacity equations; quantum theory in chemical thermodynamics. Reports and discussions on selected topics. *Prerequisite: Chem. 440.* Messrs. Sturm, Daen

Chem. 497. Surface Chemistry (3)

Applications of colloid chemistry; special topics in surface chemistry. Lectures and seminar. *Prerequisite: Chem. 441.*

Messrs. Zettlemoyer, Chessick

Chem. 498. Advanced Physical Chemistry Seminar (3)

An intensive study of some field of physical chemistry. Quantum chemistry, or theory of solutions, or rheology, etc. Mr. Daen

Chem. 499. Physical Chemistry Methods (2)

Advanced course in methods of physical chemistry laboratory practice. Mr. Sturm

CIVIL ENGINEERING

Professors Eney, *C. D. Jensen, Beedle, †Thurlimann
Associate Professor Liebig
Assistant Professors Dinsmore, Dittig, Driscoll, Errera, Galambos, Herbich, Leonard, Ostapenko, Sword
Messrs. Apmann, Basler, Levi, Nasser, Reemsnyder, Rumpf, Baillie, Brach, Cook, Grigoriadis, Joung, Krehnbrink, Pai, Rosner, Waddington, Weiss

C.E. 40. Principles of Surveying (3)

An introduction to surveying, including linear and angular measurements, surveying astronomy, geometry of surveying instruments, stadia, traverse and area computations, simple curves, use of instruments; introduction to photogrammetry. Emphasis on theory of errors and on means of obtaining optimum precision. *Prerequisites: Plane trigonometry, C.E. 61.* Second semester.

C.E. 41. Engineering Surveys (3)

Applications of surveying to route location, topography, highways, construction. Daily recitation and field work for a three-week period. *Prerequisite: C.E. 40.* Summer session.

C.E. 43. Advanced Surveying (3)

Adjustment of instruments; investigation of systematic and observational errors; elements of least squares with application to surveying; ad

*On leave, beginning February, 1959.
†Resigned January 31, 1960.

justment of level nets and triangulation; celestial observation; precise leveling; photogrammetry. Office work, with some field exercises. *Prerequisite: C.E. 40.* Second semester.

C.E. 61. Engineering Graphics (3)

Use of drawing instruments; freehand lettering and shape description; theory of orthographic projection, revolution, and pictorial representation; dimensioning; developments and intersections; theoretical problems in space relationships between points, lines, and planes; surfaces as loci. Emphasis on visualization and geometric logic. First and second semesters.

C.E. 100. Industrial Employment

During the summer following the junior year, students are required to spend at least eight weeks in approved office or shop work or on engineering construction. A written report on the shop work or project, outlining the experience obtained, is due on return from Christmas recess.

C.E. 101. Foundation Engineering (2)

Application of soil engineering to foundation design. Site investigations and engineering tests to evaluate subsoil conditions. Procedures for choosing and proportioning foundation elements to meet specific structural requirements. The design and construction of temporary and permanent retaining structures. *Prerequisites: C.E. 139; C.E. 153 previously or concurrently.* First semester.

C.E. 102. Civil Engineering Proseminar (1)

A study of current civil engineering projects and developments with written reports. At weekly meetings these reports are presented orally in abstract. *Prerequisite: Senior standing.* First semester.

C.E. 103. Special Problems (1-4)

Supervised individual research problems with report. *Prerequisite: Consent of instructor.* First and second semesters.

C.E. 104. Readings in Civil Engineering (1-3)

Study of selected technical papers, with abstracts and reports. *Prerequisite: Consent of instructor.* First and second semesters.

C.E. 106. Structural Design (3)

Elementary theory and design of structures in steel, wood, and concrete, An abridged course in stress analysis and design for students other than civil engineers. *Prerequisite: Mech. 11.* Second semester.

C.E. 107. Structural Welding (1)

The design of welded steel structures, together with a study of current literature. A few periods will be devoted to the manual operation of making welds. *Prerequisite: Senior standing in civil or mechanical engineering.* Second semester.

C.E. 111. Materials of Construction (1)

Properties of non-metallic structural materials, including concrete and its components, wood, masonry, plastics, rubber, insulation materials, and protective coatings; design of concrete mixes. To be taken in conjunction with Met. 61. *Prerequisites: Chem. 5, Mech. 11 and 13.* Second semester.

C.E. 112. Advanced Mechanics of Materials (3)

Further topics in column and beam theory, including unsymmetrical bending, combined stresses, conjugate beam methods; curved beams, impact loading, buckling. *Prerequisite: Mech. 11.* First semester.

C.E. 121. Mechanics of Fluids (3)

The behavior of real fluids and the more important physical laws; potential flow, boundary layer, lift, drag, and waves, with practical applications to flow through pipes, open channels, turbines, and pumps. Dimensional analysis and similitude. *Prerequisite: Mech. 102 previously or concurrently.* First and second semesters.

C.E. 123. Fluid Mechanics Laboratory (1)

Introduction to laboratory techniques, calibration principles, and fluid measurements. Closed conduit flow of water, oil, and air; open channel flow of water, wind tunnel studies; hydraulic machinery testing. *Prerequisite: C.E. 121 concurrently.* First and second semesters.

C.E. 124. Applied Hydrology (2)

The hydrologic cycle, with quantitative study of precipitation, percolation and runoff, ground water, impoundage, water losses. Water quantity determination for public and industrial purposes. Statistical analysis. *Prerequisite: C.E. 121.* Second semester.

C.E. 125. Hydraulic Engineering (2)

Flow in pressure conduits in series, parallel and network arrangements; uniform and non-uniform flow in open channels; pumping; design of sanitary and storm sewage systems; consideration of engineering economy as applied to hydraulic projects. *Prerequisites: C.E. 121, 123.* First semester.

C.E. 139. Soil Mechanics (3)

Fundamental physical and mechanical properties affecting soil action in engineering projects: identification; classification; hydromechanical, deformation, shear and compaction properties. Applications of theories and principles in engineering practice. *Prerequisite: Mech. 11.* Second semester.

C.E. 145. Transportation Engineering I (3)

Principles of the design, construction, and maintenance of transportation facilities. Emphasis on highway and airport design. Geometric, drainage, and pavement design. Properties and performance of material used. Field trips and design problems. *Prerequisites: C.E. 41; C.E. 139.* First semester.

C.E. 146. Transportation Engineering II (3)

Principles of planning for major forms of transportation facilities. Development, operation, coordination, and regulation of highway, rail, air, water, and pipeline transportation. Traffic studies, location analysis, and economic consideration. Mass transportation of freight and passengers. Studies of large transportation terminals. *Prerequisite: C.E. 145.* Second semester.

C.E. 150. Structural Analysis I (3)

Analysis of statically determinate frames and trusses; influence lines; deflections; statically indeterminate structures by method of deflections. *Prerequisite: Mech. 11.* First semester.

C.E. 151. Structural Theory (3)

Introductory course in the theory of structural steel design, including riveted and welded connections, pins, tension members, columns, and beams. *Prerequisites: C.E. 112; C.E. 150.* First semester.

C.E. 153. Reinforced Concrete Theory (3)

Introduction to the theory and design of simple reinforced concrete structures. Laboratory work includes the preparation of concrete mixtures and tests of control cylinders, beams, and columns. *Prerequisites: C.E. 112; C.E. 150.* First semester.

C.E. 154. Structural Analysis II (3)

Elastic analysis of statically indeterminate beams, frames, and trusses by methods of energy, column analogy, moment distribution, and slope deflection; influence lines; introduction to plastic analysis. *Prerequisite: C.E. 150.* Second semester.

C.E. 155. Structural Design (3)

Design of structures utilizing various structural materials. *Prerequisites: C.E. 101, 151, 153, 154.* Second semester.

C.E. 162. Sanitary Engineering (3)

A systematic study of water and waste-water treatment employing the concept of unit-operations. Laboratory work includes field studies, examination of water and waste-water samples, batch and pilot plant experiments. *Prerequisites: Chem. 5, C.E. 121.* Second semester.

For Advanced Undergraduates and Graduates

C.E. 320. Hydraulic Engineering Projects (3)

Hydrology, analysis of design of earth and gravity dams, outlet structures, flood control methods, and flood routing. *Prerequisites: C.E. 124, 125.* First semester. Messrs. Herbich, Dittig

C.E. 321. Water Power and Pumping (3)

Pump and turbine selection and testing; study of penstocks, flumes, surge tanks, control gates; water power hydrology. First semester.

Messrs. Herbich, Dittig

C.E. 322. Hydromechanics (3)

Fundamental principles of fluid motion, with emphasis on hydraulic applications. Euler's, Bernoulli's, and Laplace's equations, gradually varied open channel flow, wave motion, water hammer, turbulence, sediment transportation, cavitation, and air entrainment. *Prerequisites: Math. 206, C.E. 121.* Second semester. Mr. Herbich

C.E. 351. Structural Design: Timber (2)

Analysis and design of timber columns, beams, tension members, trusses, connections, mechanical fasteners; study of allowable stresses, fire resistance, and preservation of timber structures; design project and timber tests with reports. *Prerequisite: C.E. 151.* Second semester.

Messrs. Eney, Liebig

C.E. 360. Sanitation (3)

Study of those environmental factors having an influence upon public health, including food and milk sanitation; garbage and refuse collection and disposal; insect and rodent control; lighting, heating, and ventilating; plumbing; industrial hygiene; school sanitation; and swimming pools, but excluding water works and sewage. *Prerequisite: C.E. 162, previously or concurrently.* Second semester. Mr. Dittig

For Graduates

Subject to proper approval a graduate student majoring in Civil Engineering may include the following courses in his program. The prerequisite for any course listed is a course of similar title on a less advanced level. At the end of this group of courses are listed courses in other departments which may be selected as a part of a C.E. major.

C.E. 400. Research Methods (3)

Research procedures as applied to engineering materials and structures; methods of experimental stress analysis. First semester. Mr. Errera

C.E. 401. Mechanical Methods of Stress Determination (3)

Use of mechanical devices in investigation of special problems, such as temperature deformations, foundation displacements, and integral action of structures; theory of similitude. First semester. Mr. Eney

C.E. 402. Structural Model Analysis (2-5)

Individual structural research problems, with report. *Prerequisite: C.E. 401.* Second semester. Mr. Eney

C.E. 404. Structural Research (2-5)

Individual research problems with reports. First or second semester. May be repeated for credit. Staff

C.E. 405. Structural Welding (3)

Welded design of structures subjected to static and repeated loadings; distortion, residual stresses, inspection, costs; study of current research. First semester of alternate years. *(Offered Fall, 1960.)*

C.E. 406. Special Problems in Civil Engineering (1-3)

An intensive study, with report, of some special field of Civil Engineering. May be repeated for credit. Staff

C.E. 407. Thesis (1-6) Staff

C.E. 410. Prestressed Concrete (3)

Cement, aggregates, strength laws; elastic and plastic properties of concrete; analysis and design of prestressed members by the various methods of prestressing. First semester. Mr. Ostapenko

C.E. 411. Selected Topics in Concrete Structures (3)

Analysis and design of prestressed, thin-shelled, rigid frame, and composite concrete structures. Influence of shrinkage and plastic flow on forces in redundant structures. Second semester of alternate years. *(Offered Spring, 1962)* Mr. Galambos

C.E. 420. Hydrology and Open Channel Flow (3)

Components of the hydrologic cycle. Analysis and prediction of basic quantities required for hydraulic engineering design and storage requirements. Non-uniform flow in open channels and reservoirs, backwater curves in natural and artificial channels, hydraulic jump, surges and waves, standing waves in supercritical flow. Transportation of sediment. Supervised problems. Second semester of alternate years. *(Offered Fall, 1961.)*
Messrs. Dittig, Herbich

C.E. 421. Hydraulic Laboratory Practice (2-5)

Study of theory and method of hydraulic experimentation simultaneously with laboratory work. First or second semester. Mr. Herbich

C.E. 422. Hydraulic Research (2-5)

Individual research problems with reports. First or second semester.
Mr. Herbich

C.E. 440. Soils Research (2-5)

Individual research problems relating to soil mechanics with report. *Prerequisite: A course in soil mechanics.* First or second semester.
Mr. Leonard

C.E. 443. Advanced Soil Engineering I (3)

The origin, composition, and physico-chemical properties of soils and their influence on the engineering properties and behavior of soils; transmission of water in saturated and unsaturated soils; frost action; application of hydromechanics to soil engineering problems; theories of consolidation. *Prerequisite: An undergraduate course in soil engineering.* First semester. Mr. Leonard

C.E. 444. Advanced Soil Engineering II (3)

Fundamental and advanced theories of soil mechanics and their application to earth structures and foundation design; detailed study of stress-strain and strength characteristics of cohesive and non-cohesive soils under various loading conditions; case histories of some applications. *Prerequisite: C.E. 443.* Second semester. Mr. Leonard

C.E. 450. Advanced Structural Theory (3)

The design and investigation of statically indeterminate structures of steel and reinforced concrete, including arches. First semester.
Messrs. Ostapenko, Eney

C.E. 451. Advanced Structural Theory (3)

Continuation of C.E. 450. Second semester.
Messrs. Ostapenko, Eney

C.E. 453. Structural Members and Frames (3)

General torsion of thin-walled open, closed, and combined open and closed cross-sections; general instability of thin-walled members; inelastic instability; special problems of stability. Desirable preparation: Math. 221 and Mech. 415. Second semester of alternate years. *(Offered Spring, 1961.)* Mr. Galambos

C.E. 456. Graduate Seminar (1-3)

Study of current topics in the field of civil engineering. *(Offered on sufficient demand).* Messrs. Eney, Beedle

C.E. 458. Plastic Analysis and Design (3)

Theory of plasticity and its applications to structural design. The behavior of steel structures beyond the elastic limit and up to collapse. Study of component parts of frames; methods of predicting strength and deformation in the plastic range. Studies of industrial type frames. Current research. Comparison of conventional design methods with plastic design techniques. Second semester. Messrs. Beedle,Galambos, Driscoll

C.E. 460. Water Supply and Sewage (3)

Theory and design of facilities for the supply and distribution of water and for collection of waste water. First semester of alternate years. *(Offered Fall, 1960.)* Mr. Dittig

C.E. 461. Treatment of Water and Waste Water (3)

Theory and design of treatment facilities for water, sewage, and industrial waste; advanced topics on current practices, with reports. Second semester of alternate years. *(Offered Spring, 1961.)*

Additional courses which may be a part of a C.E. major: Mech. 402 Advanced Analytical Mechanics, Mech. 404 Advanced Vibration Analysis, Mech. 411, 412, Theory of Elasticity and Plasticity, Mech. 415 Structural Mechanics and Elastic Stability,

Mech. 416 Theory of Plates and Shells, Mech. 421 Hydrodynamics, and Mech. 422 Advanced Mechanics of Compressible Fluids.

Each candidate for a master's degree is expected to take at least one research course (C.E. 402, 404, 406, 407, 422, 440), but a minimum of 24 hours of his program should consist of courses outside this group. Research assistants and fellows will normally prepare a thesis.

CLASSICAL LANGUAGES

Associate Professor Maurer
Assistant Professor Feaver

GREEK

Gk. 1. Elementary Greek (3)

For all students who desire to obtain a knowledge of the fundamentals of the Greek language. Early in the semester there will be reading in stories and legends in easy Greek. First semester.

Gk. 2. Elementary Greek (3)

Continued work in Greek vocabulary, forms, and syntax. Selected readings in Greek prose. *Prerequisite: Gk. 1.* Second semester.

Gk. 3. Second-Year Greek (3)

Xenophon: *Anabasis,* and other works. Grammar review. *Prerequisites: Gk. 1 and 2, or one year of entrance Greek.* First semester.

Gk. 4. Second-Year Greek (3)

Plato: *Euthyphro, Apology, and Crito,* or other dialogues. *Prerequisite: Gk. 3.* Second semester.

Gk. 11. Greek Drama (3)

Representative plays of Sophocles, Euripides, and Aristophanes. Literary study of the drama. *Prerequisite: Gk. 4.* First semester.

Gk. 12. Greek Drama (3)

Continuation of Gk. 11. *Prerequisite: Gk. 4.* Second semester.

Gk. 13. Greek Historians (3)

Selections from Herodotus, Thucydides, or Xenophon. A study of Greek historiography. *Prerequisite: Gk. 4.* First semester.

Gk. 14. Greek Oratory (3)

Selections from the earlier Attic orators and Demosthenes. *Prerequisite: Gk. 4.* Second semester.

Gk. 21. Ancient History (3)

The development of civilization from palaeolithic times to the world empire of Alexander the Great. The social, economic, religious, philosophic, artistic, and literary development of the ancient world; the origin of political institutions. First semester.

Gk. 50. Greek Literature in English Translation (3)

The development of the major departments of Greek literature; required readings in English translations, with special attention to the epic, drama, and lyric poetry. No knowledge of the Greek language is required. First or second semester.

Gk. 111. Homer (3)

Rapid reading of considerable portions of the *Iliad* or the *Odyssey*. Homeric language, syntax, and metre. *Prerequisites: Gk. 4 and consent of head of department.* First semester.

Gk. 116. Plato (3)

The Republic, and other dialogues. Lectures on classical philosophy. *Prerequisites: Gk. 4 and consent of head of department.* Second semester.

For Advanced Undergraduates and Graduates

Gk. 202. Greek Archaeology (3)

Aims and methods. A chronological presentation of prehistoric civilizations including the Neolithic, Minoan, Helladic, and Mycenaean periods. A study of extant ancient monuments, buildings, and city plans of important sites of the classical and Hellenistic periods. Lectures, collateral readings, and reports. No knowledge of the Greek language is required. Second semester.

LATIN

Lat. 22. Ancient History (3)

Continuation of Gk. 21. The Hellenistic Age. Rome from its origin to 395 A.D. Second semester.

Lat. 51. Latin Literature in English Translation (3)

A study of Latin literature by means of the best English translations. The lives of the most important authors are studied and their works read according to the major departments of literature—history, comedy, epic, lyric, etc. Emphasis is placed on the chronological development of the literature and historical background necessary to the interpretation of the author's works. Lectures and readings with special reports. No knowledge of the Latin language is required. First or second semester.

Lat. 61. Elementary Latin (3)

For all students who desire to obtain a knowledge of the fundamentals of the Latin language. Special emphasis on English derivations and the principles of grammar. First semester.

Lat. 62. Caesar (3)

Selections from Caesar: *The Gallic War.* Prose composition and syntax. *Prerequisite: Lat. 61 or 2 entrance units.* Second semester.

Lat. 63. Nepos and Cicero (3)

Nepos: *de Viris illustribus;* Cicero's orations and either *de Senectute* or *de Amicitia. Prerequisite: Lat. 62 or 3 entrance units.* First semester.

Lat. 64. Ovid and Terence (3)

Ovid: *Metamorphoses,* and Terence: *Adelphoe. Prerequisite: Lat. 63 or at least 3 entrance units.* Second semester.

Lat. 65. Vergil (3)

Vergil: *Aeneid,* selections from the entire work; study of the aesthetic, political, and philosophical values of Vergil's poetry. *Prerequisite: Lat. 64 or at least 4 entrance units.* First semester.

Lat. 66. Horace (3)

Selected Odes. Lectures on the history and development of lyric poetry; constant practice in reading the more important metres; memorization of stanzas and passages. *Prerequisite: Lat. 65 or at least 4 entrance units.* Second semester.

Lat. 67. Livy (3)

Selections from earlier books. Some study of early Roman history and topography. Selected poems of Catullus. *Prerequisite: Lat. 66 or consent of head of department.* First or second semester.

Lat. 68. Latin Drama (3)

Readings of selected plays of Plautus, Terence, and Seneca. *Prerequisite: Lat. 66 or consent of head of department.* First or second semester.

Lat. 106. Roman Prose Writers of the Empire (3)

Selections from the following: Petronius, *Cena Trimalchionis;* Apuleius, Cupid and Psyche story from the *Metamorphoses;* Suetonius, *Lives;* Seneca, *Moral Epistles* and *Dialogues;* Tacitus, *Germania. Prerequisite: Lat. 66 or consent of head of department.* First or second semester.

Lat. 108. Lucretius (3)

Selected passages illustrating Lucretius' poetry and philosophy. *Prerequisite: Lat. 66 or consent of head of department.* First or second semester.

Lat. 169. Satire (3)

Selected satires of Horace and Juvenal. Lectures on the history of Roman satire and its influence on modern literature; study of social conditions under the empire. *Prerequisites: Lat. 66 or consent of head of department.* First and second semesters.

Lat. 170. Medieval Latin (3)

Selected readings from the works of late Latin writers. *Prerequisites: Lat. 66 or consent of head of department.* Second semester.

For Advanced Undergraduates and Graduates

Lat. 203. Archaeology of Italy (3)

Neolithic, Terremare, Villanovan, and Etruscan cultures. Rome the City: its buildings, monuments, and streets, its destruction and rediscovery through excavation; origin and growth of the city; methods of identifying and dating monuments. A survey of Pompeii, Herculaneum, and Ostia. Lectures, readings, and reports. No knowledge of the Latin language is required. First or second semester.

ECONOMICS AND SOCIOLOGY

Professors Bratt, Diamond, F. B. Jensen
Associate Professors Jacobi, Urban, Walters
Assistant Professors Balabkins, Johnson, Snider
Messrs. Benjamin, Corkhill, Hackman, Keefe, Orsagh, Tailby, Gooding, O'Leary, Mitchell, Rogalewicz

ECONOMICS

Eco. 1. Industrial Evolution (3)

An introductory course outlining the gradual development of economic organization with special attention to the stages of economic progress and social institutions growing out of these stages. First semester.

Eco. 3. Economics (3)

A general course in the principles of economics, covering the fundamental forces governing the production, distribution, and consumption of wealth. The work deals with the basic institutions of economic life, the nature of production, the organization of productive enterprise, and the principles of value and price. *Prerequisite: Sophomore standing.* First and second semesters.

Eco. 4. Economics (3)

A continuation of Eco. 3 in which the work deals with the principles of money and banking, national income, and important economic problems such as the business cycle, international trade, labor problems, social security, public finance, and alternative economic systems. *Prerequisite: Eco. 3.* First and second semesters.

Eco. 50. Economic Geography (3)

A survey of world resources and world trade, with special reference to the chief economic materials and the geographic and economic factors responsible for the position of the United States in the economic world. Second semester.

For Advanced Undergraduates and Graduates

Eco. 160. Insurance (3)

A non-mathematical course in the economic principles and business practice of insurance, particularly life, fire, and casualty insurance. *Prerequisite: Eco. 4.* Second semester.

Eco. 235. Transportation (3)

The economics of transportation by rail, highway, water, pipeline, and air; effects of transport costs on prices and on location of industries and markets; rate theory and practice; regulation, finance, government ownership, and coordination. *Prerequisite: Eco. 4.* First semester.

Eco. 301. Business Management (3)

How various functional aspects of business are coordinated in the conduct of an enterprise. Designed to provide the student with an over-all perspective of the problems of management. *Prerequisite: Senior standing in business administration.* First and second semesters. Mr. Urban

Eco. 302. Business Policy and Organization (3)

A study of administrative organization, policy formulation, and processes directing business activities. Reference to planning and decision making. Discussion supplemented by selected cases. *Prerequisite: Eco. 301.* Second semester. Mr. Urban

Eco. 303. Economic Development (3)

The principal determinants of economic development; economic development in advanced and underdeveloped countries. *Prerequisite: Eco. 4.* First or second semester. Mr. Jensen

Eco. 305. The Economic Development of Latin America (3)

Salient features of industrial and agricultural developments in Latin America, effects of development upon the economy; domestic marketing, foreign trade, the balance of payments, etc. *Prerequisite: Eco. 4.* First or second semester. Mr. Walters

Eco. 306. Intermediate Economic Theory (3)

Determination of prices in terms of the equilibrium of the business enterprise and consumer choices in markets of varying degrees of competition; determination of wages, rent, interest, and profits; interactions of consumption, savings, employment, and income. *Prerequisite: Eco. 4.* First and second semester. Messrs. Urban, Balabkins

Eco. 307. Advanced Economics (3)

An advanced course in the principles of economics, dealing especially with the theory of the distribution of wealth, the nature of the productive process, the history of economic doctrines, and proposed plans for economic reform, such as socialism. *Prerequisite: Eco. 4.* First semester. Mr. Tailby

Eco. 308. Advanced Economics (3)

Continuation of Eco. 307. *Prerequisite: Eco. 4.* Second semester.

Mr. Tailby

Eco. 333. Labor Problems (3)

The economics of labor; the history of labor movements in the United States, forms of labor organizations, and the methods and policies of trade unions. *Prerequisite: Eco. 4.* First and second semester.

Messrs. Diamond, Johnson

Eco. 334. Labor Legislation (3)

State and federal labor legislation. Background, experience, and economic impact. *Prerequisite: Eco. 4.* Second semester. Mr. Diamond

Eco. 336. Business and Government (3)

A general survey of the economic aspects of the relation of government and business in the United States, with considerable emphasis on problems of public utility rate making, finance, public ownership and operation, and related issues. *Prerequisite: Eco. 4.* Second semester. Mr. Johnson

Eco. 371. Readings in Economics (3)

Readings in various fields of economics, designed for the student who has a special interest in some field of economics not covered by the regularly rostered courses. *Prerequisite: Preparation in economics acceptable to the head of the department.* First semester.

Messrs. Bratt, Balabkins, Johnson, Snider, Urban, Walters

Eco. 372. Readings in Economics (3)

Continuation of Eco. 371. *Prerequisite: Preparation in economics acceptable to the head of the department.* Second semester.

Messrs. Bratt, Balabkins, Johnson, Snider, Urban, Walters

(For graduate program see Business Administration)

ECONOMIC STATISTICS

E.S. 45. Statistical Method (3)

The methods of statistical description and induction, including tabular and graphic analysis and presentation. *Prerequisite: Eco. 3.* First and second semesters.

For Advanced Undergraduates and Graduates

E.S. 346. Business Cycles and Forecasting (3)

The nature of the business cycle and the application of statistics to business trends, with special attention to forecasting and business barometers. *Prerequisite: E.S. 45 or approved equivalent.* First and second semesters.

Mr. Bratt

E.S. 347. National Income Analysis (3)

Analysis of income and product aggregates from the point of view of development and structural breakdown, emphasizing sector accounts, saving and investment. *Prerequisite: E.S. 346.* First semester. Mr. Bratt

E.S. 348. Advanced Business Cycles (3)

Recent business cycle theories; the evolution of the theories, and the problems of economic change which the theories attempt to explain. *Prerequisite: E.S. 346.* Second semester. Mr. Bratt

E.S. 352. Advanced Statistical Method (3)

Sampling and correlation methods employed in industry and government. *Prerequisite: E.S. 45 or approved equivalent.* First semester. *(Given in alternate years.)* Mr. Orsagh

E.S. 353. Time Series Analysis (3)

Statistical measurement of economic change. *Prerequisite: E.S. 346.* First semester. *(Given in alternate years.)* Mr. Bratt

E.S. 371. Readings in Economic Statistics (3)

An unrostered course designed for students with special interests in some field of economic change or economic forecasting. *Prerequisites: E.S. 346 and consent of the head of the department.* First semester.

Messrs. Bratt,Orsagh

E.S. 372. Readings in Economic Statistics (3)

Continuation of E.S. 371. *Prerequisites: E.S. 346 and consent of the head of the department.* Second semester. Messrs. Bratt, Orsagh

(For graduate program see Business Administration)

MARKETING

Mkt. 11. Marketing (3)

A detailed and critical analysis of the principles of marketing, designed to acquaint the student with major institutions and functions involved in the distribution of goods and services from the producer to the consumer. *Prerequisite: Eco. 3.* First and second semester.

For Advanced Undergraduates and Graduates

Mkt. 113. Advertising (3)

The principles, practices, and problems of advertising with special reference to its social and economic aspects. *Prerequisite: Mkt. 11.* First semester.

Mkt. 115. Retailing (3)

A study of modern retail institutions; principles and methods of retail organization and management; economic, social, and legislative aspects of the retailing structure. *Prerequisite: Mkt. 11.* Second semester.

Mkt. 214. Selling and Sales Management (3)

The principles and practices of modern selling and sales management; the function of distribution in modern management. *Prerequisite: Mkt. 11, or consent of instructor.* First and second semester.

Messrs. Snider, Walters

Mkt. 217. Industrial Marketing (3)

Analysis of the problems of industrial marketing; make-up of the product, market distribution, sales methods, advertising, etc., as differentiated from the marketing of consumer goods. *Prerequisite: Mkt. 11, or consent of instructor.* First semester. Messrs. Snider, Walters

Mkt. 312. Marketing and Distribution Research (3)

Analysis of the techniques of marketing research; determination of research objectives; procedures involved in the conduct of marketing investigations. *Prerequisites: Mkt. 11 and one other course in marketing.* Second semester. Messrs. Snider, Walters

(For graduate program see Business Administration)

SOCIOLOGY

Soc. 41. Cultural Anthropology (3)

The development of nonliterate cultures and social organizations. A comparative study of primitive institutions and social patterns, including: marriage and the family, religion, economic activities, political organizations, folklore, and language. The significance of nonliterate cultures for an understanding of contemporary society. First semester.

Soc. 42. Principles of Sociology (3)

A course designed to introduce the student to the general field of sociology and familiarize him with the basic sociological concepts. Included are: group types, the mechanisms of group behavior, processes of social interaction, social structure, social institutions, social change, the individual and society. First and second semester.

Soc. 44. The American Community (3)

Urban and rural communities in the United States, with emphasis on the urban community. Includes: ecological patterns and growth, institutional organization, population characteristics and trends, social stratification, resources and problems, future development and planning. *Prerequisite: Soc. 42.* Second semester.

For Advanced Undergraduates and Graduates

Soc. 262. Social Problems (3)

Special problems of contemporary society, including population trends, crime, public health, poverty, child welfare, the handicapped, etc. Second semester. Mr. Jacobi

Soc. 263. Introduction to Social Work (3)

The philosophy and practices of modern social work. Includes: social work as an institution, the fields of social work, private and public welfare, the support and control of agencies, case work and group work, community organization, social legislation. *Prerequisite: Soc. 42.* First semester. *(Given in alternate years.)* Mr. Jacobi

Soc. 264. The Family (3)

A sociological study of man's basic institution. Includes: an analysis of historical backgrounds, interactions within the family, relation to other groups and institutions; problems of family disorganization, legal aspects of marriage and divorce, family adjustment, the family in a changing society. *Prerequisite: Soc. 42.* First semester. *(Given in alternate years.)*

Mr. Jacobi

Soc. 265. Development of Sociological Theory (3)

A critical and comparative study of the principal schools of social thought which have contributed to the development of sociological theory. The origins and development of sociology; major contributors; current trends. *Prerequisite: Consent of instructor.* First or second semester. *(Given in alternate years.)* Mr. Jacobi

Soc. 266. Population Problems (3)

Quantitative and qualitative aspects of U.S. and world population. Includes causes and effects of migrations, racial composition and race relations, population theories, legal aspects, social consequences of population, trends, present trends, and future predictions. Second semester.

Mr. Jacobi

Soc. 271. Readings in Sociology (3)

Reading in various fields of sociology, designed for the student who has a special interest in some field of sociology not covered by the regularly rostered courses. *Prerequisite: Preparation in sociology acceptable to the head of the department.* First semester. Mr. Jacobi

Soc. 272. Readings in Sociology (3)

Continuation of Soc. 271. *Prerequisite: Preparation in sociology acceptable to the head of the department.* Second semester.

Mr. Jacobi

EDUCATION

Professor H. P. Thomas
Associate Professors Bream, Mazurkiewicz
Assistant Professors O'Neal, Smith
Messrs. Hayward, L. R. Johnston, Watkins, Granger, Farber, Shuman, Oswalt, Drumm, Kentopp, Sandel, Shelly, Mrs. Bream, Mrs. Stewart

Educ. 0. Effective Study Methods

A practical course in study techniques and in the tools of study, including reading and fundamentals of mathematics, as the needs of individual students may require. An extensive testing program is carried on to assist the student in adjusting himself. *Prerequisite: Consent of the instructor.* Second half of first semester.

Educ. A. Effective Study Methods (3)

A continuation of Educ. 0. *Prerequisite: Educ. 0.* Second semester

Educ. 1. Introduction to Education (3)

A general introduction to the field of education, giving a broad survey of the work of the teacher and of the public school; the aims, organization, and materials of public education; the place of the Federal Government and the State in a program of public education; local problems, e.g., finance, law, buildings, personnel, school boards. Required for the Pennsylvania college provisional certificate. Should be taken during the sophomore year. First and second semester.

Educ. 20. Educational Psychology (3)

An introductory course furnishing a psychological foundation immediately related to educational problems and practice. Practical problems involving analysis of designated material are assigned regularly for solution and report. Required for the college provisional certificate. Should be taken concurrently with Educ. 353, during the junior year. *Prerequisite: Psych. 1.* First semester.

For Advanced Undergraduates and Graduates

Educ. 321. The Diagnosis and Adjustment of Reading Difficulties (3)

A survey of problems in diagnosing and adjusting reading difficulties. The psychology of readings as related to learning difficulties; the measurement and diagnosis of reading difficulties; the development of informal tests for identifying reading difficulties; materials for corrective and/or remedical instruction. Second semester. Mr. Mazurkiewicz

Educ. 330. History of Education in Europe (3)

A survey of the Greek, Roman, and early Christian periods; late medieval and early modern periods; European movements since the French Revolution and their implications for American education. Second semester. Mr. Smith

Educ. 331. History of Education in the United States (3)

The development of primary, secondary, and higher education in the United States; the aims, curricula, methods, and systems of education in relation to significant problems, economic changes, social conditions, and processes. First semester. Mr. Bream

Educ. 350. Foundations of Secondary Education (3)

An introductory course in the field of secondary education. The aims, organizations, and materials of secondary education; characteristics of secondary school pupils; and a general treatment of the problems of secondary education. Recommended for the college provisional certificate. Second semester. Messrs. Smith, Granger

Educ. 351. Organization of Units of Instruction (3)

A practical course for the teacher in service, offering opportunity for cooperative planning of courses and units of instruction. Applies the

principles of curriculum construction to the selecting, assembling, and organizing of learning experiences. The teacher is advised to work in his field of special interest. *Prerequisite: Consent of instructor.* Second semester. Mr. Bream

Educ. 352. Methods of High School Teaching (3)

Basic methods of secondary instruction, including the objectives of education in relation to the curriculum; socialized procedure; problem-project unit method; contract plans; types of teaching related to different fields; directed study; organization of courses around criticized objectives; and the conduct of classes along the lines of individualized instruction. Recommended for the college provisional certificate. Should be taken concurrently with Educ. 354 during the junior year. *Prerequisite: Educ. 20.* Second semester. Mr. Smith

Educ. 353. Observation of Secondary School Teaching (3)

Study, directed observation, and discussion of the various phases of teaching activity in high schools in or near Bethlehem. The class meets two hours each week. A minimum of 60 clock hours of directed observation and 15 clock hours of supervised practice teaching in the public schools is required. Required for the college provisional certificate. *Prerequisites: Educ. 1 previously or concurrently, Educ. 20 concurrently, consent of instructor.* First semester. Mr. Smith

Educ. 354. Practice Teaching of Secondary School Subjects (3)

An intensive practical application of the principles of teaching to classroom conditions. The class meets two hours each week. A minimum of 75 clock hours of supervised practice teaching in the public schools is required. Students must have at least one free hour at the same time each day throughout the week. Required for college provisional certificate. *Prerequisites: Educ. 353 and 15 semester hours in the subject area in which the candidate expects to teach, Educ. 352 concurrently.* Second semester. Mr. Smith

Educ. 356. Practice Teaching of Secondary School Subjects (3)

A continuation of Educ. 354. Teaching must be done in a field for which practice teaching credit has not been granted previously. *Prerequisites: Educ. 353 and 15 semester hours in the subject area in which the candidate expects to teach. Educ. 354 may be taken concurrently.* Second semester. Mr. Smith

Educ. 360. Personnel Practices in Business and Industry (3)

A study of the techniques and principles used in the understanding and treatment of industrial problems confronting the line organization. Personnel administration as both a line and staff function. Case studies used for discussion of employee services, wage administration, and building, training, and maintaining the labor force. *Prerequisite: Consent of instructor.* First or second semester. Messrs. Bracken, Brennan

Educ. 371. Educational Statistics (3)

Designed to give teachers and administrative officers the techniques necessary to enable them to gather data and present the results of their work in their classrooms and schools. Provides a practical knowledge of the simpler statistical methods for use in handling common problems and in understanding educational literature. First or second semester.

Messrs. Smith, Thomas

Educ. 373. Diagnostic and Remedial Teaching (3)

The analysis and treatment of difficulties in the various subjects. The student may select any subject in which he has adequate background as his field of work. Practice is given in the development of materials, and actual work with failing pupils is expected. First or second semester.

Mr. Oswalt

Educ. 390. Audio-Visual Education (3)

Types of audio-visual aids, the special value of each, their use in different subjects, the psychological basis for the use of such material, and the standards for the selection of these aids. Required for the permanent college certificate. First semester. Mr. Bream

Educ. 391-392. Workshop (3, 5, or 6)

Cooperative study of current educational problems. Designed to provide elementary and secondary school teachers an opportunity to work at their own teaching levels and in their own fields. Students will be limited to one workshop during a summer session but may eventually register for more than one, provided there is no duplication in subject matter. First or second semester. Messrs. Bream, Hayward

For Graduates

The major in education on the graduate level is intended for students preparing for school administration and supervision and for other types of public school positions as well as for specialists in elementary and secondary education. Preparation is offered for such positions as superintendent of schools, supervising principal, elementary principal, secondary principal, guidance counselor, and master teacher. All work is approved by the State Councils of Education of Pennsylvania and New Jersey.

At least four semester courses in education are prerequisite for a graduate major in this field. The prerequisites may be taken concurrently with a partial major program. Attention is called to Educ. 321, 330, 331, 350, 351, 360, 371, 373, and 390, all of which are open to advanced undergraduates and graduate students, and which may be taken as part of a major or as collateral work in education.

Educ. 419. Social Policy and Education (3)

A critique of the aims of education in the modern social order; the nature, needs, and adjustments of modern industrial society; the conflicting demands upon education by a changing civilization as represented by modern social points of view; the implications of contemporary American educational philosophy for democratic social progress. *Prerequisite: Educ. 331 or consent of instructor.* Second semester. Mr. Bream

Educ. 420. Advanced Educational Psychology (3)

Study and practice of techniques and methods involved in making a detailed psychological analysis of the pupil, particularly in relation to school problems. First or second semester. Mr. Smith

Educ. 421. Analytic and Remedial Reading Procedures and Practices (3)

A laboratory course in remedial procedures and practices in the teaching of reading. Provision is made for clinical practice with individual and small groups of children on the elementary or secondary level. Emphasis is placed upon the development of practical and informal techniques and materials for diagnosing reading difficulties and instructing retarded readers. *Prerequisite: Educ. 447A or 448.* First semester.
Mr. Mazurkiewicz

Educ. 422. Education of Exceptional Children (3)

Methods of instruction and provision of materials for children who differ markedly from the normal, i.e., gifted, subnormal, and maladjusted; the problems of the teacher in a system that makes little provision for the exceptional child. Actual case studies of pupils are required. First or second semester. Mr. Oswalt

Educ. 426. Special Problems in Education (3)

Intensive study in an area of education not adequately covered in currently listed offerings. The field of research will be varied to meet the special needs of advanced students of unusual ability and adequate preparation. First and second semester. Mr. Thomas and Staff

Educ. 432. Educational Sociology (3)

An analysis of the school as a social institution. This includes a consideration of man's cultural heritage and the function of education in preserving and improving it; group behavior relating to school problems; the integration of education with the life and institutions of the community and society; the social role of the teacher; social change and the school. First or second semester. Mr. Jacobi

Educ. 440. Foundations of Elementary Education (3)

The aims, organization, and materials of elementary education; characteristics of elementary school pupils; and a general treatment of the problems of elementary education. First or second semester. Mr. Bream

Educ. 443. Elementary School Administration (3)

The major problems of organization and administration of elementary schools; types of organizations, pupil promotion, time allotment, service agencies, and plant and equipment. Required for a principal's certificate. First or second semester. Messrs. Hayward, Kentopp

Educ. 444. The Elementary School Curriculum (3)

Problems of curriculum development in the first six grades; scope and sequence of learning experiences, program-making for different types of schools, units of instruction vs. special subjects, articulation, and similar problems. First or second semester. Messrs. Hayward, Kentopp

Educ. 446. Elementary School Supervision (3)

Methods, materials, organization, and evaluation of supervision. Each student will be required to develop a supervisory program for a subject or a school. First or second semester. Messrs. Hayward, Kentopp

Educ. 447. A-F. Current Problems in Elementary School Subjects (3)

A. Reading. B. Arithmetic. C. Social Studies. D. Science. E. Language Arts. F. Arts and Crafts. Selection, study, and development of problems with reference to the various levels of the elementary school. Special attention will be given to students' classroom problems. Classes will be limited to a consideration of one subject. First and second semesters.

Messrs. Hayward, Mazurkiewicz, Drumm, Kentopp, Shelly

Educ. 448. Reading in Secondary Education (3)

Principles and practices in reading instruction for secondary education, emphasizing identification of reading needs, approaches to reading instruction, and reading problems in content courses. *Prerequisite: Educ. 447A or consent of instructor.* First or second semester. Mr. Mazurkiewicz

Educ. 453. Secondary School Administration (3)

The major problems of organization and administration of secondary schools: program of studies, teaching staff, pupil personnel, plant and equipment, and community relationships. Required for a principal's certificate. *Prerequisite: Educ. 350 or its equivalent.* First or second semester.

Messrs. Granger, Johnson

Educ. 454. The Secondary School Curriculum (3)

Related to Educ. 453, but organized in such a way that it may be taken independently. Methods of study of curriculum problems, the selection of subject matter in various fields, the principles of program construction, and similar problems. *Prerequisite: Educ. 350 or its equivalent.* First or second semester. Mr. O'Neal

Educ. 456. Supervision in Secondary Schools (3)

Related to Educ. 453 and 454, but may be taken independently. The purpose of supervision, a program for the improvement of teaching, the evaluation of teaching, measurement, supervisory relationships, and similar

problems, involved in the supervision of instruction in secondary schools. *Prerequisite: Educ. 350 or its equivalent.* First or second semester.
Messrs. Granger, Johnston

Educ. 457. Modern Trends in Teaching (3)

Designed for the teacher in service and for principals who wish a knowledge of the most recent developments in the trends and techniques of teaching. Special attention is given to experimental studies in group method. Students will be sectioned on the basis of interest in elementary or secondary education. First or second semester. Messrs. Bream, Smith

Educ. 458. Extra-Curricular Activities (3)

A cooperative study in the philosophy and psychology supporting activity programs; their organization and administration. Emphasis will be given to the teacher's part in the program, e.g., clubs, student councils, homeroom and class organization, assemblies, publications, finance. First or second semester. Messrs. Granger, Johnston

Educ. 463. Public School Administration (3)

A systematic treatment of the problems of administration, local, state, and national. The newer developments which are modifying educational administration: state authorization and organization, the board of education, the superintendent of schools, personnel management, business administration, financial support, and public relations. First or second semester. Messrs. Thomas, Watkins, Farber, O'Neal

Educ. 464. Foundations of Curriculum Construction (3)

Principles of curriculum construction which underlie the reorganization of the program of studies for elementary and secondary schools. Consideration of the origin and background of the curriculum, methods of organization, state, county, and city programs, curriculum planning and development, techniques for developing materials, and similar pertinent topics. First or second semester. Mr. Bream

Educ. 466. Supervision of Instruction (3)

Analysis of the principles underlying the organization and supervision of instruction. Applications to specific teaching situations. No lines will be drawn between the elementary and the secondary school. First or second semester. Messrs. Johnston, Thomas

Educ. 468. Vocational Education (3)

The social basis for vocational education; present practices and trends in the major types of vocational education; recommendations for organization and administration of teaching problems; student employment; laws and regulations. First or second semester. Mr. Shuman

Educ. 469. A-C. Evaluation of Public Schools (3)

Evaluation of all aspects of the school program in terms of its philosophy and objectives. Criteria will be studied and applied to the instructional program, student activities, guidance, and the library, the school

staff, the school plant, and the school administration. Section A will deal with the elementary school. Section B will deal with the secondary school and Section C will deal with a survey of the public school system. First and second semesters. Mr. Granger, Mrs. Stewart

Educ. 472. Educational Tests and Measurements (3)

Selection of education tests, organization of a testing program, use of tests in classification, construction of classroom tests, use of tests, in improving teaching, and diagnosis of pupil difficulties. Students will be sectioned on the basis of interest in elementary or secondary education. For advanced work in this field attention is called to the seminar and individual research courses. First or second semester. Mr. Smith

Educ. 482 A-B. Educational and Vocational Guidance (3)

a. General Introduction (2)
General principles of guidance. Discovery of interests and abilities, study of occupations, study of educational opportunities, guidance activities, group programs, student personnel problems.

b. Organization of School Programs (1)
Analysis and development of homeroom programs, school programs, and community programs. First or second semester.
Messrs. Granger, O'Neal, Mrs. Bream

Educ. 483. Techniques of Counseling (3)

An intensive examination of personnel techniques including interviews, rating scales, and counseling by such means as lectures, demonstrations, and case histories. Case studies of selected students are required. Required for guidance counselor's certificate. First or second semester.
Mrs. Bream

Educ. 484. Occupations (3)

Trends in supply and demand of workers in various occupations; requirements for occupations; sources of descriptive materials; testing for occupational aptitude. Required for guidance counselor's certificate. First or second semester. Mrs. Bream, Mr. Shuman

Educ. 491-492. Seminars (3)

One seminar is organized in each half-year provided three or more students select such work. These courses do not duplicate the courses of individual research. It is the purpose of seminar courses to provide for cooperative study of special problems in the field of elementary and secondary education. First and second semester.
Messrs. Granger, Hayward, Johnston, Mazurkiewicz, Thomas, Bream, O'Neal

Educ. 493-494. Individual Instruction, Field Work, or Research (3)

Open to students with appropriate preparation and needs for pursuing independent investigation. The student must have shown interest in and capacity for advanced work in the chosen field, evidenced in part by an approved plan of work. First and second semesters. Mr. Watkins and Staff

Educ. 495-496. Seminars in School Administration (3-6)

Cooperative study of special problems in the field of school administration. Appropriate problems include: finance, building programs, public relations, teacher-personnel policies, business management, and school law. First and second semesters.

Messrs. Farber, Thomas, Watkins, O'Neal

Educ. 497 A-E. Administrative Clinics (3-6)

This course, open only to a selected group of advanced students, will concern itself with an examination of duties and responsibilities of the various types of school administrators through analysis of literature, courses, institutional and state programs, and especially clinics with school administrators and representatives of state and national organizations. Students will be sectioned according to their primary interests as follows: Section A, elementary school principals, Section B, secondary school principals, Section C, guidance counselors, Section D, superintendents of schools, and Section 1, reading specialist. First semester.

Staff

Educ. 498. Internship (3)

A follow-up of Educ. 497 designed to give a limited number of advanced students an opportunity to obtain experience as administrative assistants in selected school systems. Conference hours for students and staff members will be devoted to discussion of work and problems encountered by students in their internships. Each student is required to submit a report describing and appraising experience gained in this internship. Second semester.

Staff

ELECTRICAL ENGINEERING

Professors Karakash, Bewley, A. R. Miller
Associate Professor McCracken
Assistant Professors Teno, Larky
Messrs. Das, Hwang, Venkatesulu, Slocum, Holzinger

E.E. 100. Summer Work

During the vacation following the junior year, each student in electrical engineering is required to spend at least eight weeks getting practical experience in some approved industrial organization. A written report on the experience gained therein, is due on or before January 8. These reports should contain such calculations, photographs, drawings, and plots as each individual case may require.

E.E. 104. Circuit Analysis (5)

Electric and magnetic circuits. Complex numbers and the complex plane. Sinors and phasors. Loop and node analysis of networks. Fourier series. Network theorems. Network functions. Polyphase circuits. The course in-

cludes one 3-hour laboratory. *Prerequisites: Phys. 4; Math. 206; Phys. 110 concurrently.* First semester.

E.E. 106. Electrical Machinery (5)

Electrical, magnetic, and mechanical features of electrical machines. Analysis of direct current machines, transformers, and polyphase induction motors. This course includes one 3-hour laboratory. *Prerequisite: E.E. 104.* Second semester.

E.E. 108. Alternating Current Machines (3)

A continuation of E.E. 106. The electrical, magnetic, and mechanical features of synchronous generators, motors, and converters. *Prerequisite: E.E. 104.* First semester.

E.E. 109. Alternating Current Machine Laboratory (1)

Laboratory tests on synchronous generators, motors, and converters; measurement of constants; parallel operation, calculations. *Prerequisite: E.E. 108 concurrently.* First semester.

E.E. 110. Electronics (4)

A study of the fundamentals of electronic devices and circuits; motion of charged particles in metals, vacua, and semi-conductors; electrons in metals; electron emission; operating characteristics of electron tubes, diodes, and transistors. *Prerequisite: E.E. 104 or Phys. 32. Phys. 111 concurrently.* Second semester.

E.E. 111. Electrical Engineering Proseminar (1)

A weekly meeting for discussion of topics from the current journals of theoretical and applied electricity. Presentation of papers on assigned topics. *Prerequisite: Senior standing.* Second semester.

E.E. 133. Power System Analysis I (4)

Determination of transmission line constants; differential equations and solutions. General circuit constants. Regulation, efficiency. Symmetrical components. System faults. Sequence impedances of transmission lines, transformer banks; metering. *Prerequisite: E.E. 108 previously or concurrently.* First semester.

E.E. 141. Electronic Circuits (4)

Analysis of vacuum-tube and semi-conductor circuits. Operating characteristics of lumped and distributed parameter single- and multistage, unilateral and bilateral linear amplifiers. Factorization synthesis for multistage amplifiers and single-loop feedback amplifiers. Laboratory work and measurement techniques on lumped parameter transistor circuits. *Prerequisite: E.E. 110.* First semester.

E.E. 142. Electronic Circuits (4)

Continuation of E.E. 141. Signal flow analysis for feedback and transistor amplifiers. Oscillators, non-linear amplifiers, modulators, and demodulators. Principles of modulation and communication in the presence

of noise. Laboratory work and measurement techniques on lumped parameter transistor circuits. *Prerequisite: E.E. 141.* Second semester.

E.E. 143. Communication Networks (4)

Introductory theory of transmission lines. Application to problems in the voice, radio, and microwave range. Analysis of impedance transformation and matching techniques. Use of graphical methods and charts. The exponential line. Laboratory measurements on transmission lines. *Prerequisite: E.E. 110.* First semester.

E.E. 144. Communication Networks (4)

Continuation of E.E. 143. Introductory theory of two-terminal and four-terminal networks. Foster and Cauer forms. Determination of external network parameters. Matrix representation of networks. Filter theory. Laboratory measurements on transmission networks. Second semester.

E.E. 160. Electrical Circuits and Apparatus (3)

Theory and applications of direct-current and alternating-current circuits, electronics. Direct-current and alternating-current machines and apparatus. *Prerequisites: Math. 13, Phys. 4.* First or second semester.

E.E. 161. Electrical Problems (1)

A three-hour problem period to accompany E.E. 160. *Prerequisite: E.E. 160 concurrently.* First or second semester.

E.E. 162. Dynamo Laboratory (1)

Tests on direct-current and alternating-current circuits, apparatus and electronic devices. *Prerequisite: E.E. 160 concurrently.* First or second semester.

E.E. 232. Electric Transients (3)

Electrical, mechanical, and heat flow transients of circuits, transmission lines, electrical machinery; operational calculus, to include Fourier integral, Bromwich integral, Laplacian transform, and the direct operational method. *Prerequisite: E.E. 104.* First semester. Mr. Teno

For Advanced Undergraduates and Graduates

E.E. 331. Electric and Magnetic Fields (3)

The calculation and construction of electric and magnetic fields for conductors, plates, vacuum tubes, slots, teeth, etc.; analogous problems in fluid flow. The methods of the theory of functions of a complex variable and of Fourier series and integrals are introduced in sufficient detail to serve in the analytical work; the rules for freehand plotting are derived and applied. *Prerequisite: E.E. 108.* Second semester. Mr. Teno

E.E. 334. Transmission Line Transients (3)

Traveling waves; free and forced oscillations; reflections; transition points; multi-conductor systems; multi-velocity waves; attenuation and distortion; lightning surges; switching surges; arcing grounds; protective

devices; surges in transformer and machine windings. *Prerequisites: E.E. 133; E.E. 232.* Second semester. Mr. Teno

E.E. 336. Power System Analysis II (4)

Steady state and transient power limits of transmission systems; electromechanical characteristics of electrical machines and networks. *Prerequisites: E.E. 133; E.E. 337 and 338 concurrently.* Second semester. Mr. Miller

E.E. 337. Advanced Machine Theory (3)

The transient theory of A.C. machines; balanced and unbalanced conditions; time constants; approximate and rigorous solutions. *Prerequisites: E.E. 133; E.E. 336 concurrently.* Second semester. Mr. Miller

E.E. 338. Transients Laboratory (1)

An oscillographic laboratory study of transmission line transients, system stability, and machine transients. *Prerequisite: E.E. 337 concurrently.* Second semester. Mr. Miller

E.E. 345. Electromagnetic Theory (3)

Vector analysis; divergence, gradient, curl; Stokes' and Gauss' theorems; generalized coordinates; Maxwell's equations; Poynting's theorem; transmission, reflection and refraction of waves; retarded potentials; rectangular and cylindrical wave guides; radiation from antennae. *Prerequisite: E.E. 104.* Second semester. Mr. Slocum

For Graduates

Graduate students intending to major in electrical engineering must have completed a program of study equivalent to that required for the B.S. in E.E. at Lehigh University.

Graduate courses are given to qualified men from the industries of the surrounding district.

The following subjects may be considered as a part of the major field for an M.S. in E.E.: Math. 405, 406, 416, 431, 453, Phys. 363, 420, 421, 422, 423, 428, and 429, and Mech. 402, 411, 412, 421, 422.

E.E. 410. Theory of Vacuum Tubes (3)

Motion of electrons in electric and magnetic fields. Application to electron guns and beams. Detailed study of grid controlled tubes, klystrons, traveling wave tubes and magnetrons. Consideration of other topics related to vacuum tubes including noise, electron emission. First semester. *(Given in alternate years.)*

E.E. 413. Active Networks (3)

Vacuum tube and transistor circuits. Monostable, bistable, and astable transistor circuits and logic elements. Application to analogue and digital computer systems. Second semester. *(Given in alternate years.)* Mr. Larky

E.E. 433. Tensor Analysis of Electric Circuits and Machines (3)
The application of dyadics, matrices, and tensors to the theory of electric circuits and machinery; static networks, network theorems, vacuum tube circuits, transformers, and transmission lines. First semester. Mr. Bewley

E.E. 434. Tensor Analysis of Electric Circuits and Machines (3)
Continuation of E.E. 433. The generalized machine; equation of motion, voltage, torque, small oscillations and power for holonomic, nonholonomic and quasi-holonomic reference systems; applications to all machines constituting special cases of the generalized machine; the equations of Lagrange, Maxwell, and Maxwell-Lorentz are used as starting points in the general theory. Second semester. Mr. Bewley

E.E. 435. Power System Stability (3)
Power flow in electric circuits; steady state power limits of systems having synchronous and asynchronous machines with salient poles or round rotors; stability criteria; and other related topics. First semester. *(Given in alternate years.)* Mr. Miller

E.E. 436. Power System Stability (3)
Continuation of E.E. 435. Transient stability problems, including machine inertias, governor action, unbalanced system conditions, various excitation systems and exciter transient effects, and switching operation. Second semester. Mr. Miller

E.E. 437. Advanced A.C. Machine Theory (3)
The two-reaction theory of synchronous machines in the steady and transient states; harmonic analysis; field and armature time constants; direct and quadrature synchronous, transient, and sub-transient reactances; electrical and mechanical transients of electrical machines, both singly and in conjunction with external circuits; calculation of voltage, current, mechanical oscillations, and hunting, forces and torques; operation of machines under unbalanced conditions and faults; effect of variable excitation. Two lectures and one laboratory period per week. First semester. *(Given in alternate years.)* Mr. Miller

E.E. 438. Advanced A.C. Machine Theory (3)
Continuation of E.E. 437. Second semester. Mr. Miller

E.E. 441. Theory of Control Systems I (3)
Characteristic behavior of open- and closed-loop, linear, time-invariant systems. System synthesis and simulation with an analogue computer. System analysis and synthesis using Bode diagrams, Nichols charts, and Evans root locus methods. First semester. Mr. McCracken

E.E. 442. Theory of Control Systems II (3)
Application of the Wiener criterion to linear, time-invariant systems. Elements of stationary, stochastic processes; probability density functions, correlation functions, power density spectra, etc. Error minimization procedures for free- and semi-free configurations. Design of systems for minimum bandwidth. Second semester. *(Given in alternate years.)* Mr. McCracken

E.E. 443. Network Theory I (3)

Properties of driving-point and transfer functions; synthesis; realizability and positive-real functions. First semester. Mr. Larky

E.E. 444. Network Theory II (3)

Extension of E.E. 443. Consideration of distributed parameter circuits and determination of their external parameters. Microwave circuit theory and application to coaxial and waveguide networks. Microwave cavities. *(Given in alternate years.)* Mr. Karakash

E.E. 445. Radiation and Antennas (3)

Physical principles of radiation; plane and spherical waves. Directive radiations; directivity and effective area. Horns, slot antennas, and lenses. Second semester. *(Given in alternate years.)* Mr. McCracken

E.E. 450. Special Topics (3)

Selected topics not covered elsewhere in the curriculum.

ENGINEERING GEOPHYSICS

See Mining Engineering

ENGLISH

Professors Severs, Christensen, Strauch
Associate Professors S. B. Ewing, Hook, Armstrong
Assistant Professors Rights, Criswell, Dilworth
Emerson, Hartung, McMullen, Frakes, Greene, Hertz
Messrs. W. A. Neville, Paris, Hopkins, Collura,
Knies, Saderholm, Burger, Cook, Rhody

Freshman Composition

All students are required to complete successfully courses in freshman composition carrying a total of six credit hours toward graduation.

On the basis of their performance in preliminary tests given during freshman week, first semester freshmen are assigned to one of the three courses designed to meet their particular needs. Engl. 1 is taken by all whose preparation appears to have been adequate but who do not give evidence of outstanding ability. Students who demonstrate superior ability and training take Engl. 11. Those who do poorly in the preliminary tests are required to take Engl. 0. Engl.1 normally is followed by Engl. 2, and Engl. 11 by Engl. 12 in the second semester, while students who take

and pass Engl. 0 in the first semester enroll in Engl. 1 in the second. A student whose classwork shows that he has been placed in the wrong group may be transferred to a higher or lower group at any time during the year, if his instructor recommends and the head of the department approves the transfer.

Since Engl. 0 carries no credit toward graduation, students assigned to this course in their first semester are required to continue the study of freshman composition beyond the freshman year until the minimum requirement of six semester hours has been met.

Engl. 0. Elementary Composition (0)

Extensive practice in the fundamentals of composition. First and second semesters.

Engl. 1. Composition and Literature (3)

Practice in expository writing and the application of rhetorical principles; readings in expository prose; a rapid review of functional grammar. First and second semesters.

Engl. 2. Composition and Literature (3)

Continuation of Engl. 1. Further practice in expository writing in conjunction with readings in literature. *Prerequisite: Engl. 1.* First and second semesters.

Engl. 1X. English for Foreign Students (3)

Practice in reading, writing, and speaking the English language, with exercise in listening and notetaking. A substitute for Engl. 1 for foreign students who demonstrate a need. Open also to transfer and graduate students. *Prerequisite: Consent of head of department.* First semester.

Engl. 2X. English for Foreign Students (3)

Continuation of Engl. 1X. A substitute for Engl. 2 for foreign students who demonstrate a need. *Prerequisites: Engl. 1X or its equivalent and consent of head of department.* Second semester.

Engl. 11. Types of World Literature (3)

A course in composition and literature for superior students who do not need or who have had the basic training of Engl. 1 and 2. In addition to wide and thoughtful reading in world masterpieces, the course requires correct and effective writing of critical essays, original sketches, and documented research papers. Not open to students who have taken Engl. 36 First semester.

Engl. 12. Types of World Literature (3)

Continuation of Engl. 11. *Same prerequisites as Engl. 11.* Second semester.

English Literature and Advanced Composition

Students wishing to major in English literature should take as preliminary work Engl. 8 and 9, or such equivalent courses as may be recommended by the head of the department. They should then elect a total of ten advanced English courses in the junior and senior years. Students working for honors take a course in which they prepare a thesis as part of the honors requirement.

Engl. 4. A Study of the Drama (3)

Reading and critical study of types of drama; theories of the drama; the drama and the stage; the drama as a criticism of life. *Prerequisite: Engl. 2.* First semester.

Engl. 5. A Study of the Drama (3)

Continuation of Engl. 4. *Prerequisite: Engl. 2.* Second semester.

Engl. 7. A Study of the Short Story (3)

A critical study of the short story, English, American, and Continental. Class discussions, extensive collateral reading, and reports. *Prerequisite: Engl. 2.* Second semester.

Engl. 8. English Literature (3)

A survey of English literature from *Beowulf* through the Pre-Romantics, with selected readings. *Prerequisite: Engl. 2.* First semester.

Engl. 9. English Literature (3)

A survey of English literature from Wordsworth to Housman. *Prerequisite: Engl. 2.* Second semester.

Engl. 18. The Novel (3)

A study of a selection of novels as noteworthy works of literature. *Prerequisite: Engl. 2.* First semester.

Engl. 19. The Novel (3)

Chronological continuation of Engl. 18. *Prerequisite: Engl. 2.* Second semester.

Engl. 20. American Literature, 1607-1855 (3)

A survey of the major writers from the settlement of America to the Civil War. Lectures and class discussions. *Prerequisite: Engl. 2.* First semester.

Engl. 21. Modern American Literature (3)

A study of the development of American literature from Whitman to the present day. Lectures and class discussions. *Prerequisite: Engl. 2.* Second semester.

Engl. 35. Poetry (3)

The analytical and critical reading of poetry, to provide such acquaintance with idiom and technique that poetry may be read with pleasure and understanding. *Prerequisite: Engl. 2.* Second semester.

Engl. 36. Masterpieces of World Literature (3)

A study of great works selected from the literature of epic poetry, the drama, the romance, philosophy, and the essay to illustrate the humanistic traditions of Western civilization. Not open to students who have taken Engl. 11 or 12. *Prerequisite: Engl. 2.* First and second semesters.

Engl. 41. Business Letters (3)

Rhetorical and psychological principles and forms in modern business communication; practice in writing letters of inquiry, request, reply, acknowledgment, adjustment, credit, collection, sales, and application. *Prerequisite: Engl. 2.* First and second semesters.

Engl. 117. The Modern Play and Playwright (3)

Readings and discussion of the foremost American dramas and dramatists. Summer session.

Engl. 142. Technical Writing (3)

Study and practice in forms and methods of technical exposition, description, definition, classification; the technical report, abstract. *Prerequisite: Engl. 2.* First and second semesters.

Engl. 181. Undergraduate Thesis (3)

Open to advanced undergraduates who wish to submit theses in English. *Prerequisite: Consent of head of department.* First semester.

Engl. 182. Undergraduate Thesis (3)

Continuation of Engl. 181. *Prerequisite: Consent of head of department.* Second semester.

Engl. 183. Readings in English Literature (3)

Open to advanced students who wish to pursue special courses of reading in English literature. *Prerequisite: Consent of head of department.* First semester.

Engl. 184. Readings in English Literature (3)

Continuation of Engl. 183. *Prerequisite: Consent of head of department.* Second semester.

For Advanced Undergraduates and Graduates

Engl. 318. American Literature (3)

Movements that have shaped American thought and feeling as expressed in the national literature. Puritanism, Americanism, Romanticism, Transcendentalism, Individualism, the Civil War, Democracy, the West, Realism, Internationalism, and Skepticism, as presented by Jonathan Edwards,

Franklin, Paine, Longfellow, Poe, Emerson, Thoreau, Mark Twain, Henry James, and Henry Adams. Summer session. Mr. Strauch

Engl. 320. The Novel (3)

The great masterpieces of prose fiction produced in England, in America, and on the Continent during the nineteenth and twentieth centuries. Development of types of the novel. The theory and technique of the novel. Summer session. Mr. Dilworth

Engl. 321. Twentieth-Century Literature (3)

Present-day American literature. Collateral readings and reports. First semester. Mr. Strauch

Engl. 322. Twentieth-Century Literature (3)

Present-day English and European literature. Collateral readings and reports. Second semester. Mr. Strauch

Engl. 323. Shakespeare and the Elizabethan Drama (3)

The development of the English drama, including the important plays of Shakespeare. First semester. Mr. Hook

Engl. 324. Shakespeare and the Elizabethan Drama (3)

Continuation of Engl. 323. Second semester. Mr. Hook

Engl. 325. English Literature of the Romantic Era (3)

Poetry and prose of the chief romantic writers—Wordsworth, Coleridge, Scott, Byron, Shelley, Keats, Lamb, Hazlitt, DeQuincey—with consideration of the political, religious, and social problems of the period as they are exhibited in the literature. Readings and class discussions. First semester. Mr. Severs

Engl. 326. English Literature of the Victorian Era (3)

Poetry and prose of the chief Victorian writers—Tennyson, Browning, Arnold, Clough, Rossetti, Morris, Swinburne, Macaulay, Carlyle, Mill, Newman, Ruskin—with consideration of the political, religious, and social problems of the period as they are exhibited in the literature. Readings and class discussions. Second semester. Mr. Severs

Engl. 331. Milton (3)

The life and works of John Milton in connection with the history of his times and the chief sources of his inspiration. First or second semester. Mr. Emerson

Engl. 333. Restoration and Augustan Literature (3)

Prose and poetry from 1660 to 1745 with emphasis on the works of Dryden, Pope, and Swift. First or second semester. Mr. Dilworth

Engl. 334. Age of Johnson (3)

English prose and poetry from 1745 to 1798—Dr. Johnson and his circle, and the Pre-Romantics, including Burns and Blake. First or second semester. Mr. Dilworth

Engl. 335. History of the English Language (3)

A survey of the development of the English language, in vocabulary, pronunciation, and structure, beginning with its relation to the other Germanic languages and coming down to modern English usage. First or second semester. Mr. Ewing

Engl. 336. Writing for Publication (3)

Comprehensive study of the short-story and practice in the various techniques of writing short-stories, essays, and poems with a view to publication. First or second semester. Mr. Criswell

Engl. 337. The Renaissance (3)

The growth of English non-dramatic literature in the sixteenth century and the stimulus of the Italian Renaissance and northern humanism. Readings in and class discussions of the works of the chief writers—Petrarch, Erasmus, More, Wyatt, Surrey, Lyly, Sidney, and Spenser. First semester. Mr. Ewing

Engl. 338. The Seventeenth Century (3)

The rich variety of English literature from Donne to Dryden—Donne and the "Metaphysical School"; Johnson and "The Tribe of Ben"; Cavalier and religious poetry; the prose of Bacon, Browne, Burton, Walton, and Bunyan. Second semester. Mr. Armstrong

Engl. 339. Chaucer (3)

Reading and critical study of the chief works of Geoffrey Chaucer, with attention to his language and the background of his works. First or second semester. Mr. Hartung

For Graduates

Candidates for the master's degree majoring in English literature may qualify for the degree under either of two plans offered by the department. Under Plan I the candidate is required to complete successfully eight semester courses (twenty-four semester hours), and to write a thesis representing the equivalent of six hours of course work, but he is not required to take an examination covering the entire field. Under Plan II no thesis is required; but the student, in addition to completing successfully ten semester courses (thirty semester hours), must pass an examination, usually oral, covering the entire field of English literature. The candidate selects the plan better suited to his needs and abilities, upon the advice and with the approval of the head of the department.

If his needs and interests make it desirable for him to do so, the candidate for the master's degree is permitted to take collateral work in other departments to the extent of six semester hours in lieu of an equivalent amount in the major field.

Candidates for the doctor's degree are expected to master the subject matter of the entire field of English and American literature. Other requirements for the doctorate will be found on pages 161-165.

Students desiring to qualify for graduate degrees in this department should have taken as part of their undergraduate work at least twelve semester hours of advanced courses in English literature. Those with undergraduate deficiencies who are admitted because otherwise well qualified will be expected to make up such deficiencies in addition to satisfying the minimum requirements for the degree sought.

Engl. 420. Graduate Seminar (3)

An intensive study of the works of one or more English or American authors or of a type of literature. Summer session.

Messrs. Armstrong, Dilworth, Emerson, Ewing, Hook, Severs, Strauch

Engl. 421. Graduate Seminar (3)

An intensive study of the works of one or more English or American authors. Subject and instructor vary from semester to semester according to the need of the students and the wishes of the department. Courses available are Donne (Mr. Armstrong), Pope (Mr. Dilworth), Johnson's Literary Criticism (Mr. Dilworth), Prose Satire (Mr. Dilworth), Colonial American Literature (Mr. Emerson), Mark Twain and Henry James (Mr. Emerson), Milton (Mr. Emerson), Sir Philip Sidney (Mr. Ewing), Spenser (Mr. Ewing), Shakespeare's History Plays (Mr. Hook), Keats (Mr. Severs), Wordsworth (Mr. Severs), Emerson and Hawthorne (Mr. Strauch), Whitman and Melville (Mr. Strauch), Carlyle and Arnold (Mr. Strauch). First semester.

Messrs. Armstrong, Dilworth, Emerson, Ewing, Hook, Severs, Strauch

Engl. 422. Graduate Seminar (3)

Second semester.

Messrs. Armstrong, Dilworth, Emerson, Ewing, Hook, Severs, Strauch

Engl. 427. Old English (3)

A study of the Old English language and literature. First or second semester. Mr. McMullen

Engl. 429. Literary Criticism (3)

A course aimed to correlate and unify the student's previous work in literature by means of wide readings in critical literature and discussions of theories and schools of criticism. First semester. Mr. Ewing

Engl. 430. Literary Criticism (3)

Continuation of Engl. 429. Second semester. Mr. Ewing

Engl. 431. Graduate Thesis (3)
First semester. Mr. Severs and others

Engl. 432. Graduate Thesis (3)
Second semester. Mr. Severs and others

Engl. 433. Literature of the Fourteenth Century (3)
Types of medieval literature with special attention to Langland, Gower, Chaucer. Mr. Severs

Engl. 434. Chaucer (3)
A study of the life and works of Chaucer, with some attention to his chief contemporaries. Readings, reports, and class discussions. First semester. Mr. Severs

Engl. 435. Chaucer (3)
Continuation of Engl. 434. *Prerequisite: Engl. 434.* Second semester. Mr. Severs

Engl. 436. Bibliography and Methods of Research (3)
A study of the bibliographical tools essential to an advanced student of English literature. Survey of historical, or critical, bibliography, of both printed books and manuscripts; of practical bibliography, including direction in the compilation of a list of books and articles on an assigned subject and in the procedures of thesis writing; and of enumerative bibliography of English language and literature. First or second semester. Mr. Severs

SPEECH — RADIO — THEATRE

Professor Davis
Assistant Professors Rights, Barker, Vasilew

Speech Clinic
For the purpose of diagnosis and treatment of speech defects. Individual instruction provided for students with minor disturbances of voice and speech, as well as those with more serious handicaps. Open to all students in need of corrective treatment and to those desiring speech tests. By appointment. No credit.

Speech 11-13. Principles of Theatre Art (1)
The aesthetic process by which plays are translated into theatrical terms for the appreciation and enjoyment of all forms of dramatic art. Students enrolling for their first semester register for Speech 11; for their second semester, Speech 12, etc. First and second semesters.

Speech 21-23. Impromptu Speaking (1)
The organization and presentation of short expository speeches and of speeches for special occasions. Content drawn from contemporary events. Students enrolling for their first semester register for Speech 21; for their second semester, Speech 22, etc. First and second semesters.

Speech 30. Fundamentals of Speech (3)

A foundation course designed to develop knowledge of the basic principles of speech and ability to speak effectively on the platform. First and second semesters.

Speech 31. Business and Professional Speaking (3)

Development of speech for business and professional problems: technique of expository speaking; use of visual graphics; persuasive speaking applied to the emotional or analytical approach in selling; methods of interviewing; techniques of conference. First and second semesters.

Speech 32. Conference and Discussion (3)

The technique of investigation, analysis, evidence, inference, briefmaking, and refutation in oral argument; participation in the various forms of discussion—conference table, panel, and symposium—and in various types of debate—conventional, cross-examination, and direct clash. First and second semesters.

Speech 33. Parliamentary Procedure (1)

Study and drill in modern rules and methods of conducting organized group-deliberation. First and second semesters.

Speech 34-36. Debate (1)

A study of the principles and techniques of debate, analysis, evidence, reasoning, refutation, briefing, speech composition, and delivery skills. Members required to participate in the activities of the Debate Society. Students enrolling for their first semester register for Speech 34; for their second semester, Speech 35, etc. First and second semesters.

Speech 41. Broadcasting in America (3)

The exposition and analysis of the origin and growth of broadcasting, the forces which regulate, control, and shape it, and the influences which it wields. Four basic divisions in the course are: history of broadcasting, regulation of broadcasting, economics of broadcasting, and control and influence of broadcasting. Lecture and field trips. First semester.

Speech 51. Radio Workshop (3)

This course is designed to give the student basic training in the skills and techniques necessary to the effective employment and appreciation of the radio and television media. These skills range from simple manual ones to those requiring high intellectual and artistic abilities including operation of technical equipment, radio speech, various types of writing for radio and television, and the production of programs for radio and television. *Prerequisite: Consent of head of department of English.* Second semester.

Speech 61. Dramatics (3)

The practical technique and production of plays; acting, stage-lighting, scenic design and execution, and student direction of plays. Each member

must write either an original one-act play or a thesis upon any practical problems of the modern theatre. One play is presented each semester.

Speech 62. Dramatics (3)
Continuation of Speech 61. *Prerequisite: Speech 61.*

For Advanced Undergraduates and Graduates

Speech 260. Speech for the Teacher (3)
An orientation course in the field of speech for those engaged in classroom teaching or in directing extra-curricular speech activities. Discussion as a teaching device; integration of speech with other subjects; recognition of common defects of speech; modern emphases in speech contest; individual investigations, report, and conferences. Summer session. Mr. Davis

JOURNALISM

Associate Professor McFadden
Mr. Hutchins

Journalism majors must successfully complete at least four credits in Journ. 1-10, *Brown and White,* taking it during each semester of residence following the declaration of their major. They must also take Journ. 11, 12, 16, 17, 113, 115, 118, 120 and the following courses: Gk. 21 or Lat. 22, Govt. 352, Phil. 14 and 15.

Journ. 1-10. Brown and White (1)
Enrollment constitutes membership on the staff of the semi-weekly paper. Students enrolling for their first semester register for Journ. 1; for their second semester, Journ. 2, etc. First and second semesters.

Journ. 11. News Writing (3)
Definition, determinants, and components of news; news story structure and style; sources; interviewing; practice in gathering and writing news. First semester.

Journ. 12. Reporting of Public Affairs (3)
Reporting and writing news of government on the local, county, state, and federal levels; civil and criminal courts; labor, science, and entertainment news. *Prerequisite: Journ. 11.* Second semester.

Journ. 16. Law of the Press (3)
Constitutional development of freedom of the press; law of and defenses in libel; rights and responsibilities of the press. Second semester.

Journ. 17. Magazine Article Writing (3)
Writing and marketing non-fiction magazine articles. First semester.

Journ. 21. Creative Writing (3)
The study and writing of essays and short-stories (and verse, if requested), with a view to developing each student's particular talent. *Prerequisite: Engl. 2.* First semester.

Journ. 22. Creative Writing (3)
Continuation of Journ. 21. *Prerequisite: Engl. 2.* Second semester.

Journ. 111. Problems in Advanced Reportage (3)
Intensive practice in the reporting of complex events. First semester.

Journ. 112. Problems in Advanced Reportage (3)
Continuation of Journ. 111. Second semester.

Journ. 113. Editing (3)
Study of and practice in newspaper desk work; headline writing, make-up, and typography; selecting, editing, and rewriting news and feature copy; use of reference works and morgue. *Prerequisite: Journ. 11.* First semester.

Journ. 115. Interpretive Writing (3)
Editorial interpretation of current events; practice in interpretive writing, including editorials. *Prerequisite: Journ. 12.* Second semester.

Journ. 118. History of American Journalism (3)
English background of the American newspaper; development of press from Colonial days to the present; influence of newspaper on American life; contributions of outstanding journalists. Second semester.

Journ. 120. Journalism Proseminar (3)
Survey of the press in its relation to public affairs. Extensive research and reports. First semester.

FINANCE

Professors Bradford, F. B. Jensen
Associate Professor Schwartz
Assistant Professor Krouse

Fin. 123. Financial Institutions (3)
A study of credit and financial institutions, both non-monetary and monetary, with emphasis on commercial and savings banks and their functions, the nature and functions of money, credit creation and the Federal Reserve System, and international financial institutions. *Prerequisite: Eco. 4.* First and second semesters.

Fin. 125. Principles of Corporation Finance (3)
An intensive course covering the fundamentals of corporation finance in one semester. *Prerequisite: Eco. 3.* First and second semesters.

Fin. 130. Money and Banking (3)

A course dealing with the nature and functions of money and commercial banking, monetary and banking development in the United States, the value of money, international exchange, and monetary and credit policies. *Prerequisite: Fin. 123.* Second semester.

Fin. 241. International Trade and Finance (3)

Economic, commercial, and financial relations of nations, including economic organizations, basic principles and practices of international trade, finance, and investment. *Prerequisite: Eco. 4.* First semester.

Mr. Jensen

For Advanced Undergraduates and Graduates

Fin. 323. Investments (3)

A study, from the standpoint of the investor, of the various types of corporation and government securities, with special reference to owners' equities, comparative yields, and the machinery of investment, including stock exchange operation. *Prerequisite: Fin. 125.* First semester.

Mr. Krouse

Fin. 324. Investments (3)

A project course in investment analysis for advanced students who are already familiar with investment principles. Sources of data and analysis procedures; the securities of industrials, railroads, public utilities, and municipalities. *Prerequisite: Fin. 323.* Second semester. Mr. Krouse

Fin. 326. Problems in Financial Management (3)

Continuation of Fin. 125. Consideration is given to the financial policies of management, with considerable emphasis placed on the corporation's relationship to government and the general economy. *Prerequisite: Fin. 125.* Second semester. Mr. Schwartz

Fin. 331. Bank Credit Management (3)

A course dealing with the problems surrounding the extension of loans to customers and the purchase of open market paper by the individual banker. Legal regulations and restrictions, the instruments of bank credit extension, and the analysis of the bank borrower's credit position will be treated in detail. *Prerequisite: Fin. 130 or 123.* Second semester.

Mr. Krouse

Fin. 332. Monetary-Fiscal Policy (3)

A course devoted to the study of monetary, credit, and fiscal policies of governments and central banks with particular reference to policies of the United States Treasury and the Federal Reserve System. Current problems will receive special emphasis. *Prerequisite: Fin. 130 or 123.* First semester.

Mr. Schwartz

Fin. 342. International Trade and Finance (3)

Continuation of Fin. 241. *Prerequisites: Fin. 241, or Fin. 130, or Fin. 123.* Second semester. Mr. Jensen

Fin. 351. Public Finance: Federal (3)

A course dealing with government expenditures and revenues, the economics of taxation, and government administration. *Prerequisite: Eco. 4.* First semester. Mr. Schwartz

Fin. 352. Public Finance: State and Local (3)

The major issues regarding revenues, expenditures, debt and budgeting policy will be examined in the light of fiscal principles and economic effects. Particular attention will be given to current practices in Pennsylvania and contiguous states. *Prerequisite: Fin. 351.* Second semester.
Mr. Schwartz

Fin. 371. Readings in Finance (3)

A course of readings in various fields of finance, designed for the student who has a special interest in some field of finance not covered by the regularly rostered courses. *Prerequisite: Consent of head of department.* First semester. Staff

Fin. 372. Readings in Finance (3)

Continuation of Fin. 371. *Prerequisite: Consent of head of department.* Second semester. Staff

For graduate program see Business Administration

FINE ARTS

Professor Quirk
Mr. Redd

F.A. 1. Survey of Painting and Sculpture (3)

A basic history of man's artistic expression in painting and sculpture from prehistoric times through the High Renaissance. Lectures. First semester.

F.A. 2. Survey of Painting and Sculpture (3)

Manneristic, baroque, rococco, Nineteenth Century and Contemporary expression. Lectures. Second semester.

F.A. 3. Pre-Renaissance Architecture (3)

A study of man's expression through architecture from prehistoric through the Romanesque period. Conditioning influences, evolution of styles, the development of organic and inorganic types, are studied in relation to structural purposes. Lectures. First semester.

F.A. 4. Architects and Architecture (3)

Comparable to F.A. 3. Factors determining the development and spread of Gothic, Renaissance, and succeeding styles, the effects of discovery and exploration, the rise of romantic, classic, functional, international, and con-

temporary movements are examined as periodic expression. Principles of appreciation and aesthetic character in the scientific age. Lectures. Second semester.

F.A. 15. Italian Renaissance Art (3)

Painting and sculpture are examined as the outgrowth of conditions in Italy during the fourteenth, fifteenth, and sixteenth centuries: the influence of medieval thought and tradition, the awakening interest in nature, the effect of antiquity, especially the stimulus it gave to individual effort. Lectures. Open to all classes. First semester.

F.A. 16. Art in the United States (3)

A survey of architecture, painting, and sculpture; including colonial America, traditional influences, periods, and styles. The evolution of American Art. Contemporary Expression and the understanding of art as a reflection of its time. Lectures. Second semester.

F.A. 19. Nineteenth Century Art (3)

Painting and sculpture from Neoclassicism through the developments of Romanticism, Naturalism, Impressionism, and Expressionism from Goya to Van Gogh. Lectures. Second semester. Odd-numbered years.

F.A. 20. Form and Milieu in Twentieth Century Art (3)

The developments of modern art through various schools and movements from 1890 to the present, showing their relationship to their environment. Second semester. Even-numbered years.

F.A. 31. Elements of Art (3)

Elementary techniques in representation, color theory, composition, surface anatomy, design theory are taught with the use of various media preliminary to the practice of guided creative expression. Portrait models, casts, still life precede landscape study. For beginners and trained students. Evaluation based on individual advancement in the sequential, assigned projects. Studio. First semester.

F.A. 32. Elements of Art (3)

Essentially the same as F.A. 31 for beginners. Advanced students extend experience and range of media. Emphasis is placed on more effective control of basics, the establishment of individual style, and the incorporation of aesthetic principles in assigned as well as original projects. Studio. Second semester.

F.A. 33. Painting Practices and Principles (3)

Focus is on the broader aspects of creative expression and the effective production of paintings designed to accent an area of optional specialization. Assignments in complimentary areas, research and experimentation in combined media. *Prerequisites: F.A. 31 or 32; consent of head of department.* Studio. First semester.

F.A. 34. Painting Practices and Principles (3)

Similar to F.A. 33. Further penetration of manners and means of expression in chosen area and style. Easel and mural painting. Assigned projects. *Prerequisites: F.A. 31 or 32; consent of head of department.* Studio. Second semester.

F.A. 41. Basics in Architecture (3)

An introduction to rendering, three-dimensional forms, utility, organization of space. Perspective, color, textures of materials, site, and light. Emphasis on contemporary design. Plans. For beginners and trained students. *Prerequisites: Either engineering drawing, architectural drawing, or field experience; or consent of head of department.* First semester.

F.A. 42. Contemporary Architectural Design (3)

Further study in techniques. Plans and details, models, design problems. Integration of function and visual satisfaction. For beginners and trained students. *Prerequisites: Either engineering drawing, architectural drawing, or field experience; or consent of head of department.* First semester.

F.A. 131. Advanced Studio Practice (3)

Primarily for students with thorough art foundation. Painting, drawing, graphics. Industrial projects. Woodblock, etching, oil painting, silverpoint, tempera. *Prerequisite: Consent of head of department.* First semester.

F.A. 132. Advanced Studio Practice (3)

Continuation of F.A. 131. Familiarization with variety of media and techniques. *Prerequisite: Consent of head of department.* Second semester.

Art Galleries

The Lehigh Art Gallery, located on the second floor of the University Library, is the scene of a series of "meet the artist" teas and receptions for exhibitors. Monthly exhibitions provide a continuous showing of prints, drawings, sculpture, and paintings by American and foreign contemporary artists. Gallery hours are 2 to 5 on Sundays, Tuesdays, Wednesdays, and Thursdays, with campus family and community welcomed.

The North and South Galleries of the Alumni Memorial Building are devoted to separate scheduling of exhibitions on a six weeks basis. These Galleries are open from 9 to 5 daily and 9 to 12 Saturday mornings. The annual exhibition of Contemporary American Paintings, Print Exhibitions, Intercollegiate and Alumni Arts and Hobbies Exhibitions are presented here, as are private collections, items from the permanent collection, and work of invited artists.

In several nearby offices units from the permanent collection of Student Paintings may be seen.

In the University Center contemporary American paintings from the collection of Mr. and Mrs. Ralph L. Wilson are shown. This expanding collection is located in the Tom Girdler Gallery Lounge and adjacent areas.

The music room and student card rooms are hung with prints and paintings appropriate to these areas. Numerous other paintings, either loans or gifts, decorate other major Center rooms.

The Cort Room houses framed original contemporary prints. This display, a series of "miniature exhibitions," was made possible by the freshmen of the Class of 1962.

The departmental offices and study areas in Coppee Hall house the collection of etchings, drypoints, lithographs, and engravings, providing basic study material for research. Here, too, is located the collection of more than ten thousand lantern slides and numerous viewers which permit further study or reference. From here are rented more than four hundred framed reproductions for student and faculty use.

Gallery talks, discussions, and lectures are frequently scheduled for on-campus or visiting groups. A continuing reflection of current tendencies in American contemporary expression is presented through the permanent and rotating collections. Guide service may be obtained for groups of ten or more as a Department of Fine Arts service.

FRENCH

See Romance Languages

GEOLOGY

Professor Gault
Associate Professors Whitcomb, Ryan,
Tuominen, G. R. Jenkins
Assistant Professor Chave
Messrs. Mentzer, Bieller, Mackenzie, Rooth

Geol. 1. Principles of Geology (3)

Fundamental concepts of geology; the composition, structure, and development of the earth; processes of geologic change. Lectures, laboratory work, and field trip. First and second semesters.

Messrs. Ryan, Whitcomb

Geol. 2. Principles of Geology (3)

A continuation of Geol. 1 for non-major students. A summary of earth history considering the development of the continents, life of the past, economic products, and weather factors. Lectures, laboratory work, and field trips. *Prerequisite: Geol. 1.* First and second semesters.

Mr. Whitcomb

Geol. 6. Engineering Geology (4)

Designed primarily for students in civil engineering. Basic geologic principles; selected minerals, rocks, building materials, geologic structures; applications of geology to such problems as dam sites, tunnels, foundations, highways, underground water, and flood control. Three lectures and one laboratory period or field trip per week. Second semester.

Geol. 12. Historical Geology (3)

The development of the continents and life forms; evolution based on the remains of animal and plant life preserved on the rocks. Lectures, laboratory, and field trips. *Prerequisite: Geol. 23 or consent of head of department.* Second semester. Mr. Whitcomb

Geol. 23. Structural Geology (3)

The major and minor rock structures of the earth's crust. Problems of the type encountered in geological, geophysical, and mining work are studied in the laboratory and field. *Prerequisite: Geol. 1 or 6.* First semester. Mr. Tuominen

Geol. 34. Minerals and Rocks (3)

Elements of crystallography, mineralogy, and petrology; megascopic study and identification of common minerals and rocks. Lectures and laboratory work. *Prerequisite: Chem. 4.* Second semester. Mr. Tuominen

Geol. 141. Field Geology (3)

Principles and methods of geologic mapping and field work. Preparation of a report and geologic map based on field work by each student in a specific area. *Prerequisites: Geol. 23, 34.*

For Advanced Undergraduates and Graduates

Geol. 257. Introduction to Economic Geology (3)

The formation of mineral deposits and the occurrence and characteristics of deposits of economic importance. Includes metals, non-metals, and fuels. Lectures, laboratory work, and inspection trips. *Prerequisites: Geol. 12 and 34.* First or second semester. Messrs. Gault, Chave

Geol. 281. Geological Research (1-3)

Independent investigation of a special problem in the field, laboratory, or library. *Prerequisite: Consent of head of department.* First semester.

Staff

Geol. 282. Geological Research (1-3)
Similar to Geol. 281. May be elected as a continuation or separately. *Prerequisite: Consent of head of department.* Second semester. Staff

Geol. 311. Paleontology (3)
Morphology of invertebrate fossils, their use in interpreting geologic history; evolution of the faunas and floras. Lectures and laboratory work. *Prerequisite: Biol. 1 or 11.* First semester. Mr. Whitcomb

Geol. 312. Stratigraphy and Sedimentation (3)
Study of sedimentary rocks: their geologic distribution and megascopic and microscopic characteristics. Lectures, laboratory work, and field trips. *Prerequisite: Geol. 333.* Second semester. Mr. Chave

Geol. 333. Crystallography and Mineral Optics (4)
Minerals as crystalline materials with special emphasis on crystal optics; crystal morphology and internal structures; projections and measurements; the polarizing microscope; identification of minerals by the immersion method and in thin-section. Lectures and laboratory work. *Prerequisite: Phys. 16 or 4.* First semester. Messrs. Gault, Ryan

Geol. 334. Theoretical Petrology (4)
Evolution of crystalline rocks and their distribution in space and time; physical and chemical factors in igneous and metamorphic processes. Microscopic study of rocks. Lectures, laboratory work, and field trips. *Prerequisite: Geol. 333.* Second semester. Messrs. Ryan, Tuominen

Geol. 337. Chemical Geology (3)
Processes controlling the distribution of elements in the lithosphere, hydrosphere, atmosphere, and biosphere. *Prerequisite: Geol. 312 or consent of head of department.* Messrs. Chave, Gault

Geol. 339. Techniques in Geochemistry (1-2)
Study of chemical and physical analytical techniques as applied to earth materials; problems of sampling. Laboratory work. *Prerequisite: Geol. 337, previously or concurrently.* Messrs. Chave, Gault

Geol. 351. Geology of Fuels (2)
The geology and geochemistry of oil, gas, and coal. *Prerequisite: Geol. 312 or consent of head of department.* Mr. Chave

Geol. 352. Industrial Minerals and Rocks (2)
The geology and economic characteristics of non-metallic minerals and rocks. Lectures and inspection trips. *Prerequisite: Geol. 257 or consent of head of department.* Mr. Gault

Geol. 364. Hydrometeorology (3)
Analysis of the hydrologic cycle with emphasis on atmosphere processes; frequency analysis and problems of forecasting hydrometeorologic

events. Lectures, laboratory work, and field trips. *Prerequisite: Major in geology, biology, or natural resources, or consent of head of department.* Second semester. Mr. Jenkins

Geol. 374. Geology of Soils (3)

Factors in soil formation; soil classification; problems of utilization of soil resources. Lectures, laboratory work, and field trips. *Prerequisite: Major in geology, biology, or natural resources, or consent of head of department.* Second semester. Mr. Jenkins

Geol. 390. Problems of Geology (3)

History and present status of controversial basic geologic problems. *Prerequisite: Geol. 312 or consent of head of department.*

Messrs. Chave, Tuominen

For Graduates

Geol. 411. Advanced Paleontology (4)

Classification, evolution, biometrics, and paleoecology; study of fossil and modern populations and assemblages. Lectures and laboratories. *Prerequisite: Geol. 311.* First or second semester. Messrs. Chave, Whitcomb

Geol. 414. History of Geology (2)

The growth of geologic thought from the Greeks to the present; the great geologists, their theories, controversies, and contributions. Reading, conferences, preparation of reports. Second semester. Mr. Whitcomb

Geol. 416. Vertebrate Paleontology (3)

The origin and evolution of the several classes of vertebrate animals based upon paleontology and comparative osteology. Lectures, laboratory work, and museum trips.

Geol. 417. Sedimentary Petrography (3)

The theory and application of petrographic methods in the study and classification of sedimentary rocks. *Prerequisite: Geol. 312, 332.* First semester. *(Offered alternate years.)* Mr. Ryan

Geol. 418. Sedimentary Petrogenesis (3)

The origin and development of sedimentary rock types; mineral provenance, environment of deposition, diagenesis, sediments in time, stratigraphic synthesis. *Prerequisite: Geol. 417.* Second semester. *(Offered alternate years.)* Mr. Ryan

Geol. 421. Tectonics (3)

The major structural features of the earth's crust and the problems of crustal instability; the relationships between major and minor structures; distribution of rock types as related to crustal deformation. First semester. *(Offered alternate years.)* Mr. Tuominen

Geol. 422. Tectonics (3)

Continuation of Geol. 421. Second semester. *(Offered alternate years.)* Mr. Tuominen

Geol. 424. Advanced Structural Geology (3)

The theory and application of analytical methods in the study of rock deformation: experimental deformation, petrofabric analysis; statistical field methods. Second semester. *(Offered alternate years.)* Mr. Ryan

Geol. 435. Advanced Mineralogy (3)

Topics of contemporary interest in mineralogy. *Prerequisite: Chem. 302 or equivalent.* First semester. *(Offered as required.)* Messrs. Chave, Gault, Ryan

Geol. 436. Advanced Mineralogy (3)

Similar to Geol. 435. *Prerequisite: Chem. 302 or equivalent.* May be elected separately. Second semester. *(Offered as required.)* Messrs. Chave, Gault, Ryan

Geol. 437. Igneous and Metamorphic Processes (3)

Selected problems on crystalline rocks. Lectures, conferences, assigned reading, field trips. First semester. *(Offered alternate years.)* Mr. Tuominen

Geol. 438. Igneous and Metamorphic Processes (3)

Continuation of Geol. 437. Second semester. *(Offered alternate years.)* Mr. Tuominen

Geol. 456. Ore Deposits (3)

Advanced study of the origins and geochemistry of ore deposits. Mr. Gault

Geol. 458. Ore Mineralogy (1-3)

Phase relations of the ore minerals, experimental studies of ore mineral textures and associations; ore microscopy. Mr. Gault

Geol. 461. Marine Geology (3)

Chemical and physical oceanography; marine ecology; modern sediments. First semester. *(Offered alternate years.)* Mr. Chave

Geol. 462. Paleoecology (3)

Reconstruction of paleoenvironments based on principles of paleoecology and sedimentary petrology. *Prerequisite: Geol. 461.* Second semester. *(Offered alternate years.)* Mr. Chave

Geol. 481. Geological Investigation (1-6)

Research on a special problem; field, laboratory, or library study; report required. Credit above three hours granted only when a different problem is undertaken. First semester. Staff

Geol. 482. Geological Investigation (1-6)

Similar to Geol. 481. Credit above three hours granted only when a different problem is undertaken. Second semester. Staff

Geol. 483. Thesis (3)
May be elected only by master's degree candidates. First semester. Staff

Geol. 484. Thesis (3)
Continuation of Geol. 483. Second semester. Staff

Geol. 490. Special Topics (3)
An extensive study of selected topics not covered in more general courses. First semester. *(Offered as required.)* Staff

Geol. 491. Special Topics (3)
Similar to Geol. 490. May be elected separately. Second semester. *(Offered as required.)* Staff

GEOPHYSICS

See Mining Engineering

GERMAN

Associate Professors Tremper, Wood
Assistant Professor Gardner
Messrs. Glebe, Watt

All new students with preparation in German who wish to take courses in the language during their first year at Lehigh and all other students who have had work in the language and wish to resume the study of it after an interruption of more than one semester are expected to take the placement test given during freshman week. The results of this test will be taken into consideration in determining the appropriate course for each such student.

To insure adequate provision being made for them, all students other than first-semester freshmen who plan to take the test should notify the Office of Placement, Testing, and Counseling (Christmas-Saucon Hall) at least one month before the beginning of Freshman Week.

Ger. 1. Elementary German (3)
Drill in the fundamentals of German grammar; pronunciation; simple conversation and composition; extensive outside reading of simple vocabulary-building tests. No previous study of German required. First and second semesters.

Ger. 2. Elementary German (3)

Continuation of Ger. 1. *Prerequisite: Ger. 1.* First and second semesters.

Ger. 6. Elementary German for Science Students (3)

A course paralleling Ger. 2, but using, to the extent that suitable material is available, reading texts more directly related to the professional objectives of science and engineering students. Open only to students majoring in the natural sciences and engineering. *Prerequisites: Ger. 1 or the equivalent; consent of the head of the department.* Second semester.

Ger. 11. Intermediate German (3)

German prose and poetry; outside reading; composition. *Prerequisite: One year of college German or two units of entrance German.* First semester.

Ger. 12. Intermediate German (3)

Continuation of German 11. *Prerequisite: Ger. 11.* Second semester.

Ger. 27. Scientific German (3)

Reading of material of a more advanced type than that read in Ger. 6, with stress on chemistry and physics. *Prerequisites: Ger. 2, 6, or 11, or three units of entrance German; sophomore standing or consent of the head of the department.* First and second semesters.

Ger. 31. Conversation and Composition (3)

Remedial exercises in grammar; phonetics; conversation and composition stressing situations taken from daily life. *Prerequisites: Ger. 12, or Ger. 11 and 27, or three units of entrance German; consent of the head of the department.* First semester.

Ger. 32. Conversation and Composition (3)

Continuation of Ger. 31. Oral and written reports, personal and business letters, fundamentals of good style. *Prerequisite: Ger. 31.* Second semester.

Ger. 33. Types of German Literature (3)

Lectures and reading assignments on the development of German literature from the beginning through the Classical Period; reading of texts representative of various periods and individual writers. *Prerequisites: Ger. 12, or Ger. 11 and 27, or three units of entrance German.* First semester.

Ger. 34. Types of German Literature (3)

Continuation of Ger. 33, covering developments from the end of the Classical Period to approximately the downfall of Naturalism. *Prerequisites: Ger. 12, or Ger. 11 and 27, or three units of entrance German.*

Ger. 36. Goethe's Faust (3)

Study of Part I; lectures on the origin and development of the Faust story; collateral reading. *Prerequisites: Ger. 33 or 34, or three units of entrance German and consent of the head of the department.* Second semester.

Ger. 201. The Classical Period (3)

Selected works from the Classical Period not covered in Ger. 33, 34, and 36. *Prerequisite: Equivalent of three years of college German.* First semester. Mr. Wood

Ger. 202. The German Novelle (3)

Study of the origin and history of the *Novelle* and of contributions by outstanding writers. *Prerequisite: Equivalent of three years of college German.* Second semester. Mr. Glebe

Ger. 203. Nineteenth Century German Drama (3)

Survey of developments and reading of outstanding dramatic works in German literature from the Classical Period through the age of Naturalism. *Prerequisite: Equivalent of three years of college German.* First semester. Mr. Tremper

Ger. 204. Medieval German Literature (3)

Study of the Middle High German Period, with the reading of selected works in New High German translation. *Prerequisite: Equivalent of three years of college German.* Second semester. Mr. Watt

Ger. 205. Twentieth Century Literature (3)

Study of developments since the downfall of Naturalism; reading of works illustrative of trends and authors. *Prerequisite: Equivalent of three years of college German.* First semester. Mr. Glebe

Ger. 250. Special Topics (3)

Study of literary and linguistic topics not covered by regular courses, or continuation of study of topics begun in regular courses. *Prerequisite: Equivalent of three years of college German.* First or second semester.

GOVERNMENT

See History and Government

GREEK

See Classical Languages

HISTORY AND GOVERNMENT

Professors Harmon, Schulz, Tresolini
Associate Professors Kyte, Cowherd, Yates
Assistant Professors Haight, Hale, Dowling
Messrs. Quay, Smith, Lesser, Marcus

HISTORY

Hist. 11. Development of Western Civilization (3)

The roots of Western civilization; the evolution of economic, social, and political institutions; the impact of scientific and technological developments; the influence of major trends of thought. Required of all freshman engineering students. First semester.

Hist. 12. Development of Western Civilization (3)

The modern Western world; the rise of the nation-state; the occident and the orient; the rise and decay of the older imperialisms; the role of science and idealism in both peace and war in the twentieth century. Required of all freshman engineering students. Second semester.

Hist. 13. United States History (3)

The era of constitution-making; the evolution of political parties; foreign relations during the wars of the French revolutionary period; the western movement and western state-building; the growth of sectionalism. First semester.

Hist. 14. United States History (3)

The war for the Union; the reconstruction of the South; the era of big industry and labor combinations; the United States as a world power; the new national paternalism. Second semester.

Hist. 15. English History (3)

The history of the rise and growth of English political and social institutions prior to 1603. First semester.

Hist. 16. English History (3)

The history of the development of English political and social institutions from the death of Elizabeth to the present. Emphasis is placed upon the political and intellectual legacy bequeathed to the modern world as a result of this development. Second semester.

Hist. 25. European History (3)

A rapid survey of some of the major historic forces from the collapse of the Roman Empire to the end of the seventeenth century. First semester.

Hist. 26. European History (3)

Continuation of Hist. 25. A survey of major developments in European history from about the year 1700 to the middle of the twentieth century. Second semester.

Hist. 29. Modern Europe (3)

The study of revolution and reaction in western Europe between 1789 and 1870. Emphasis is laid upon the birth, growth, and spread of nineteenth-century liberal doctrines as well as upon the attempts made to stifle that growth by every political and diplomatic means available. Summer session.

Hist. 30. Modern Europe (3)

A study of contemporary Europe; the origins and consequences of two World Wars; the rise of revolutionary governments in Italy, Germany, and Russia. Summer session.

Hist. 49. History of Latin America (3)

A survey of the Spanish and Portuguese colonization of America and the struggles for independence, preceded by a brief view of the ancient American civilizations and the Iberian backgrounds. First semester.

Hist. 50. History of Latin America (3)

Continuation of History 49. The development of the Latin American nations in the nineteenth and twentieth centuries. Second semester.

Attention is called also to the following courses in history offered by other departments: Eco. 1, Industrial Evolution; Gk. 21, Ancient History; Lat. 22, Ancient History; Gk. 183, The Economic and Social Life of the Greeks; Lat. 184, The Economic and Social Life of the Romans.

For Advanced Undergraduates

Hist. 151. The Civilization of the Middle Ages (3)

Consideration will be given to political institutions, economic activity, and cultural and intellectual developments in Medieval Europe to the early Renaissance.

Hist. 152. The Renaissance and Reformation (3)

Within the political and economic framework of the era, study will be made of the culture of the Renaissance, and the religious conflicts resulting from the crisis in the sixteenth century Church.

For Advanced Undergraduates and Graduates

Hist. 319. Seventeenth Century America (3)

The founding and growth of English, French, and Dutch colonies in North America. Attention will be paid to motives behind European expansion as well as to developments in the colonies. Mr. Kyte

Hist. 320. Eighteenth Century America (3)

Continuation of Hist. 319. American political, economic, and cultural developments including the War for American Independence and the founding of a new nation. Mr. Kyte

Hist. 321. United States History, 1789 to 1877 (3)

The development of the American people from the establishment of the Republic to the end of Reconstruction in the South. Consideration will be given to political, economic, and cultural developments with special emphasis on westward expansion, Jacksonian democracy, and the Civil War crisis. Mr. Dowling

Hist. 322. United States History Since 1877 (3)

The urbanization and industrialization of American society and the political, social, and economic effects thereof. Special emphasis will be placed on economic and political developments. Mr. Dowling

Hist. 327. Development of American Institutions (3)

The colonial origin and national expansion of social, cultural, religious, and economic institutions to 1865. First semester. *(Not offered, 1960-61.)* Mr. Dowling

Hist. 328. Development of American Institutions (3)

A continuation of History 327. Developments from the Civil War to the present, with emphasis on industrialization, urbanization, the populist and progressive movements, and social changes as factors in institutional development. Second semester. *(Not offered, 1960-61.)* Mr. Dowling

Hist. 329. American Foreign Policy (3)

The French alliance; independence and boundaries; commercial restrictions; French Revolution and neutrality; purchase of Louisiana; War of 1812; acquisition of Florida; Monroe Doctrine; relations with France and Great Britain, Oregon and Texas; the Mexican War; the Civil War and possible European intervention. First semester. Mr. Harmon

Hist. 330. American Foreign Policy (3)

The diplomatic moves, 1865-1898; War with Spain; the new Caribbean policies; the World War of 1914-1918 and its aftermath; diplomatic events preceding Pearl Harbor; outbreak and prosecution of the war; plans for peace. Second semester. Mr. Harmon

Hist. 333. A Proseminar in United States and Pennsylvania History for Teachers (3)

This course is designed to meet the certification requirement of the Pennsylvania State Council of Education that all teachers in the public schools should have a course in United States history in which particular emphasis is placed upon the history of Pennsylvania. The following topics will be stressed in the proseminar: American colonization; racial origins; the beginnings of agriculture, industry, and commerce; the expansion of the frontiers; the movement for independence; constitution-framing; the party system of government; cultural tendencies and progress toward social betterment; the problem of states' versus national rights; the era of great industry. Summer session. Mr. Harmon

Hist. 345. England, 1066-1603 (3)
The foundation and growth of English political, religious, and economic institutions from the Norman Conquest to 1603. Mr. Cowherd

Hist. 347. The British Empire, 1603-1848 (3)
The expansion of the English-speaking people from 1603 to 1848; the origins of self-government; the founding of the Empire in Asia and Africa; the role of Great Britain in world affairs. Mr. Cowherd

Hist. 348. The British Empire and Commonwealth Since 1848 (3)
The expansion of the Empire in Asia and Africa since 1848; the growth of federalism and self-government; the independence movements in Ireland and India; the formation of the Commonwealth; the impact of two World Wars; the decline of the Empire since the Second World War. Mr. Cowherd

Hist. 353. European History, 1648 to 1848 (3)
A study will be made of the conditions and forces that led from the absolutism of Louis XIV to the revolutions of 1848. Special attention will be placed upon the French Revolution and its impact upon Europe. Mr. Haight

Hist. 354. European History Since 1848 (3)
Liberalism, socialism, and nationalism which produced the revolutions of the mid-nineteenth century and the mass conflicts of the twentieth century. Mr. Haight

Hist. 355. The Intellectual Expansion of Modern Europe, 1300 to 1700 (3)
A study of the heritage bequeathed to modern Europe by the cultural achievements and traditions of the Renaissance, Reformation, and the 17th century. Special attention will be paid to scientific and technological development and to the growth of political thought and theory during these centuries. First semester. *(Not offered, 1960-61.)* Mr. Haight

Hist. 356. The Intellectual Expansion of Modern Europe, 1700 to the Present (3)
A continuation of the preceding course, the enlightenment to the present, with special attention paid to the effect upon modern thought of the industrial revolution and the rapid advancement in technology. Second semester. *(Not offered, 1960-61.)* Mr. Haight

Hist. 365. Modern Latin America (3)
Individual investigation and reports on selected nineteenth and twentieth century topics valuable for an understanding of present Latin American culture. *Prerequisite: Hist. 49, 50, or the consent of the head of the department.* Mr. Hale

Hist. 366. Modern Latin American (3)
Continuation of History 365. *Prerequisite: Hist. 49, 50, or the consent of the head of the department.* Mr. Hale

Hist. 371. Special Topics in History (3)
Intensive study in an area of history not adequately covered in currently listed offerings. The field of research may be varied from time to time and the course may be administered as a reading program or otherwise as may best seem fit to meet the needs of students of unusual ability and adequate preparation. *Prerequisite: Consent of the head of department.*

Hist. 372. Special Topics in History (3)
Continuation of Hist. 371. *Prerequisite: Consent of the head of department.*

For Graduates

Graduate students desiring to major in history should have had at least twelve semester hours of undergraduate work that bear upon this field or in other ways should satisfy the department that they are in a position to undertake profitably the required program of study.

Candidates for the master's degree may qualify either by completing successfully thirty hours of approved course work and passing an examination covering the entire field or by completing twenty-four hours in approved courses and submitting a satisfactory thesis. Each candidate will select, upon the advice and with the approval of the head of the department, the plan better suited to his needs and abilities.

All graduate students majoring in history are expected to take Hist. 401, Methods in Historical Research.

Hist. 401. Methods in Historical Research (3)
Technique of research along the lines of historical method; training in the critical handling of documentary materials, in measuring the value of evidence, and in formal presentation of the results of research. Required of all graduate students in history and government. First semester. Mr. Kyte

Hist. 402. Historiography (3)
In this course the emphasis will be placed upon historiography. Second semester. Mr. Kyte

Hist. 403. Modern Europe, 1789-1870 (3)
The French Revolution; Napoleon; Congress of Vienna and reconstruction of Europe; industrial revolution and subsequent social reforms; France and Germany; democracy and nationalism; Second French Empire; unification of Italy and Germany. First semester. Mr. Haight

Hist. 404. Modern Europe Since 1870 (3)
Latin and Teutonic Europe; Great Britain and Ireland; Russia and the Dardanelles; Turkey and Europe; nationalism and the new imperialism;

World War I and the Treaty of Versailles; League of Nations; national socialism vs. democracy; thirst for power; World War II and its aftermath. Second semester. Mr. Haight

Hist. 411. England under the Tudors (3)

An intensive study of political, economic, and social history during the period 1485-1603. First semester. Mr. Cowherd

Hist. 412. England under the Stuarts (3)

An intensive study of political, economic, and social history during the period 1603-1760. Second semester. Mr. Cowherd

Hist. 413. Modern England—The Age of Reform, 1760-1890 (3)

A study of industrial England, liberal and humanitarian reforms, and the growth of colonial self-government. First semester. *(Not offered, 1960-61.)* Mr. Cowherd

Hist. 414. Modern England—The Age of Conflict, 1890 to the Present (3)

The growth of socialism, the rise of the Labor Party, the expansion of empire, formation of the Commonwealth, and the origins and consequences of two World Wars will be studied. Second semester. *(Not offered, 1960-61.)* Mr. Cowherd

Hist. 421. English Colonization in North America in the Seventeenth Century (3)

The activities of the overseas trading companies, proprietors, and royal governors, and the founding and development of the English colonies in the West Indies and along the shores of North America. First semester. Mr. Kyte

Hist. 422. America in the Eighteenth Century (3)

A continuation of Hist. 421, with emphasis upon the workings of the mercantile system, the evolution of colonial institutions, the development of imperial administration, and the causes, events, and results of the wars with France and the War for American Independence. Second semester. Mr. Kyte

Hist. 423. American Constitutional History (3)

The major problems involved in the growth of the powers of the national government. Summer session. Mr. Harmon

Hist. 424. American Constitutional History (3)

Continuation of Hist. 423. Summer session. Mr. Harmon

Hist. 425. The United States, 1776-1800 (3)

Revolutionary movement and the Revolution; patriots and loyalists; diplomats and diplomacy; early state constitutions and the Articles of Confederation; Constitutional Convention of 1787 and the Constitution; Federalists in control; plots and conspiracies; rise of the Republican party; downfall of the Federalists. First semester. *(Not offered, 1960-61.)* Mr. Harmon

Hist. 426. The United States, 1800-1850 (3)

Jeffersonian democracy; territorial expansion; War of 1812; new nationalism; sectionalism; protective tariffs; slavery and expansion; Texas; Mexican War; compromise measures of 1850. Second semester. *(Not offered, 1960-61.)* Mr. Harmon

Hist. 427. The United States, 1850-1898 (3)

Background of the Civil War; rise of the Republican party; Buchanan's policy; election of 1860; Lincoln's attitude; views of Northern and Southern leaders; war powers of the President; downfall of the Confederacy; reconstruction; Grant's administration; big business; organized labor; granger movement; Bryan and silver; Cuba and Spain. Mr. Harmon

Hist. 428. The United States Since 1898 (3)

Causes and results of the Spanish-American War; insular possessions; Theodore Roosevelt's policies; Progressive movement; Wilson and reform; World War I; speculative 1920's; the great depression; Democrats in control; Franklin D. Roosevelt's domestic and foreign policies; aftermath of World War II. Mr. Harmon

Hist. 431. America as a World Power (3)

The results of the Spanish-American War; the United States' Pacific possessions; Theodore Roosevelt and world affairs; Knox and "Dollar Diplomacy"; World War I; American neutrality; the United States as a belligerent; the Treaty of Versailles. First semester. Mr. Dowling

Hist. 432. America as a World Power (3)

The United States and the League; the reconstruction of Europe; the rise of Hitler; World War II and its aftermath; the Monroe Doctrine; the Good Neighbor Policy; the problems of the Pacific; China and Japan; Japan and the United States; the War with Japan; Red China and the Korean crisis. Second semester. Mr. Dowling

GOVERNMENT

Govt. 1. The Foundations of Government (3)

A survey of the basic principles and problems of governmental organization and operation, with emphasis on controversial issues and on the relevant political institutions and practices, both contemporary and past, of American, European, and Asiatic peoples. First and second semesters.

Govt. 2. American Political Ideas (3)

A survey of the ideas underlying and associated with the political institutions and practices of the United States. Second semester.

Govt. 3. Foreign Governments (3)

The governmental systems of foreign countries: the parliamentary systems of Great Britain and France; authoritarian government in the

U.S.S.R.; democratic and authoritarian regimes in various other countries of Europe and the Americas. *Prerequisite: Sophomore standing.* First semester.

Govt. 4. Political Parties (3)

The organization, functions, and techniques of political parties; pressure groups and pressure politics; nomination and election methods. Second semester.

Govt. 6. Democracy (3)

An analysis of the theory and the practice of democratic government in selected countries. *Prerequisite: Sophomore standing.* Second semester.

Govt. 51. American National Government (3)

Constitutional principles; organization and operation of the national government; the party system, citizenship, and civil rights. *Prerequisite: Sophomore standing.* First semester.

Govt. 52. American State and Local Government (3)

The position of the states in the union; machinery and functions of state governments; nominations and elections; the various systems of local government. *Prerequisite: Sophomore standing.* Second semester.

Govt. 101. History of Political Thought (3)

History of leading political ideas. Analysis of the views of representative ancient, medieval, and modern political philosophers of the western world. First semester.

For Advanced Undergraduates and Graduates

Govt. 351. Constitutional Law (3)

The law of the Constitution as expounded by the Supreme Court of the United States. First semester. Messrs. Schulz, Tresolini

Govt. 352. Civil Rights (3)

A study of constitutional guarantees designed to protect the individual against arbitrary, unreasonable, and oppressive government. Freedom of speech and of the press, religious freedom, freedom of assembly, property rights. Constitutional problems concerning crime and its punishment. Second semester. Messrs. Schulz, Tresolini

Govt. 354. Administrative Law (3)

Consideration of the authority, procedures, and methods utilized by executive agencies in the administration of public policy. Analysis of the general problem of adjusting the administrative process to traditional constitutional principles. Second semester. Mr. Tresolini

Govt. 357. City Government (3)

The machinery and processes of city government in the United States; city-state and federal-city relations; the problems of metropolitan areas; forms of city government, with special emphasis on the operation of the council-manager plan. First semester. Mr. Schulz

Govt. 359. Law-making (3)

Organization and procedure of legislative and constituent assemblies. Legislative leadership. Role of administrative and judicial agencies in law-making. Pressure groups, parties, and policy determination. Direct legislation. First semester. Mr. Tresolini

Govt. 360. Public Administration (3)

The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary systems; forms of administrative responsibility. Second semester.

Messrs. Schulz, Tresolini

Govt. 363. Contemporary Political Thought (3)

Analysis of the fundamental concepts of political science. The nature of the state, nationalism, sovereignty, law, and liberty. Constitutions; unitary and federal systems of government; authoritarianism and democracy. First semester. Mr. Schulz

Govt. 364. Contemporary Political Thought (3)

Recent thought concerning the ethical basis of political authority and the proper role of the state in society. Analysis and appraisal of anarchism, individualism, socialism, communism, syndicalism, fascism, and other doctrines. Second semester. Mr. Schulz

Govt. 371. Readings (3)

Readings in political science assigned to properly qualified students in consideration of their special interest in particular political institutions and practices. *Prerequisite: Consent of the political science staff.* First semester.

Govt. 372. Readings (3)

Continuation of Govt. 371. *Prerequisite: Consent of the political science staff.* Second semester.

For Graduates

Graduate students desiring to major in political science should have had at least twelve semester hours of undergraduate work bearing on this field or should satisfy the department in other ways that they are qualified to pursue the required program of study.

Candidates for the master's degree in political science may qualify by completing thirty hours of approved course work and

passing an examination covering the entire field or by completing twenty-four hours of approved courses and submitting a satisfactory thesis. The choice between these plans shall be made by each candidate upon the advice and with the approval of the head of the department.

All graduate students seeking the master's degree in political science shall enroll for a minimum of eighteen hours of courses in the political science field. International relations courses fall in the political science category. At least twelve hours are to be selected from the following courses, *viz.,* Govt. 451 and 452, American Political Institutions, Govt. 463 and 464, Political Theory, and Govt. 471 and 472, Foreign Governments. Appropriate courses in other fields, among them economics, history, philosophy, social psychology, and sociology, may be selected to meet the total of hours required for the master's degree.

Govt. 451. American Political Institutions (3)

The federal and state constitutions; Congress and the state legislatures; the presidency; state governors; the judicial system; political parties; nomination and election methods; local government; the council-manager plan. First semester. Mr. Tresolini

Govt. 452. American Political Institutions (3)

Continuation of Govt. 451. Second semester. Mr. Tresolini

Govt. 463. Political Theory (3)

Theories pertaining to the nature of the state, its organization, and its functions. Authority, law, and liberty; the issue of state sovereignty; doctrines respecting the legitimate objectives of government and the proper sphere of political authority. First semester. Mr. Schulz

Govt. 464. Political Theory (3)

Continuation of Govt. 463. Second semester. Mr. Schulz

Govt. 471. Foreign Governments (3)

The theory and development of constitutions, governments, and parties in Great Britain and the Commonwealth countries. First semester. Mr. Yates

Govt. 472. Foreign Governments (3)

The nature and development of governmental systems in France, Italy, Germany, the U.S.S.R., and countries of Central Europe. Second semester. Mr. Yates

HONORS SEMINARS

Honors Seminars are open only to students admitted to the College Honors Program (see pages 69-71), or, in unusual circumstances, to special students approved by the Honors Council. Enrollment is limited.

Seminars are conducted with a combination of lectures, student reports, and discussion. Emphasis is placed on the development of the student's ability to conduct, report on, and defend independent research. In addition to the scheduled seminar hours, there will be personal conferences with the instructor.

Course titles indicate only the general area in which a seminar will be conducted. The particular concepts to be considered and the material to be studied will be determined by the instructor with the concurrence of the Honors Council.

Creative Concepts 101. The Humanities (3)

A study of concepts significant in man's attempts to understand himself as an individual, his place in and his relation to the universe, the meaning of his existence, and the way in which he should live. Material is drawn chiefly from literature, philosophy, religion, and the fine arts and music.

Creative Concepts 102. The Life Sciences (3)

A study of concepts significant in man's efforts to understand and to control the living world of which he is a part. Material is drawn primarily from biology, psychology, and geology, but also, because of the ultimate inseparability of the natural sciences, from chemistry and physics.

Creative Concepts 103. The Physical Sciences (3)

A study of concepts significant in man's efforts to understand and use the physical universe in which he lives. Material is drawn primarily from chemistry, physics, mathematics, and astronomy, but also, because of the ultimate inseparability of the natural sciences, from biology and geology.

Creative Concepts 104. The Social Sciences (3)

A study of concepts significant in man's attempts to understand himself as a social being, his beliefs as to how men should live together and the means he has used to achieve social order. Material is drawn, depending on the orientation of individual seminars, from the political and social sciences.

INDUSTRIAL ENGINEERING

Professors Gould, Richardson
Associate Professor Monro
Assistant Professors Kane, Brennan, W. A. Smith
Messrs. G. L. Smith, Jacobs

I.E. 40. Machine Shop Practice (3)

A course given for three weeks during the summer following the sophomore year in conjunction with the Bethlehem Vocational High School. The theory of metal removing and welding processes are covered in lecture with laboratory practice in the operation of various hand tools, machines, and welding equipment. Summer Session.

I.E. 100. Industrial Employment

Following the junior year, students in the industrial and mechanical engineering curriculum are required to do a minimum of eight weeks of practical work, preferably in the work they plan to follow after graduation. A report is required. *Prerequisite: Sophomore standing.*

I.E. 105. Thesis (3)

Candidates for the bachelor's degree in industrial engineering may, with the approval of the department staff, undertake a thesis as a portion of the work of the senior year. *Prerequisite: Senior standing.*

I.E. 110. Engineering Economy (3)

Quantitative analysis of engineering proposals with emphasis on economic factors including recovery of first cost with a rate of return, depreciation, incremental costs, and breakeven point costs; operations economy including optimum order size, crew size, and performance ratios. *Prerequisites: Eco. 3, 4.* First semester.

I.E. 114. Plant Administration (3)

The manufacturing plant, its organization, and operation. Lectures, problem exercises, trips, and collateral reading. First semester. *Prerequisite: Math. 233, previously or concurrently; or Psych. 24.*

I.E. 115. Personnel Administration (3)

Industrial personnel, their selection, training, care, and reward. Lectures, problem exercises, and collateral reading. Second semester. *Prerequisite: Math. 233 or consent of instructor.*

I.E. 116. Plant Administration (3)

Continuation of I.E. 114. *Prerequisites: I.E. 114, Math. 233.* Second semester.

I.E. 140. Mfg. Processes Laboratory (1)

Experiments in application of metal cutting theory with emphasis on the economics of metal removal. Testing of tool life, tool materials, cut-

ting fluids, and determination of machinability of materials. *Prerequisite: I.E. 40, Met. 63.*

I.E. 162. Industrial Management (3)

A course in the essential problems of organization and management of industrial enterprises. Planned for students other than those in engineering. *Prerequisites: Eco. 3, 4.* First semester.

I.E. 164. Industrial Management (3)

An abridgment of I.E. 114 and I.E. 116. Planned primarily for engineering students other than those in industrial engineering. *Prerequisites: Eco. 3, 4.* Second semester.

For Advanced Undergraduates and Graduates

I.E. 321. Experimental Industrial Engineering (3)

Experimental projects in selected fields of industrial engineering, approved by the instructor. A written report is required. *Prerequisite: Senior standing in industrial engineering and consent of instructor.* Staff

I.E. 322. Experimental Industrial Engineering (3)

Continuation of I.E. 321. *Prerequisites: Senior standing in industrial engineering and consent of instructor.* Staff

I.E. 325. Production Control (3)

The coordination of an industry's activities to produce its commodities in sufficient quantity, of proper quality, and at the right time, for the least possible cost. Lectures, problem exercises, trips, and term projects. *Prerequisites: I.E. 110, 116.* Second semester. Mr. Gould

I.E. 326. Quality Control (3)

Industrial inspection methods; interpretation of results, based upon statistical techniques for improvement of product quality, for better coordination between design, production, and inspection, and for reduction of cost. Lectures, problem exercises, trips, and term project. *Prerequisites: I.E. 116, Math. 234.* First semester. Messrs. Monro, W. A. Smith

I.E. 328. Work Simplification (3)

Process and product simplification, involving method study, time study, and other analysis techniques. Lectures, problem exercises, trips, and term project. *Prerequisites: I.E. 114; Math. 234, or Psych. 324.* First and second semesters. Mr. Richardson

I.E. 329. Wage and Salary Administration (3)

The theory and practice of job evaluation, employee merit rating, and community wage surveys for the purpose of establishing salary levels which provide proper payment for various jobs, reward individual effort and merit, and meet competition. Lectures, problem exercises, and trips. *Prerequisite: I.E. 115.* First semester. Mr. Brennan

I.E. 330. Industrial Relations (3)

The policies, organization, and operation of an industrial relations department, based upon existing governmental regulations and current policies of organized labor. Lectures, problem exercises, and term project. *Prerequisite: I.E. 115.* Second semester. Mr. W. A. Smith

I.E. 340. Production Engineering (3)

Capabilities of manufacturing processes. Analysis of tool requirement and design of jigs and fixtures and special tooling. Application of metal processing theory to product manufacturing and engineering materials utilization. Term project. *Prerequisites: I.E. 140, M.E. 102, Math. 234.* Mr. Kane

I.E. 350. Industrial Engineering Problems (2)

Comprehensive study of problems encountered in manufacturing, with special attention to quantitative methods of problem analysis including such topics as sampling controls, queueing theory, mathematical programming, probability theory, design of experiments. *Prerequisite: Senior standing in industrial engineering.* Messrs. Gould, Monro

For Graduates

The prerequisite for graduate work in industrial engineering is a course of study equivalent to that required for the B.S. in I.E. at Lehigh University. Graduates of other engineering curricula may be required to devote additional time to prerequisite and basic courses. Subject to proper approval, a graduate major may include a maximum of nine hours from the following two groups with no more than six hours from each group: (1) "400" level courses in other branches of engineering; (2) Psych. 422, Industrial Fatigue; Eco. 431, Managerial Economics; Eco. 433, Labor Management Economics.

I.E. 400. Management Policies (3)

Analysis of the factors entering into the determination of management policies; discussion of case material bearing upon the organization, location, growth, size, and control of types of industries. First semester. Mr. Richardson

I.E. 402. Personnel Policies (3)

Analysis of the factors entering into the determination of personnel policies; discussion of case material bearing on the worker and his relation to industry. Second semester. Mr. Gould

I.E. 405. Special Topics in Industrial Engineering (3)

An intensive study of some special field of industrial engineering. Staff

I.E. 406. Advanced Methods and Time Study (3)

A critical evaluation of methods and time study procedures and research techniques including systems analysis, motion picture techniques, ratio

delay studies, predetermined standard times, and the construction of standard data. Mr. Richardson

I.E. 407. Operations Analysis and Control (3)

A study of planning and control activities in a manufacturing organization with emphasis on quantitative techniques of analysis. Mr. Gould

I.E. 408. Data Processing (3)

Introduction to data processing by computers, with particular emphasis on manufacturing control applications. Includes basic punched card principles and operation; flow charting; design of classification codes; methods of data storage; types of commercial digital computers, and their characteristics, peripheral equipment types; requirements and characteristics; remote transmission systems; integrated data processing systems; and bases for cost evaluation of feasibility studies. Lectures; demonstrations; tours; practice exercises; visiting discussants; individual research reports; and student projects using the LGP-30 computer.

Mr. W. A. Smith

I.E. 409. Industrial Engineering Standardization (3)

Identification of the basic variables that exist in industrial engineering problem-solving techniques and investigation of the means for standardization of these variables. Techniques analyzed for standardization include motion and time study, metal process planning, statistical quality control, and production planning and control. Mr. Kane

INTERNATIONAL RELATIONS

Associate Professors Joynt, Dunlap
Assistant Professor Braddick
Mr. Groom

I.R. 1. Diplomacy (3)

Elements of international politics; scrutiny of the methods and objectives of diplomacy, with particular emphasis upon illustrative examples drawn from contemporary affairs, portraying the forces and ideas molding the actions of statesmen, acting within and outside the established national and international institutions.

I.R. 2. Diplomacy (3)

Continuation of Int. Rel. 1. Second semester.

I.R. 11. The Diplomacy of Europe 1815-1919 (3)

The development of alliances and other associations of nations, with resultant tensions and frictions; the causes of successive wars; the character of peace settlements; the formation of international institutions. First semester.

I.R. 12. The Diplomacy of Europe Since 1919 (3)

Continuation of I.R. 11. Second semester. *(Not offered Spring, 1961.)*

I.R. 21. The Diplomacy of the Far East to 1919 (3)

The opening of China and Japan; the transformation of Japan; the partition of China; international rivalries in Korea, Manchuria, the Philippines, Southeastern Asia, and the Indies; economic and territorial imperialism. First semester.

I.R. 22. The Diplomacy of the Far East Since 1919 (3)

An analysis of recent and contemporary political and economic problems confronting not only the countries of the Orient but the Western powers with interests in that region; Japan's aspirations to establish a New Order in Greater East Asia; frustration and remotivation of Japan; the spread of communism and its consequences; prerequisites for peace and security in the Far East and the Pacific region. Second semester.

I.R. 133. The Diplomacy of Russia and the Middle East to 1917 (3)

Development and expansion of the Russian Empire; principles of Russian foreign policy and their specific applications under the Tsarist and Provisional Governments, treated partially as backgrounds of Soviet policy; interaction between Russian domestic and foreign affairs. First semester.

I.R. 134. The Diplomacy of Russia and the Middle East Since 1917 (3)

A topical and chronological survey of Russian foreign relations in the Soviet period; philosophical, psychological, economic, social, and other factors influencing the formulation and execution of foreign policy; interaction between Soviet domestic and foreign affairs. First and second semester.

For Advanced Undergraduates and Graduates

I.R. 312. World Affairs Since 1919 (3)

The peace treaties of 1919; ideals and realities of the League of Nations, efforts to effect disarmament; resurgence of power politics as displayed by the German-Italian-Japanese Axis; appeasement; frustration; the war of 1939-1945; post-war occupation of Axis countries; problems of reconciliation of conflicting objectives and interest among the victors. Summer session. *(Offered Spring, 1961.)* Messrs. Joynt, Braddick

I.R. 322. The Far East in World Affairs (3)

Japanese and other quests for hegemony through extension of influence and control; decline of Western prestige and power; movements toward independence; nationalism; the struggle of China against internal and external enemies. Summer session. Messrs. Joynt, Braddick

I.R. 334. The Soviet Union in World Affairs (3)

An appraisal of the objectives and tactics of Soviet diplomacy, with particular emphasis upon Russian status as one of the great powers and upon contemporary Soviet-American relations and their backgrounds. *Prerequi-*

site: I.R. 134 or consent of the head of the department. (Offered Summer, 1960.) Mr. Dunlap

I.R. 341. International Relations (3)

Basic concepts in World politics; elements in international cooperation in dealing with historic and current issues of international politics. *Prerequisite: Consent of head of department.* First semester. Mr. Joynt

I.R. 342. International Relations (3)

Continuation of I.R. 341. *Prerequisite: Consent of head of department.* Second semester. Mr. Joynt

I.R. 351. International Organization (3)

Constitutional and political character of successive agencies of international organizations, with emphasis upon the League of Nations. First semester. Mr. Braddick

I.R. 352. International Organization (3)

Continuation of I.R. 351, with emphasis upon the United Nations. Second semester. Mr. Braddick

I.R. 361. International Law (3)

Consideration of the principles and rules generally recognized as binding upon the community of nations in time of peace; recognition of the existence and termination of states; nationality and protection of persons; acquisition and loss of territory; control over territorial waters; piracy; asylum; state responsibility and international claims. Mr. Dunlap

I.R. 362. International Law (3)

Principles applicable to the conduct of hostilities in wartime; rules of war; treatment of prisoners; transfer of property; establishment and disposition of "war guilt"; recognition of governments instituted by force; problems of neutrality. Second semester. Mr. Dunlap

I.R. 371. Readings in International Relations (3)

Directed studies and readings in the several fields of international relations, designed for the student who has a special competence or interest in some area not covered by regularly rostered courses. *Prerequisite: Consent of the head of the department.* First semester. Staff

I.R. 372. Readings in International Relations (3)

Continuation of I.R. 371. *Prerequisite: Consent of the head of the department.* Second semester. Staff

For Graduates

Candidates for the master's degree may qualify either by completing successfully thirty hours of approved course work and passing an examination covering the entire field or by completing

twenty-four hours in approved courses and submitting a satisfactory thesis. Each candidate will select the plan better suited to his needs and abilities, upon the advice and with the approval of the head of the department, and will be required to take a comprehensive oral examination. In addition, each candidate is normally expected to possess an adequate reading knowledge of one modern foreign language.

Subject to proper approval, a graduate major may include two "400" level courses chosen from history or government. Appropriate courses in economics, philosophy, psychology, and sociology are also recommended.

I.R. 441. Seminar in International Relations (3)
Intensive analysis in selected forces and problems of world politics. First semester. *(Offered 1960-61.)* Mr. Joynt

I.R. 442. Seminar in International Relations (3)
Continuation of I.R. 441. Second semester. *(Offered 1960-61.)* Mr. Joynt

I.R. 451. Seminar in International Organization (3)
Intensive analysis of selected agencies and activities of the League of Nations and affiliated institutions. First semester. *(Offered 1962-63.)* Mr. Joynt

I.R. 452. Seminar in International Organization (3)
Continuation of I.R. 451, with emphasis upon the United Nations. Second semester. *(Offered 1962-63.)* Mr. Joynt

I.R. 461. Seminar in International Law (3)
Intensive analysis of the principal theories concerning the nature of international law and its fundamental conceptions, with special studies of their application and significance in contemporary international society. First semester. *(Offered 1961-62.)* Messrs. Dunlap, Braddick

I.R. 462. Seminar in International Law (3)
Continuation of I.R. 461. Second semester. *(Offered 1961-62.)* Messrs. Dunlap, Braddick

ITALIAN

See Romance Languages

JOURNALISM

See English

LATIN

See Classical Languages

LAW

See Accounting

MARKETING

See Economics

MATHEMATICS AND ASTRONOMY

Professors Raynor, Shook, Pitcher, Wilansky
Associate Professors Cutler, Latshaw, Beale, Hailperin, Hsiung*, Monro
Assistant Professors Van Arnam, Soble
Messrs. Gulden, Rayna, Nassar, Oglesby, Sloyer, Berg, Bouchelle, Hilt, Miller, Reyes, Barnes, Heck, Hsieh, Lebovitz, Lerche, Packard, Roberts, Mrs. Gravez

Students who offer for entrance elementary and intermediate algebra, plane geometry, and plane trigonometry and whose proposed course of study requires Math. 11 are required to take a placement test in mathematics during Freshman Week. Those whose performance in the test is unsatisfactory must take and pass Math. 0 before being allowed to enroll in Math. 11.

MATHEMATICS

Math. 0. Mathematics Review (0)
A review of algebra and plane trigonometry. First semester.

Math. 1. Plane Trigonometry (3)
First semester.

Math. 3. Introduction to Mathematical Analysis (3)
A selection of the mathematics underlying natural processes. A study of logical processes and the concepts of number; function; with the emphasis on understanding rather than mastery of technique; but with the realization that understanding is impossible without some mastery of technique. Logic; groups and fields; the number system; function concept; algebraic, exponential, and logarithmic functions. First semester.

Students who have not completed a course in plane trigonometry and who plan to take Math. 4 should take Math. 1 concurrently with Math. 3.

*On leave of absence, 1959-60.

Math. 4. Introduction to Mathematical Analysis (3)

Continuation of Math. 3. Analytic geometry and calculus; statistics and probability. *Prerequisites: Math. 1 or entrance credit in plane trigonometry, and Math. 3.* Second semester.

Math. 10. General Mathematics for Students of Business (3)

Review of elementary algebra; graphs and charts, the straight line law, the law of the parabola; logarithms; arithmetic and geometric progression; the exponential law; the power law; curve fitting, permutations, combinations, and probability. First and second semesters.

Math. 11. Analytic Geometry and Calculus I (3)

The straight line; functions and graphs; differentiation of algebraic functions and of the sine and cosine; velocity and acceleration; related rates; maxima and minima; indefinite and definite integrals; area. *Prerequisite: Math. 1 or entrance credit in plane trigonometry.* First and second semesters.

Math. 12. Analytic Geometry and Calculus II (3)

Volume; arc length; centers of gravity; moments of inertia; work; fluid pressure; the conic sections; polar coordinates; differentiation and integration of transcendental functions; hyperbolic functions. *Prerequisite: Math. 11.* First and second semesters.

Math. 13. Analytic Geometry and Calculus III (3)

Technique of integration; improper integrals; parametric equations; vectors in the plane; curvature; curvilinear motion; determinants and linear equations; vectors and analytic geometry in three dimensions; partial differentiation. *Prerequisite: Math. 12.* First and second semesters.

Math. 14. Analytic Geometry and Calculus IV (3)

Multiple integrals; infinite series; Taylor's series; indeterminate forms; complex variables; elementary differential equations. *Prerequisite: Math. 13.* First and second semesters.

Math. 40. Mathematics of Finance (3)

Compound interest, and elementary treatment of annuities, etc. *Prerequisite: Math 10 or 11.* Second semester.

Math. 43. First Course in Mathematics of Life Insurance (3)

Mathematical theory of life contingency; preparation of life and monetary tables; computation of premiums for various life insurance policies; valuation of policies to meet statutory requirements; mathematical theory of risk and cost of insurance; computation of items for annual reports; valuation of life annuities. *Prerequisite: Math. 40.* First or second semester.

Math. 51. Advanced Algebra (3)

Number systems; properties of integers; theory of polynomial functions and equations; determinants and systems of linear equations; elimination theory. *Prerequisite: Math. 12.* First semester.

Math. 54. Higher Geometry (3)

An introductory course in projective geometry and none-euclidean geometry. *Prerequisite: Math. 12.* Second semester.

Math. 102. Finite Differences (3)

Definition of differences of various orders; the operators Δ and E; interpolation formulas for both equal and unequal intervals: central difference interpolation formulas; inverse interpolation; finite summation; differences of zero; relations between the operator Δ and D; differences of a product; finite summation by parts; some modern extensions and special devise for interpolation and summation; numerous examples illustrating the use of the theory. *Prerequisite: Math. 14.* First or second semester.

Mr. Beale

Math. 123. Probability (3)

A course designed primarily for students majoring in actuarial science. *Prerequisite: Math. 14.* First semester. Mr. Beale

Math. 171. Reading Course in Mathematics (1)

Credit not to exceed one hour per semester, total credit not to exceed three hours; approval of program and written report required. *Prerequisite: Consent of head of department.* First and second semester.

For Advanced Undergraduates and Graduates

Math. 206. Applied Mathematics I (3)

Simultaneous ordinary differential equations; Fourier series; series solutions of differential equations; vector calculus; line and surface integrals; divergence theorem; Green's theorems; Stokes' theorem; geometrical and physical applications. *Prerequisite: Math. 14.* First and second semesters.

Staff

Math. 208. Applied Mathematics II (3)

Continuation of Math. 206. The Laplace transformation with applications to differential equations; partial differential equations and boundary value problems; functions of a complex variable, including conformal mapping and applications to physical problems. *Prerequisite: Math. 206.* Second semester. Mr. Gulden

Math. 219. Principles of Analysis (3)

The real number system; limits; continuous and discontinuous functions; differentiation; integration; infinite series; absolute and uniform convergence; functions of more than one variable; implicit functions; Fourier series. Required of majors in mathematics. *Prerequisite: Math. 14.* First semester. Messrs. Hailperin, Wilansky

Math. 220. Principles of Analysis (3)

Continuation of Math. 219. Required of majors in mathematics. *Prerequisite: Math. 219.* Second semester. Messrs. Hailperin, Wilansky

Math. 221. Differential Equations (3)

Special solvable non-linear equations, linear equations, transformations, and symbolic methods, solutions in series; Ricatti's, Bessel's and Legendre's equations. *Prerequisite: Math. 14.* First semester.
Messrs. Cutler, Shook

Math. 233. Mathematical Statistics (3)

Moments; moment generating function; normal distribution function; Poisson distribution function; large sample theory of a single variable; linear regression and linear correlation; distribution functions of two variables; small sample distributions; the chi square distribution; Student's *t* distribution; analysis of variance. *Prerequisite: Math. 13.* First semester. Messrs. Beale, Latshaw, Monro

Math. 234. Mathematical Statistics (3)

Continuation of Math. 233. *Prerequisite: Math. 233.* Second semester.
Messrs. Beale, Latshaw, Monro

Math. 301. Vector and Tensor Analysis (3)

Theory and techniques of vector and tensor analysis with geometrical and physical applications. *Prerequisite: Math. 14.* First and second semesters. Mr. Cutler

Math. 303. Mathematical Logic (3)

An introductory course in symbolic logic designed primarily to acquaint the student with the principles of reasoning used in mathematics and with symbolic logic as a mathematical theory. Applications to relay-circuit design and programming of high speed electronic computors are discussed. First or second semester. Mr. Hailperin

Math. 305. Computer Programming (3)

The translation of simple mathematical and logical problems into forms permitting their solution by each of certain typical commercially available electronic digital computers, with illustrations from scientific computation and from commercial data processing. Programs will be tested on a computer during hours to be arranged. First and second semesters. *Prerequisites: Math. 206, or 221, or 233, or consent of head of department.*
Mr. Rayna

Math. 309. Theory of Probability (3)

Discrete and continuous sample spaces; random variables; conditional probability and statistical independence; binomial, Poisson, and normal distribution; limit theorems; random walk problems; Markov chains; time-dependent stochastic processes. The theory will be applied to problems in statistics, physics, and biology. *Prerequisite: Math. 14.* First or second semester. Mr. Latshaw

Math. 315. Theory of Functions of a Complex Variable (3)

Algebra of complex numbers; analytic functions. Cauchy-Riemann equations; Laplace's equation; conformal mapping; integrals of complex functions; Cauchy's theorem; power series; Taylor's theorem; Laurent's theorem, residues; applications to physical and geometrical problems. *Prerequisites: Math. 206, or Math. 219, or Math. 301.* First and second semesters. Mr. Gulden

Math. 322. Differential Equations and Harmonic Analysis (3)

Continuation of Math. 221. Partial differential equations. Fourier series, cylindrical and spherical harmonics. *Prerequisite: Math. 221 or consent of head of department.* Second semester. Messrs. Cutler, Shook

Math. 324. Probability and Numerical Analysis (3)

Probability; least squares and its application in the study of errors; formation of empirical formulas; numerical methods. Designed for students engaged in experimental or observational work. *Prerequisite: Math. 14.* First and second semesters. Mr. Latshaw

Math. 340. Higher Algebra (3)

Theory of matrices and linear transformations; linear spaces; bilinear and quadratic forms. *Prerequisite: Consent of head of department.* First semester. Mr. Rayna

Math. 341. Higher Algebra (3)

Some basic concepts of higher algebra; groups, rings, fields, lattices; algebra of classes; Boolean algebra. *Prerequisite: Math. 340.* Second semester. Mr. Rayna

Math. 350. Special Topics (3)

A course covering special topics not sufficiently covered in the general courses. *Prerequisite: Consent of head of department.* First or second semester. Staff

Math. 381. Probability and Statistics (3)

Combinatorial problems, theory of probability, various frequency distributions, standard deviation, sampling, correlation. *Prerequisite: Open only to secondary school teachers who present at least eighteen hours of undergraduate mathematics.*

Math. 382. Algebra I (3)

Fundamentals of algebra, axiomatic method, set theory, notions of group, ring, integral domain, and field. *Prerequisite: Same as Math. 381.*

For Graduates

Math. 401. Elementary Theory of Functions of Real Variables (3)

Classes, functions and relations; postulational development of positive integers; construction of real number systems; elementary inequalities; convergence of infinite series and infinite products; real functions of real

variables; derivatives; Riemann integral; existence theorems. *Prerequisite: Math. 443 or consent of head of department.* First semester.
Messrs. Pitcher, Wilansky

Math. 402. Theory of Functions of Real Variables (3)
Lebesgue measure and the Lebesgue integral; functions of bounded variation; absolute continuity; differentiation and integration as inverse processes; multiple and iterated integrals; Fourier series; convergence in the mean; Riesz-Fischer theorem. *Prerequisite: Math. 401.* Second semester.
Messrs. Pitcher, Wilansky

Math. 405. Partial Differential Equations (3)
Classification and transformation of equations; theory of characteristics; initial and boundary value problems; Cauchy's problem for hyperbolic equations; Dirichlet's problem for elliptic equations; potential theory; Green's function; harmonic and sub-harmonic functions; difference equations; applications to equations of physics. *Prerequisites: Math. 206, Math. 221.* First semester. Messrs. Cutler, Shook

Math. 406. Partial Differential Equations (3)
Continuation of Math. 405. *Prerequisite: Math. 405.* Second semester.
Messrs. Cutler, Shook

Math. 409. Mathematics Seminar (3)
An intensive study of some field of mathematics such as differential equations; integral equations; mathematical logic; advanced topics in complex variable theory; etc. *Prerequisite: Consent of head of department.* First semester. Staff

Math. 410. Mathematics Seminar (3)
Continuation of Math. 409. *Prerequisite: Consent of head of department.* Second semester. Staff

Math. 416. Theory of Functions of a Complex Variable (3)
More detailed and more rigorous treatment of the theory of analytic functions than in Math. 315, with more advanced topics such as: polygenic functions, theory of conformal mapping, bilinear transformations, uniform convergence of series, analytic continuation, summability of series, multiple-valued functions. Riemann surfaces, infinite products, Weierstrass' factor theorem, Mittag-Leffler's theorem, periodic functions, elliptic functions, Gamma functions, theory of linear differential equations, Bessel functions. *Prerequisite: Math. 315.* Second semester. Mr. Gulden

Math. 423. Differential Geometry (3)
The differential geometry of curves and surfaces in Euclidean space, including problems in the large. First semester. Messrs. Cutler, Hsiung

Math. 424. Differential Geometry (3)
Continuation of Math. 423. Riemannian geometry and geometry of differentiable manifolds. *Prerequisite: Math. 423.* Second semester.
Messrs. Cutler, Hsiung

Math. 431. Calculus of Variations (3)

Fundamental existence theorems of analysis; the classical theory of necessary and of sufficient conditions for relative minima of single integrals; fields of extremals and the Hamilton-Jacobi theory; numerous physical and mechanical applications and extensions, to be chosen according to the special interest of the students. Second semester. Mr. Pitcher

Math. 435. Functional Analysis I (3)

Transfinite induction; linear space: convex sets, separation theorems; linear topology; Frechet, Banach, Hilbert and Minkowski spaces, and Banach algebra; ordered spaces; reflexivity, weak and product topologies; open mapping, uniform boundedness; basis and orthogonal series; representation theorems; applications to classical analysis. Desirable preparation: Math. 401, and Math. 443. First semester. Mr. Wilansky

Math. 436. Functional Analysis II (3)

Continuation of Math. 435. *Prerequisite: Math. 435.* Second semester. Mr. Wilansky

Math. 443. General Topology (3)

Elementary set theory; functions; order filters; concept of a topology; topological products; separation axioms; connectedness; metric spaces; metrizability completeness; compactness; paracompactness; function spaces; selected topics from dimension theory; topology of Euclidean spaces; topological groups. First semester. Messrs. Gulden, Pitcher

Math. 444. Algebraic Topology (3)

Elementary commutative groups; simplical complexes; homology theories; Euler-Poincare characteristic; degree of a map; combinatorial manifolds; local homology groups; Poincare duality theorem. *Prerequisite: Math. 443.* Second semester. Messrs. Gulden, Pitcher

Math. 450. Modern Algebra (3)

The development of a topic from the field of modern algebra, e.g. linear algebra, rings with minimal conditions, Galois theory of equations, valuation theory, lattic theory. Second semester.

Math. 453. Modern Methods in the Theory of Functions of a Complex Variable (3)

Analytic continuation; principle of maximum modulus; conformal representation; Taylor series analysis; integral function; Dirichlet series. *Prerequisite: Math. 416.* First semester. Mr. Gulden

ASTRONOMY

Astr. 1. Descriptive Astronomy (3)

The earth as an astronomical body; the solar system; a brief introduction to sidereal astronomy. First and second semesters.

Astr. 2. General Astronomy (3)

The solar system; the sidereal system, with an introduction to celestial mechanics and astrophysics. *Prerequisite: Math. 12.* First or second semester.

Astr. 104. Stellar Astronomy and Astrophysics (3)

Introduction to astrophysics; the sun considered as a star; physical characteristics of the stars; stellar motions; binary stars; theory of binary star orbits; stellar aggregations; cosmogony. *Prerequisites: Math. 13, and Phys. 16 or Phys. 3.* First or second semester. Mr. Van Arnam

MECHANICAL ENGINEERING

Professor Hartman
Visiting Professor Johnston
Associate Professors Jackson, Eppes
Assistant Professor Erdogan
Messrs. Lucas, Olear, Terry, Bayles, Eshleman, Lee

M.E. 101. Machine Design I (3)

Application of the principles of mechanics to the design of machine elements. Introduction to kinematic principles in mechanisms. *Prerequisites: C.E. 61; Mech. 11; Mech. 102, previously or concurrently.*

M.E. 102. Machine Design II (3)

Continuation of M.E. 101. *Prerequisite: M.E. 101.*

M.E. 103. Machine Design III (5)

Consideration of dynamic loading on design of machines. Vibration and balancing. Attention to logical methods of investigating unfamiliar problems. *Prerequisites: M.E. 102; Math. 206.*

M.E. 104. Thermodynamics I (4)

Basic concepts and principles of thermodynamics with emphasis on universal applications. First and Second Law development. Energy equations. Reversibility and irreversibility. Entropy and probability. Thermodynamic functions. Properties of pure substances. *Prerequisite: Math. 14; Phys. 3.*

M.E. 105. Thermodynamics II (4)

Thermodynamics applications. Reversible and irreversible processes and cycles with various fluids. Gas and vapor mixtures. Compressible and incompressible fluid flow. Heat transfer. *Prerequisite: M.E. 104.*

M.E. 108. Laboratory I (2)

Lectures and laboratory exercises relating to various phases of engineering laboratory technique and procedures. Includes planning, execution, and analysis of tests and writing of reports. *Prerequisite: M.E. 105.*

M.E. 109. Laboratory II (2)

Continuation of M.E. 108 with emphasis on project investigations.

M.E. 110. Thesis (3)

Candidates for the degree of B.S. in M.E. may, with the approval of the director of the curriculum, undertake a thesis as a portion of the work during the senior year.

M.E. 160. Thermodynamics (3)

Fuels; combustion; principles of engineering thermodynamics; properties of steam; steam power plant equipment and cycles; internal combustion engines. *Prerequisites: Math. 13; Phys. 3.*

M.E. 161. Mechanical Engineering Laboratory (1)

Testing of mechanical engineering equipment. *Prerequisite: M.E. 160, or M.E. 104.*

M.E. 166. Procedures for Mechanical Design (2)

Studies of the functions of basic machine elements and their combinations. Types of loading imposed by service conditions. Static and dynamic loads. Stress analysis applied to the design of typical machine elements. *Prerequisite: Mech. 11.*

For Advanced Undergraduates and Graduates

M.E. 310. Projects (6)

Analysis and synthesis of selected mechanical engineering systems and devices. Case studies chosen from topics such as design of fluid machinery, power plants, internal combustion engines. Consideration of mechanical design and thermodynamic influences, with emphasis on the creative phase of design. *Prerequisites: M.E. 103; M.E. 320.*

M.E. 320. Thermodynamics III (4)

Advanced and specialized topics in thermodynamics. Determination of properties from thermodynamic relationships. Combustion and chemical equilibrium. Meta-stable phenomena. Statistical thermodynamics. *Prerequisite: M.E. 105.*

M.E. 321. Heat Transfer (3)

Conduction, free and forced convection, radiation, evaporation and condensation, mass transfer. Application to design of heat exchangers in power plant, air conditioning, and refrigeration apparatus. *Prerequisites: Math. 206; C.E. 121; M.E. 105.* Mr. Eppes

M.E. 322. Gas Dynamics (3)

Dynamics and thermodynamics of compressible flow; subsonic and supersonic flow in nozzles and ducts, heat addition, compressible flow with friction, linearized analysis of subsonic and supersonic flow, similarity

rules, normal and oblique shocks, method of characteristics, applications to design of wind tunnels, rockets, ramjets, turbines. *Prerequisites: C.E. 121, M.E. 105.*

M.E. 342. Elementary Mechanical Vibration Analysis (3)

Analysis of physical systems and setting up equations; development of significant engineering relationships. Emphasis on engineering application. *Prerequisites: Math. 206.* Mr. Hartman

M.E. 343. Instrumentation and Automatic Control (3)

Selection, design and operation of measuring instruments. Analysis of automatic control systems for thermal, hydraulic, and mechanical processes. Stability and response criteria. *Prerequisite: Math. 206.*

Messrs. Eppes, Hartman, Jackson

For Graduates

Subject to proper approval, a graduate major in mechanical engineering may include "400" level courses in mechanics and C.E. 400 Research Methods.

M.E. 403. Advanced Mechanical Engineering Laboratory (3)

The planning, design, execution, and reporting of experimental tests and investigations in mechanical engineering. Mr. Jackson

M.E. 404. Advanced Mechanical Engineering Laboratory (3)

Continuation of M.E. 403. Mr. Jackson

M.E. 420. Advanced Thermodynamics (3)

Critical review of first and second laws, entropy, and general thermodynamic equations and relations; applications to current problems in technology and research.

M.E. 421. Topics in Thermodynamics (3)

Emphasis on theoretical and experimental treatment of combustion processes including dissociation, flame temperature calculations, diffusion flames, stability, and propogation; related problems in compressible flow involving one dimensional, oblique shock waves and detonation waves. Methods of measurement and instrumentation.

M.E. 423. Boundary Layer Analysis (3)

Navier-Stokes equations, laminar boundary layer theory, analysis of friction drag, heat transfer and separation; transition from laminar to turbulent flow. Turbulent boundary layer theory. Karman integral equations, Prandtl mixing length, turbulent friction drag, heat transfer, and layer thickness. Flow in ducts, wakes, and jets. Mr. Eppes

M.E. 434. Internal Combustion Engines (3)

History; laws of mixing, carburetion, atomization, combustion, and chemical equilibrium; heat losses; friction losses; governing; gas engine cycles; engine types. Messrs. Eppes, Jackson

M.E. 436. Jet Propulsion (3)

Study of jet propulsion engines. Theory, design, operation, and performance analysis of rockets, ramjets, and gas turbines. Application to industrial installations, aircraft propulsion, and space flight. Mr. Eppes

M.E. 437. Fluid Machinery I (3)

Generalized treatment of various types of fluid handling machinery from the principles of thermodynamics and fluid mechanics. Fans, blowers, compressors, pumps, turbines, ejectors. Compressible and incompressible fluids.

M.E. 438. Fluid Machinery II (3)

Continuation of M.E. 437 with particular emphasis on mechanical design.

M.E. 440. Dynamics of Machinery (3)

Analysis of dynamic loads and the resulting stresses in machinery. Balancing of rotors, Force analysis of internal combustion engines. Dynamics of control mechanisms. Mr. Hartman

M.E. 441. Stress Analysis in Design (3)

Application of methods of the theory of elasticity to mechanical design problems. Direct, approximate, and numerical methods of analysis applied to problems in plane stress, plane strain, torsion, thermal stresses, and residual stresses. Mr. Erdogan

M.E. 442. Analytical Methods in Mechanical Engineering (3)

Treatment of advanced types of mechanical engineering problems; formulation of problems, mathematical solutions, and analysis of results. Solutions involving numerical procedures, relaxation methods, and the use of analog and digital computers. Mr. Erdogan

M.E. 450. Special Topics in Mechanical Engineering (3)

An intensive study of some field of mechanical engineering not covered in more general courses. Staff

M.E. 451. Seminar in Mechanical Engineering (1-3)

Critical discussion of recent advances in mechanical engineering. Staff

MECHANICS

Professor Beer
Associate Professor de Neufville
Assistant Professors Osborn, Parke, G. F. Smith
Messrs. Bahar, Sih, Bede, Bohl, Comerford, Engel, Hartmann, Karna, Sturm

Mech. 1. Statics (3)

Composition and resolution of forces; equivalent force systems; equilibrium of particles and rigid bodies; centroids and centers of gravity; analysis of simple structures; internal forces in beams; friction; moments and products of inertia; method of virtual work. *Prerequisites: Math. 12 and Phys. 1.* First semester.

Mech. 11. Mechanics of Materials (3)

Strength and elasticity of materials; theory of stresses and strains; deflection of beams and shafts; torsion; buckling of struts. *Prerequisites: Mech. 1; Math. 13, previously or concurrently.* Second semester.

Mech. 13. Materials Testing Laboratory (1)

Experiments to study the mechanical properties of engineering materials; correlation of the properties of different materials, of their behavior under different types of load application, and of mechanical properties to design criteria. Verification of certain assumptions used in Mech. 11. *Prerequisite: Mech. 11, preferably concurrently.* First and second semesters.

Mech. 102. Dynamics (3)

Kinematics and kinetics of particles and rigid bodies; relative motion; dynamic equilibrium; work and energy; impulse and momentum; mechanical vibrations. *Prerequisites: Mech. 1; Math. 14.* First and second semesters.

For Advanced Undergraduates and Graduates

Mech. 301. Advanced Mechanics of Materials (3)

Introduction to two-dimensional theory of elasticity; theories of failure; bending and torsion of prismatic bars; principles of indeterminate analysis; instability. *Prerequisites: Mech. 11; Math. 206 or 221, previously or concurrently.* Messrs. Osborn, Parke

Mech. 302. Advanced Dynamics (3)

Elements of vector analysis; application to equilibrium and motion of a point and a rigid body; fundamental dynamical theorems and their application to engineering problems, moving frames of reference, impulsive forces, gyroscopic motion; introduction to generalized coordinates; Lagrange's equations. *Prerequisites: Mech. 102; Math. 206, or 301.* Second semester. Messrs. Beer, Osborn

Mech. 303. Mechanics of Continua I (3)

Fundamental principles of the mechanics of deformable bodies; equilibrium and compatibility equations; energy principle; potential function; conformal representation; applications to the solution of problems in elasticity, hydrodynamics, and plasticity. First semester. *Prerequisites: Mech. 301, Math. 206 or 221, C.E. 121.* Messrs. Parke, G. F. Smith

Mech. 304. Mechanics of Continua II (3)

Continuation of Mech. 303. *Prerequisite: Mech. 303.* Second semester. Messrs. Parke, G. F. Smith

Mech. 325. Aerodynamics (3)

Fundamentals of fluid mechanics applied to wing and propeller theory and to the drag of airplane parts; the Prandtl theory of lift and drag; principles of similitude, with application to wind tunnel tests. *Prerequisites: C.E. 121; Math. 206 or 221.* First semester.

Messrs. Beer, deNeufville

Mech. 326. Aerodynamics (3)

Dynamics of the airplane; performance calculations; climbing, gliding, and other types of flight; theory of stability and control. *Prerequisite: Mech. 325.* Second semester. Messrs. Beer, deNeufville

Mech. 350. Special Topics (3)

A study of some field of engineering mechanics not covered in the general courses. *Prerequisite: Consent of the instructor.* First and second semesters. Staff

For Graduates

A graduate student majoring in Applied Mechanics is expected to possess a thorough knowledge of undergraduate mathematics and mechanics. Math. 301, 315, and 322, and Mech. 301 and 302, or their equivalents, are considered as prerequisites for graduate work in Applied Mechanics. Any of these courses which have not been taken by the student as an undergraduate should be included in his graduate program. He may then be required to present a larger number of credits than the minimum required for graduation.

Mech. 402. Advanced Analytical Mechanics (3)

Fundamental theorems and their applications; generalized coordinates, Lagrange's equations, holonomic and non-holonomic systems. Hamilton's principle; canonical equations; transformation theory; integrals of the dynamical equations. First semester. Mr. Beer

Mech. 404. Advanced Vibrations Analysis (3)

A study of the theory of vibrating systems and of the applications of this theory to mechanical and structural design. Second semester.

Messrs. Hartman, Osborn

Mech. 411. Theory of Elasticity (3)

Theory of stress and strain; generalized Hooke's Law; equations of equilibrium and compatibility; strain-energy function; applications to bending and torsion. *Prerequisite: Math. 206.* First semester. Mr. Raynor

Mech. 412. Theory of Elasticity and Plasticity (3)

Continuation of Mech. 411, with an introduction to the theory of plasticity. *Prerequisite: Mech. 411.* Second semester. Mr. Raynor

Mech. 415. Structural Mechanics and Elastic Stability (3)

Elastic behavior of structures and their components; problems in stability, torsion, and bending; numerical and finite difference procedures. First semester. Mr. Osborn

Mech. 416. Theory of Plates and Shells (3)

Analysis and design; applications to both reinforced concrete and steel construction. Desirable preparation: Math. 221. First semester. Mr. Ostapenko

Mech. 421. Hydrodynamics (3)

Mathematical theory of incompressible fluids. Two-dimensional and three-dimensional flows of an ideal fluid in ducts and around immersed bodies; potential, conformal representation, free streamlines, vortex motion. Introduction to the study of incompressible viscous fluids. First semester. Messrs. Beer, deNeufville

Mech. 422. Advanced Mechanics of Compressible Fluids (3)

Study of subsonic and supersonic flow of compressible fluids by analytical methods. Steady and unsteady flows in ducts and around immersed bodies. Second semester. Mr. W. R. Smith

Mech. 450. Special Problems (3)

An intensive study of some field of applied mechanics not covered in more general courses. First or second semester. Staff

METALLURGICAL ENGINEERING

Professors Stout, Libsch
Associate Professors Conard, Gross
Assistant Professors Johnson, Horak
Messrs. Suprinick, Kottcamp, Agnew, Canonico

Met. 1. Introduction to Metallurgy (3)

Preliminary study of metal structure and behavior, materials and apparatus used in the metallurgical industry. Unit processes in metallurgy. Roasting, smelting, refining, furnaces, refractories, pyrometry, welding. *Prerequisites: Chem. 5, Phys. 1.* Second semester.

Met. 61. Engineering Metallurgy (2)

An abridgment of Met. 1, 102, 103, especially adapted to the viewpoint of users of metals. *Prerequisites: Chem. 5 or 16; Phys. 12 or 1.* Second semester.

Met. 63. Engineering Materials and Processes (3)

A study of engineering properties and materials. Methods and effect of fabrication and treatment. Application and use of materials in engineering. Primarily metals, but including plastics, ceramics, and other engineering materials. *Prerequisites: Chem. 5 or 16; Phys. 12 or 1.* First and second semesters.

Met. 64. Engineering Materials and Processes (3)

Similar to Met. 63; modified for those who will subsequently take Met. 67. *Prerequisites: Chem. 5 or 16; Phys. 12 or 1.* Second semester.

Met. 67. Metallurgical Laboratory (2)

Laboratory study of the structure, properties, and processing of metals and alloys. Microscopic examination, temperature measurement, hardness testing, equilibrium diagrams, cold deformation and annealing, age hardening, casting, heat treatment of steel, hardenability, effect of heat treatment on tensile properties and notch toughness of steel. Laboratory exercises with accompanying lectures; emphasis on report writing. *Prerequisites: Met. 61, 63, or 64; Phys. 3 and 4.* First and second semesters.

Met. 68. Metallurgical Engineering Problems (1)

Calculations associated with metallurgical process, heat balances, change balances. Alloy diagrams. *Prerequisites: Chem. 5; Phys. 1; Met. 1, 61, or 63, previously or concurrently.* Second semester.

Met. 100. Industrial Employment

At the end of the junior year students in the curriculum of metallurgical engineering are required to secure in industrial plants at least eight weeks practical experience.

Met. 102. Ferrous Metallurgy I (3)

Study of the processes employed in the production of iron and steel. Lectures and plant visits. *Prerequisite: Met. 1.* Second semester.

Met. 103. Nonferrous Metallurgy (4)

Unit processes and production of copper, brass and bronze, nickel, aluminum, magnesium, titanium, zinc, lead, and other nonferrous metals and alloys. *Prerequisite: Met. 1.* A two or three-day inspection trip (expense about $25) is required. First semester.

Met. 191. Experimental Metallurgy (3)

Application of research techniques to a project in metallurgy selected in consultation with the curriculum director. *Prerequisite: Met. 340.* Second semester.

For Advanced Undergraduates and Graduates

Met. 230. Physical Metallurgy I (4)

Structure, metallic bonding, and properties of metals. Solidification, alloying, and constitution diagrams. Metallography. Deformation and annealing. Shaping. Atomic mobility and kinetics and mechanics of transformation. Lectures, laboratory, and plant visits. *Prerequisites: Met. 1, 61, 63, or 64; Phys. 3 and 4.* Mr. Libsch

Met. 231. Physical Metallurgy II (4)

Heat treatment. Corrosion. Surface treatment. Mechanical behavior. Properties and uses of metal and alloys. Sources of metallurgical failures. Lectures, laboratory, and plant visits. *Prerequisite: Met. 230.* Mr. Libsch

Met. 278. Metallurgical Reports (3)

An opportunity for the advanced student to develop the ability to collect available published information on a metallurgical subject and digest it in order to present oral reports and a comprehensive written survey. *Prerequisite: Senior standing.* Staff

Met. 308. Electrometallurgy (3)

The practical application of electricity to metallurgical processes; metal finishing; electroplating and electric furnaces. Lectures and laboratory work. *Prerequisite: Consent of instructor.* Second semester. Not offered every year.

Met. 310. Metallurgical Thermodynamics (3)

The application of thermodynamic relations to metallurgical processes with emphasis on solving specific problems for processes such as the open hearth for steel, heat treating atmosphere, alloy equilibrium diagrams, and others. Lectures and problem sections. *Prerequisites: Met. 102, 103, 231, Chem. 190.*

Met. 318. Theoretical Physical Metallurgy (3)

Atomic structure. Diffusion. Theories of alloying and transformation. Dislocations. *Prerequisites: Met. 230 and 231 or the equivalent.* First semester. Mr. Conard

Met. 323. Mechanical Metallurgy (3)

Deformation and fracture of metals. Theoretical considerations and their application to service processes. Lectures and laboratory exercises. *Prerequisites: Mech. 14 and Met. 231; Met. 352, previously or concurrently.* First semester.

Met. 325. Metallurgical Practice (6)

This course is restricted to a small group of seniors selected by the department from those who apply. Three full days per week are spent at the plant of the Bethlehem Steel Company. Application of metallurgical

research methods to full-scale plant operations. Application for admission to this course must be made prior to March 1 of the junior year. Second semester. Mr. Stout

Met. 338. Metallurgical Colloquium (2)

An opportunity for the student to develop (1) an acquaintance with the current metallurgical literature, (2) the ability to interpret it clearly, and (3) skill in presenting oral engineering reports. *Prerequisite: Senior standing in metallurgical engineering.*

Met. 340. Research Techniques (2)

Study, analysis, and application of experimental techniques in metallurgical research. Analysis of experimental data and methods of presentation. Design of experimental programs. Recitations and laboratory. *Prerequisite: Senior standing.* First semester. Staff

Met. 352. Ferrous Metallurgy II (3)

Structure and properties of ferrous alloys as related to heat treatment and fabrication. Alloy and special-purpose steels. Lectures and laboratory. *Prerequisite: Met. 231.* First semester. Mr. Stout

Met. 358. Industrial Metallurgy (3)

An opportunity for the advanced student to integrate basic metallurgical engineering course material and to apply what he has learned in the solution of problems relating to (1) design and service requirements of metal components, (2) failure of metal components, and (3) selection of materials and processes. Discussion of specific problems to develop approach to and judgment of engineering problems involving metallurgy. Lectures, problems, and laboratory. *Prerequisites: Met. 103, 323, and 352.* Second semester. Mr. Libsch

Met. 101. Professional Development (1)

Conference hours with the department staff for the purpose of developing the professional outlook of the engineering student. Required reading, oral reports, and term papers. *Prerequisite: Senior standing.* First semester.

For Graduates

NOTE. Not all of the courses listed below will be given in any one year. Those to be given will be determined by the number of applicants at the beginning of the semester; if the number is less than six, the course may be omitted.

Chem. 334, X-ray Methods; Chem. 436 and 437, X-ray Research, and Phys. 363, The Physics of Solids may be included in a graduate major in metallurgy.

Met. 401. Metallurgical Investigation and Thesis (4-6)

Investigation of some special metallurgical problems, such as an improvement or innovation in some metallurgical process, the establishment

of an equilibrium diagram, the effect of heat treatment on a metal or alloy; study of the literature. The study and investigation must be embodied in a written report. *Prerequisite: Undergraduate metallurgical courses in the field of the investigation.* First and second semesters.

Messrs. Conard, Gross, Johnson, Libsch, Stout

Met. 402. Metallurgical Investigation and Thesis (3)

Continuation of Met. 401. First and second semesters.

Messrs. Conard, Gross, Johnson, Libsch, Stout

Met. 405. Nonferrous Metallurgy (3)

Study of the metallurgy of any one or more of the nonferrous metals. Comparative properties, extractive processes and mechanical treatments. Reading of references on modern practices, and theoretical consideration of the possibilities of future development in manufacture or use. Both chemical and physical metallurgy of the metals and their alloys may be included. *Prerequisite: A course in nonferrous metallurgy.* First or second semester.

Met. 408. Advanced Physical Metallurgy I (3)

Advanced study of phase diagrams, diffusion, and phase transformations with emphasis on physical and thermodynamic aspects. Mechanism of deformation and annealing. Dislocation theory. Preferred orientation. Related topics. *Prerequisites: Met. 230, 231, and 352; Chem. 190; or the equivalent.* First or second semester. Mr. Conard

Met. 409. Recent Developments in the Theory of Metals (3)

Current topics and new developments in theoretical physical metallurgy. The topics will vary from year to year. There will be included for example, such subjects as diffusion, magnetism, theories of alloying and equilibrium diagrams, recovery and recrystallization, grain boundaries, dislocations, and internal friction. *Prerequisite: Met. 408.* This course may be repeated for credit with consent of the instructor. Second semester.

Messrs. Conard, Johnson

Met. 410. The Physical Chemistry of the Metals (3)

The principal fields of physical chemistry in their relation to the extraction of metals from their ores; the refining, alloying, heat treatment, welding, and corrosion of metal systems. *Prerequisites: One undergraduate course in physical chemistry; elementary ferrous or nonferrous metallurgy or Met. 230 and 231.* First or second semester. Mr. Stout

Met. 411. The Principles of Modern Welding (3)

The foundations in scientific principle upon which the welding processes rest; the metallurgical effects accompanying welding, the trends in new developments, the engineering, industrial, and commercial aspects of welding. *Prerequistes: Met. 230 and 231.* First or second semester. Mr. Stout

Met. 413. Advanced Mechanical Metallurgy

Mechanical behavior of metals and alloys from theoretical and experimental viewpoints. The course may be repeated for credit with the consent of the instructor. First or second semester. Mr. Johnson

Met. 418. Advanced Physical Metallurgy II (3)

Continuation of Met. 408. *Prerequisite: Met. 408 or permission of the instructor.* First or second semester. Mr. Conard

Met. 419. Alloy Steels (3)

The effects of alloying elements on the metallography, heat treatment, and physical properties of steel. Engineering characteristics of constructional, tool, stainless, and other alloy steels. *Prerequisites: Ferrous metallurgy; Met. 231, and 352.* First or second semester. Mr. Stout

Met. 421. Surface Treatment of Metals (3)

Study of metallic surfaces, primarily steel; preparation of surfaces by machining, grinding, polishing; methods of surface stresses as related to fatigue life. *Prerequisites: Met. 103, 323, 352 or equivalents.* First or second semester. Mr. Libsch

Met. 423. Powder Metallurgy (3)

A study of the powder metallurgy processes for forming metal parts. Discussion of metal powder production and characteristics, plastic deformation and bonding associated with pressing, the mechanism of sintering, and the nature of the sintered product; preparation of sintered alloy compacts; application of the process to special industries. *Prerequisites: Met. 102, 103, 231, 352 or equivalents.* First or second semester. Mr. Libsch

Met. 458. Metallurgical Design (3)

Analysis of design requirements for metal components. Selection of materials and processes. Study of failures in process and service and application of recent metallurgical knowledge for improved design. Solution and discussion of industrial problems, and outline of experimental approach. First or second semester. Mr. Libsch

MINING ENGINEERING

Professor Gallagher
Assistant Professors Brune, Horak

Min. 3. Mine Surveying (3)

Methods of underground surveying; solar observations; aerial surveying; radio position surveying. Public land; mining claims; U. S. Patent of Mineral Lands. Eight hours recitation, laboratory and field work at an operating mine for each week day for three weeks. *Prerequisite: C.E. 40.* Summer session.

Min. 100. Industrial Employment

Industrial employment in mining or a related field for eight weeks, usually in the summer following the junior year. A written report is required.

Min. 101. Mining Fundamentals (3)

Methods of prospecting; drilling, explosives, and blasting; tunneling, slope and shaft-sinking; support of workings; machines for cutting and loading. Visits to mines. *Prerequisites: Geol. 1; Phys. 4.* First semester.

Min. 102. Seminar (1)

A study of current mining engineering projects and developments, with oral and written reports. Second semester. *Prerequisite: Senior standing.*

Min. 161. Elements of Mining (3)

A survey of mining engineering for students in curricula other than mining engineering. *Prerequisites: Geol. 1 or 6.* First semester.

For Advanced Undergraduates and Graduates

Min. 202. Methods of Mining (3)

The methods of working bedded and vein deposits, with special attention to principles involved in the selection of a mining method and to mechanization. *Prerequisites: Mech. 11, previously or concurrently; Min. 101.* Second semester. Mr. Brune

Min. 203. Mine Ventilation (3)

A study of mine atmospheres and of gases produced or encountered in mining operations; distribution and control of the ventilating current to meet requirements of safe and efficient operation; mine fires and explosions. *Prerequisites: C.E. 121, previously or concurrently; Min. 202.* First semester. Mr. Brune

Min. 204. Materials Handling (3)

The fundamentals of basic design, selection, and application of equipment for transportation of mineral products from working face to surface plant; sources, control, and disposal of mine water. *Prerequisites: Min. 202, E.E. 160.* Second semester. Mr. Brune

Min. 205. Mining Economics (3)

Systematic exploration and examination; theory and methods of sampling; reserves; mine taxation; depreciation and depletion; valuation and reports. Visits to mines. *Prerequisite: Min. 202.* First semester. Mr. Gallagher

Min. 206. Mine Administration (2)

Mining law; mine organization and management; wage systems and trade agreements; mine safety organization and regulation; special aspects of workmen's compensation laws; personnel administration. *Prerequisite: Min. 202.* Second semester. Mr. Gallagher

Min. 207. Mineral Preparation (3)

Recovery of minerals from ores; machines and apparatus used for coarse and fine crushing; classifying and preparation for concentration; methods of concentration, including gravity and magnetic methods, flotation, etc.; principles of concentration applied to the preparation of coal. Visits to mills and coal washing plants. *Prerequisites: C.E. 121 or Ch.E. 160, or equivalent, previously or concurrently; Chem. 38.* First semester.

Mr. Horak

Min. 208. Mining Laboratory (1)

Preparation of three-dimensional drawings of mining methods. *Prerequisite: Min. 202 concurrently.* Second semester. Mr. Horak

Min. 252. Fuel Technology (3)

Solid fuels: sampling; proximate and ultimate composition of coals, calorific values, fusibility of ash; classification of coal; carbonization and gasification of fuel. Coal and gas analysis, calorimetry. *Prerequisite: Chem. 38 or equivalent.* Second semester. Mr. Horak

Min. 254. Advanced Mineral Preparation (3)

An extension of the study of fundamental theories of mineral preparation begun in Min. 207, with special reference to flotation of metallic and non-metallic minerals; design of flow sheets based on results of laboratory tests. *Prerequisite: Min. 207.* Second semester. Mr. Horak

For Graduates

Students desiring to do graduate work in mining engineering should consult with the head of the department with regard to their classification.

Min. 411. Mining Research (2-6)

Investigation of a problem in one of the fields of mining engineering: (a) Mining Methods; (b) Mineral Preparation; (c) Mine Ventilation; (d) Mining Economics. First or second semester.

Messrs. Gallagher, Brune, Horak

Min. 412. Mining Research (2-6)

A continuation of Min. 411. First or second semester.

Messrs. Gallagher, Brune, Horak

Min. 413. Advanced Mining Practice (3-9)

A continuation and amplification of undergraduate work in the major fields of mining engineering. A student may register for one, two or three of the fields in any one semester; (a) Mining Methods; (b) Mineral Preparation; (c) Mine Ventilation; (d) Mining Economics. First or second semester. Messrs. Gallagher, Brune

Min. 414. Advanced Mining Practice (3-9)

A continuation of Min. 413. First or second semester.

Messrs. Gallagher, Brune, Horak

ENGINEERING GEOPHYSICS

For Advanced Undergraduates and Graduates

E.G. 201. Geophysical Methods (3)

A treatment of the fundamental principles underlying all geophysical methods; elements of theory and physical principles of instruments; physical properties of rocks and formations and methods of their determination. *Prerequisites: Geol. 1, previously or concurrently; Phys. 4.* First semester. Mr. Brune

E.G. 202. Geophysical Applications (3)

A detailed study of the applications of geophysical prospecting to the fields of mining, petroleum, and engineering; especially to well logging. *Prerequisite: E.G. 201.* Second semester. Mr. Brune

E.G. 301. Seismic Prospecting (3)

The elements and theory of elastic deformations and wave propogation; a detailed study of the methods—reflection and refraction; theory and description of seismographs. *Prerequisites: E.G. 202, Math. 206.* First semester. Mr. Gallagher

E.G. 302. Electrical Prospecting (3)

The fundamental principles of electrical methods—self potential, AC and DC equipotential, resistivity, electromagnetic, and radio; the electrical properties of rocks and minerals; theory and description of instruments. *Prerequisites: E.G. 202, Math. 206.* Second semester. Mr. Gallagher

E.G. 305. Magnetic and Gravitational Prospecting (3)

Magnetic properties of rocks and minerals; theory and description of magnetic instruments; a treatment of the gravitational instruments; corrections, interpretations, and results. *Prerequisites: E.G. 202, Math. 206.* First semester. Mr. Gallagher

MUSIC

Associate Professor R. B. Cutler
Assistant Professor Elkus

Mus. 1-8. Lehigh University Band (0-2)

Mus. 20. Introduction to Musical Literature (3)

An approach to musical style through the study of works by representative composers from 1600 to the present.

Mus. 21. Symphony (3)

A study of the style and structure of major orchestral works from the mid-eighteenth century to the present. *Prerequisite: Mus. 20, or consent of head of department.*

Mus. 22. Sacred Choral Music (3)

The functional aspects of choral music and its relationship to the church, beginning with Gregorian Chant. Compositions of the Renaissance and Baroque masters are studied, with special attention given to the works of Bach. A survey is made of the outstanding sacred choral works of the 18th, 19th, and 20th centuries, observing the shift in emphasis from the church to the concert hall. *Prerequisite: Mus. 20, or consent of head of department.*

Mus. 23. Chamber Music (3)

A survey of works for smaller instrumental ensembles from the forerunners of Haydn to Stravinsky. *Prerequisite: Mus. 20, or consent of head of department.*

Mus. 25. Keyboard Music (3)

Description of the mechanics of keyboard instruments, such as the organ, harpsichord, and piano; discussion of keyboard music with particular reference to the styles of Scarlatti, Bach, Mozart, Beethoven, Chopin, and Bartok; demonstration of performance techniques on the various instruments. *Prerequisite: Mus. 20, or consent of head of department.*

Mus. 27. Opera (3)

A critical study of representative works of the musical theater emphasizing the contributions of music to a total dramatic effect. *Prerequisite: Mus. 20, or consent of head of department.*

Mus. 30. Aesthetics and Criticism of Music (3)

An analytic approach to writings of Berlioz, Hanslick, Oscar Weil, Stravinsky, Langer, and others with particular attention to the questions of meaning, intent, and expressive values in music. *Prerequisite: Consent of head of department.*

THE LEHIGH UNIVERSITY BAND

Band may be elected by suitably qualified freshmen and sophomores as a substitute for military or air science and tactics, with equal credit. It may also be carried in addition to military or air science and tactics, but without credit. It may be carried as an optional subject without credit by suitably qualified juniors and seniors.

The Band will consist of a marching, concert, and varsity band and will perform music, as specified by the director, for concerts, convocations, athletic events, and military ceremonies; during the latter, it will be considered an integral part of the R.O.T.C. regiment.

Except during the fall season, rehearsals will be held twice

weekly and, in addition, provision may be made for required section rehearsals.

Band uniforms and certain musical instruments are furnished by the University. A deposit of $25 is required from each member of the band for an instrument or uniform.

Students serving in the band receive the following awards: a charm for one year of satisfactory service; for two years of service, a sweater; three years, $20 in cash; and four years, an additional $20 in cash.

PHILOSOPHY

Professors Ziegler, Grünbaum
Associate Professor Rescher
Assistant Professor Haynes

Phil. 14. Logic and Scientific Method (3)

An introductory study of the methods used in clear thinking and in the detection of fallacies. Examination of the principles used in testing scientific hypotheses and in the discovery of causes. Illustrations are drawn from the problems of everyday life. First and second semesters.

Phil. 15. Ethics: The Theory of Conduct (3)

A critical study of classic and contemporary ethical theories as analyses of moral life. Special attention is given to problems concerning the nature of moral responsibility and moral judgment, the relation of man to his world, and the scientific status of moral theory. First and second semesters.

Phil. 100. Philosophy of Contemporary Civilization (3)

A philosophical analysis of the theoretical foundations of our culture, providing a useful method for formulating policies in private and public life. Special attention is given to the nature and integration of ideals of family, industry, education, art, science, religion, law, and politics. First and second semesters.

For Advanced Undergraduates and Graduates

Phil. 231. Ancient Philosophy (3)

A history of philosophy from the origins of scientific and philosophical thought in Ionia to the flowering of learning in Alexandria. Particular emphasis on the philosophical writings of Plato, Aristotle, Lucretius, Marcus Aurelius, and Plotinus. The influence of the sciences, particularly mathematics and astronomy, upon the development of philosophy in antiquity will be considered. First semester. Messrs. Rescher, Ziegler

Phil. 233. Medieval Philosophy (3)

A history of philosophy from Augustine to the Renaissance, with particular attention to the philosophical work of Augustine, Averroes, Aquinas, Roger Bacon, Duns Scotus, William of Occam, and Nicholas of Cusa. Consideration will be given to the bearing of the ideas of these thinkers on the central issues of medieval philosophical theology—God, the universe, will, and knowledge. Second semester.

Messrs. Rescher, Ziegler

Phil. 235. Modern Philosophy (3)

An historical study of the teaching of the major philosophers from the Renaissance through the end of the Eighteenth Century, especially Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and Kant. Attention will be given to the intimate connection between scientific and philosophical thought as typified by the work of these thinkers. Second semester.

Messrs. Rescher, Ziegler

Phil. 237. Nineteenth Century Philosophy (3)

A study of major philosophers—Hegel, Schopenhauer, Marx, Comte, Kierkegaard, Mill, Spencer, and Nietzsche—with emphasis on central issues of the century, such as social philosophy, the philosophy of history, evolution, the theory of knowledge, and scientific method. First semester.

Messrs. Rescher, Ziegler

Phil. 239. Twentieth Century Philosophy (3)

A study of major contemporary philosophic movements in the West, including pragmatism, idealism, realism, existentialism, logical positivism, and linguistic analysis. Special emphasis is given to the positions of the various schools regarding the problems of meaning, method, and the philosophic role of scientific knowledge. Second semester. Mr. Rescher

Phil. 241. The Evolution of Scientific Ideas (3)

An historical study of some major developments in the evolution of the natural sciences, for example: ancient astronomy and cosmology, Arabian medicine, the Galilean revolution in mechanics, crises in development of the number concept, Darwin and evolution. Attention will be given to the growth of the concept of scientific explanation and to the role of science as a central factor in shaping man's world view and culture. First semester. Mr. Rescher

Phil. 254. Logic and Philosophy of Language (3)

A study of current methods in logic, with emphasis on their philosophical implications, and on their application to problems of philosophical analysis. The topics to be treated include: the logistic method, semantics, the logical paradoxes and devices for their resolution, modal logic and its applications, the logic of evidence. *Prerequisite: Phil. 14 or consent of the instructor.* First or second semester. Mr. Rescher

Phil. 261. Philosophy of the Natural Sciences (3)

An analysis of the logical structure and significance of modern scientific knowledge. Critical comparison of rival theories of explanation in

the physical and biological sciences. The logical structure of the Special Theory of Relativity. Fact, theory, and causality. The nature of mathematical truth and the status of geometry. First and second semesters.
Mr. Grünbaum

Phil. 263. Special Topics in the Philosophy of Physics and Mathematics (3)

Consideration of philosophical issues selected from among the following topics: the theory of relativity, time and entropy, foundations of mechanics, the development of the non-Euclidean geometries, epistemological foundations of quantum theory, the principle of the conservation of energy, and foundations of the theory of probability. Not restricted to majors in physics and mathematics, and may be taken independently of any other philosophy course. First and second semesters. Mr. Grünbaum

Phil. 271. Readings in Philosophy (2-3)

A course of readings in any of the various fields of philosophy; designed for the student who has a special interest in work not covered by the regularly rostered courses. *Prerequisite: Consent of head of department.* First semester.

Phil. 272. Readings in Philosophy (2-3)

Continuation of Phil. 271. *Prerequisite: Consent of head of department.* Second semester.

Phil. 281. Philosophy of the Social Sciences (3)

An analysis of the social sciences considered as programs for achieving understanding and control of man and society. Study is made of assumptions basic to, and problems incurred in, scientific methodology in general; the implications of these for the various social sciences is stressed. First or second semester. Mr. Haynes

PHYSICS

Professors Emrich, F. E. Myers*, C. W. Curtis, Havas
Associate Professors Hyatt, Sawyer, Spatz, Wheeler, McLennan
Assistant Professor W. R. Smith
Messrs. Altman, Baker, Bruce, DeNee, Elrick, Gion, Grimm, Horan, Kennedy, Kicska, Letzing, Magan, Muhl, Meily, Roemhild, Renn, Stachel, Weaner, Weimer, Wiens

Phys. 1. Mechanics of Mass Points (4)

Introduction to physics through a study of the laws of motion and conservation principles. Two lectures, one recitation, and one laboratory period per week. *Prerequisite: Math. 11, previously or concurrently.* First and second semesters.

Phys. 3. Heat and Electricity (4)

Introduction to heat, laws of thermodynamics, sound, and steady electric fields and currents. Two lectures, one recitation, and one laboratory

*On leave of absence 1958-60.

period per week. *Prerequisites: Math. 13, previously or concurrently; Phys. 1.* First and second semesters.

Phys. 4. Electricity, Light, and Atomic Physics (4)
Continuation of Phys. 3. Electromagnetism, induced electromotive forces, electrical transients in circuits, geometrical and physical optics, introduction to quantum phenomena. Two lectures, one recitation, and one laboratory period per week. *Prerequisites: Math. 13, previously or concurrently; Phys. 3.* Second semester.

Phys. 12. Introduction to Physics (3)
A survey course for students in the Colleges of Arts and Science and of Business Administration. A brief introduction to principal fields of physics. Lecture demonstrations, recitations, and laboratory. First semester.

Phys. 16. General Physics (3)
A continuation of Phys. 12. Lecture demonstrations and recitations. *Prerequisite: Phys. 12.* Second semester.

Phys. 17. General Physics Laboratory (2)
A laboratory course in general physics to accompany Phys. 16. *Prerequisite: Phys. 16, preferably concurrently.* Second semester.

Phys. 32. Electricity and Electronics (3)
Intermediate electrical theory and introductory electronics. *Prerequisites: Phys. 4 and Math. 14, previously or concurrently.* Second semester.

Phys. 100. Industrial Employment
Eight weeks industrial employment during the summer following the junior year, with submission of a written report.

Phys. 110. Electrical Measurements (1)
Precise measurements. *Prerequisite: Phys. 4.* First semester.

Phys. 111. Electronics Laboratory (1)
Study of electron devices. Continuation of Phys. 110. *Prerequisite: Phys. 4.* Second semester.

Phys. 171. Physics Proseminar (1)
Discussion of current problems in physics. Intended for seniors majoring in the field. Second semester. Mr. W. R. Smith

Phys. 191. Laboratory Techniques (1)
Laboratory practices and glass blowing. *Prerequisites: Phys. 4 or 17.*

Phys. 192. Advanced Physics Laboratory (1 or 2)
Laboratory work of research type. Special problems assigned and the student placed largely on his own initiative. Intended for seniors majoring in the field. First semester.
Messrs. Curtis, Sawyer, W. R. Smith, Weimer

Phys. 193. Advanced Physics Laboratory (1 or 2)
Continuation of Phys. 192. Intended for seniors majoring in the field. Second semester. Staff

For Advanced Undergraduates and Graduates

Phys. 213. Theory of Electricity and Magnetism (3)
A continuation of Phys. 32. *Prerequisites: Phys. 32; Math. 206, previously or concurrently.* First semester. Mr. W. R. Smith

Phys. 252. Geometrical and Physical Optics (4)
Geometrical optics and the wave theory of light, interference, diffraction, polarization, etc. One laboratory and three class periods a week. *Prerequisites: Math. 14; Phys. 4 or 16.* Second semester.
Messrs. Curtis, Hyatt

Phys. 266. Atomic and Nuclear Physics (3)
General foundations of quantum theory, special theory of relativity, atomic theory of origin of spectra, wave mechanics, atomic and nuclear structure, interaction of particles with matter, radioactivity, nuclear reactions, fission phenomena. *Prerequisites: Math. 14, Phys. 4.* First semester.
Mr. Spatz

Phys. 268. Introduction to Modern Physical Theories (3)
A study of the fundamental concepts of classical physics, the theory of relativity, and quantum theory. Atomic and nuclear physics, cosmic rays. *Prerequisites: Phys. 213; Math. 206 or 221.* First semester. Mr. Havas

Phys. 269. Introduction to Modern Physical Theories (3)
Continuation of Phys. 268. *Prerequisite: Phys. 268.* Second semester.
Mr. Spatz

Phys. 270. Atomic and Nuclear Physics Laboratory (1)
Selected experiments in atomic and nuclear physics. Intended for physics and engineering physics majors. *Prerequisite: Phys. 269, preferably concurrently.* Mr. W. R. Smith

Phys. 315. Electric Oscillations and Electric Waves (4)
Electric oscillations and waves and high frequency phenomena. One laboratory and three class periods a week. Some knowledge of vacuum tube characteristics and circuit theory is assumed. *Prerequisites: E.E. 110, Math. 206, Phys. 110 and 111.* First semester.

Phys. 340. Heat, Thermodynamics, and Pyrometry (4)
Basic principles of heat, thermodynamics, and kinetic theory of gases with emphasis on physical systems, supplemented by practical exercises in the use of thermocouples, resistance thermometers, pyrometers, and similar instruments. One laboratory and three class periods a week. *Prerequisites: Math. 14, Phys. 16 and 17 or Phys. 4.* First semester.
Messrs. Sawyer, McLennan

Phys. 362. Spectroscopy (2 or 3)
The interpretation of the findings of modern spectroscopy with particu-

lar emphasis on the theory and applications of atomic spectra. The method of obtaining data will be illustrated in laboratory problems. Two class periods per week and one optional laboratory period per week. Students desiring the laboratory work will register for three credits. Some training beyond the elementary level in physics or physical chemistry is desirable. *Prerequisites: Math. 14, Phys. 16 and 17 or Phys. 4.* First semester.
Mr. Curtis

Phys. 363. Modern Theory of Solids (3)
Recent developments in the theory of solids with particular reference to the physics of metals. *Prerequisite: Phys. 266 or 268.* Second semester.
Mr. Curtis

Phys. 367. Nuclear Reactor Physics (3)
Slowing down and diffusion of neutrons, chain reaction requirements, critical size, types of reactors, physical principles of the operation of reactors, radiation damage and radiation protection, instrumentation. *Prerequisite: Phys. 266, or Chem. 303, or Phys. 269 concurrently.* Second semester. Mr. Spatz

Phys. 372. Special Topics in Physics (1-3)
A course covering selected topics not sufficiently covered in the general courses. Lectures and recitations or conferences. *Prerequisites: Math. 14, Phys. 4 or Phys. 16.* First and second semesters. Staff

For Graduates

The election of purely graduate courses in physics should ordinarily be preceded by such study of the particular field as that presented in courses in the "200" and "300" groups. A thorough knowledge of the differential and integral calculus is presupposed, and further accompanying study of mathematics is generally advisable.

Phys. 420. Theoretical Physics (3)
Development of the classical theory of particles and fields. This and the three courses Phys. 421, 422, and 423 cover classical mechanics, electrodynamics, and the theory of relativity. First semester. Mr. W. R. Smith

Phys. 421. Theoretical Physics (3)
Continuation of Phys. 420. *Prerequisite: Phys. 420.* Second semester.
Mr. W. R. Smith

Phys. 422. Advanced Theoretical Physics (3)
A continuation of Phys. 420 and 421. *Prerequisite: Phys. 421 or equivalent.* First semester. Mr. Havas

Phys. 423. Advanced Theoretical Physics (3)
Continuation of Phys. 422. *Prerequisite: Phys. 422.* Second semester.
Mr. Havas

Phys. 424. Quantum Mechanics (3)

General principles of the present theory, applications to simple problems, perturbation methods, calculation of energy levels and spectral intensities, quantum theory of collision processes and of radiation, and relativistic quantum mechanics are covered in this course and Phys. 425. Second semester. Mr. McLennan

Phys. 425. Quantum Mechanics (3)

A continuation of Phys. 424. First semester. Mr. Havas

Phys. 428. Methods of Mathematical Physics (3)

The equations of theoretical physics and the methods of their solution. First semester. Mr. Wheeler

Phys. 429. Methods of Mathematical Physics (3)

Continuation of Phys. 428. Second semester. Mr. Wheeler

Phys. 440. Thermodynamics (3)

Classical and quantum thermodynamics, including the treatment of non-equilibrium systems. Second semester. Mr. McLennan

Phys. 441. Kinetic Theory (3)

The classical and quantum considerations of the kinetic theory of gases, and of statistical mechanics, with additional applications to electrical phenomena. First semester. Mr. McLennan

Phys. 464. Atomic and Molecular Physics (3)

Studies of the extra-nuclear properties of atoms and molecules and the foundations of quantum theory. First semester. Mr. McLennan

Phys. 465. Nuclear Physics (3)

Studies of stable and unstable nuclei, fundamental nuclear particles, nuclear reactions, and methods of producing them. Second semester. Mr. Sawyer

Phys. 467. Nuclear Physics (3)

Continuation of Phys. 465, dealing particularly with nuclear theory. First or second semester. Mr. Havas

Phys. 472. Special Topics in Physics (1-3)

Selected topics not sufficiently covered in the more general courses. First or second semester. Staff

Phys. 474. Seminar in Modern Physics (3)

A discussion of important advances in experimental physics. First or second semester. Mr. Curtis

Phys. 475. Seminar in Modern Physics (3)

A discussion of important advances in theoretical physics. First or second semester. Mr. Havas

Phys. 481. Basic Physics I (3)

A course designed especially for secondary school teachers in the master teacher program. Presupposing a background of two semesters of college mathematics through differential and integral calculus and of two semesters of college physics, the principles of physics are presented with emphasis on their fundamental nature rather than on their applications. Open only to secondary school teachers and those planning to undertake teaching of secondary school physics. Summer session.

Phys. 482. Basic Physics II (3)

Continuation of Phys. 481. Summer session.

Phys. 491. Research (3)

Research problems in experimental or theoretical physics. First and second semesters. Staff

Phys. 492. Research (3)

Continuation of Phys. 491. May be repeated for credit. First and second semesters. Staff

PORTUGUESE

See Romance Languages

PSYCHOLOGY

Professor Brozek
Associate Professor N. B. Gross
Assistant Professors Millon, Weinstock,
Harris, Brody

Psych. 1. Introduction to Psychology (3)

Principles of psychology as a science of behavior. Techniques of investigation. Special fields and practical applications of psychology to individuals and groups. A foundation course for students taking further work in psychology when supplemented by Psych. 2. Three hours of lectures. First and second semesters.

Psych. 2. Introductory Psychology Laboratory (1)

Laboratory work supplementing Psych. 1. One 3-hour session per week. *Prerequisite: Psych. 1, previously or concurrently.* First and second semesters.

Psych. 16. Psychology in Business (3)

Applications of psychological concepts and methods to business including advertising, consumer research, and personnel practices. *Prerequisite: Psych. 1.*

Psych. 20. Statistical Analysis and Experimentation (4)

An integrated presentation of the basic methods of collecting and evaluating experimental data in psychology. The laboratory part of the course provides an opportunity for supervised statistical computations and for the planning and execution of experiments. Three hours of lectures and one 3-hour laboratory per week. *Prerequisites: Psych. 1 and 2.* First and second semesters.

Psych. 26. Social Psychology (3)

A systematic survey of contemporary theoretical positions, methods of investigation, and research relating to the social determination of behavior. Attitude formation, prejudice, need and perception, national character, and personality in primitive culture. *Prerequisite: Psych. 1.* First semester.

Psych. 28. Personality (3)

Concepts of normal personality and the major forms of behavior disorders. A critical review of clinical diagnostic and treatment techniques. *Prerequisites: Psych. 1 and 2.* Second semester.

Psych. 101. History and Systems of Psychology (3)

Development of scientific psychology, taking into account interaction with biological and social sciences. Emphasis is placed on twentieth-century trends. *Prerequisites: Psych. 1 and 2. Given only when required for students' programs.* First semester.

Psych. 102. Psychological Measurement (3)

Principles of measurement and scaling in psychology. Application to construction and use of tests in selected areas of quantitative appraisal of behavior. *Prerequisites: Psych. 1, 2, and 20.* Second semester.

Psych. 103. Comparative Psychology (3)

Behavior of representative animal species. Reference is made to ethology's contribution to the study of insects, fishes, and birds. Experimental quantitative study of mammal behavior constitutes the core of the course. *Prerequisites: Psych. 1 and 2. Given only when required for students' programs.*

Psych. 104. Independent Study (1-3)

Readings on topics selected in consultation with a staff member. Minor research on assigned problems. Supervised field studies. *Prerequisites: Psych. 1 and 2, and consent of head of department. May be repeated for credit.*

Psych. 201. Industrial Psychology (3)

The application of psychological techniques to industry with emphasis on job training, incentive, fatigue, work methods, human relations, supervision, and morale. *Prerequisite: Psych. 1.* First semester.

Psych. 300. Seminar in Contemporary Problems (1)

Current developments. Reports of research in progress. Recommended for seniors majoring in psychology. *Prerequisites: Psych. 1 and 2, and consent of the head of department. May be repeated for credit.* First and second semesters.

Psych. 308. Developmental Psychology (3)

Contemporary theories, outstanding research contributions, and methods of analysis concerning the sequential and interrelated patterns of physiological and social development. *Prerequisite: Psych. 1.* Second semester.

Psych. 309. Abnormal Psychology (3)

Methods of investigation and research findings relating to behavior abnormalities. Lectures, and observations at the State Mental Hospital. *Prerequisites: Psych. 1 and 2.* Second semester.

Psych. 324. Intermediate Psychological Statistics (3)

Emphasis is placed on inferential statistics employed in experimental design. *Prerequisites: Psych. 1, 2, and 20.*

Psych. 329. Physiological Psychology (3)

The physiological basis for psychological processes. Two hours of discussion and two hours of laboratory work per week. *Prerequisites: Psych. 1 and 2.*

Psych. 354. Human Engineering (3)

Experimental psychology as applied to the optimal design of equipment. Survey of the human operators capabilities. Discussion of displays and controls upon which the designs are based. *Prerequisite: Psych. 1.*

Psych. 361. Sensation (3)

Basic sensory processes are considered. Quantitative methods are stressed. Laboratory exercises in the various sensory areas are provided. *Prerequisites: Psych. 1 and 2, and Psych. 20, previously or concurrently.*

Psych. 362. Perception (3)

Determinants and properties of perception considered in relation to current theoretical positions. Laboratory exercises supplement the lectures. *Prerequisites: Psych. 1 and 2, and Psych. 20, previously or concurrently.*

Psych. 363. Learning (3)

Basic data and major theories of learning. Laboratory provides an opportunity for repetition of basic experiments using animal and human subjects. *Prerequisites: Psych. 1 and 2, and Psych. 20, previously or concurrently.*

For Graduates

Psych. 418. Individual Testing (3)

A basic practicum course illustrating the contribution of individual tests in the assessment of intelligence and personality. First semester.

Psych. 419. Projective Techniques (3)

Administration, scoring, and basic interpretive principles of the Rorschach and TAT. Critical examination of these and allied techniques, with a view toward improving diagnostic methods through research. Second semester.

Psych. 420. Psychotherapy (3)

Review of theoretical formulations underlying the major approaches to psychotherapy. Discussion and demonstration of principles and techniques of therapeutic interviewing, psychoanalysis, and group treatment methods. First semester.

Psych. 421. Clinical Field Work (1)

Observation of therapeutic techniques and participation in diagnostic testing under supervision; case conference groups and informal discussion at affiliated hospital and clinic centers. Both semesters. May be repeated for credit.

Psych. 423. Design and Analysis of Experiments (3)

Manipulation and control of variables in psychological research. Advanced psychological statistics including non-parametric tests. Design and analysis of factorial, latin square, and combinational paradigms. Additional topics include curve-fitting, maximum likelihood estimation, linear difference equations, and probability models arising in psychology. *Prerequisite: Psych. 324 or equivalent.* Second semester.

Psych. 424. Human Factors in Industry (Seminar) (3)

A critical study of the literature dealing with psychological research related to morale, leadership, communication, and group participation in simulated and actual industrial settings, with emphasis on techniques, research methodology, and relations of research findings to general psychological theory. *Offered only as required for students' programs.*

Psych. 426. Advanced Experimental Psychology (3)

Consideration of the problems encountered in the application of statistical design procedures in psychological research. Practice in the design and carrying out of psychological experiments. *Prerequisite: Psych. 324 or its equivalent.* First semester.

Psych. 428. Thesis (3)

Original investigation for the master's thesis.

Psych. 429. Thesis (3)

Continuation of Psych. 428.

The following courses will be offered in either semester but only as required for students' programs.

Psych. 430. Seminars

A. Learning (3). Examination of the current theories of learning and the major issues dividing them, together with a study of recent pertinent research.

B. Comparative (3). The development of sensory, motor and nervous system through the phylogenetic series, with the correlated changes in discrimination, learning, and other aspects of behavior.

C. Vision (3). An intensive examination of special topics drawn from psycho-physical, conditioning, evoked potential, and degeneration studies.

D. Audition (3). Special topics drawn broadly from the fields of speech and hearing.

E. Physiological Psychology (3). The study of the physiological correlates of sensory information and behavior. Special emphasis to be placed on electro-physiological recordings and behavioral correlates of brain function.

F. Perception (3). The determinants and properties of perception; current theories and attempts at generalizations, applicable to all perceptual phenomena.

G. Motivation-emotion (3). Consideration of research findings with animals and humans in relation to the major theoretical constructs in these areas.

H. Social Behavior (3). Analysis of recent research and theory regarding the operation of social variables in human behavior, including such topics as opinion formation, group interaction, leadership, and attitude change.

I. Personality (3). Systematic evaluation of contemporary theories of personality development and structure based on clinical, experimental, and anthropological research. Critical examination of issues dividing the major schools of psychoanalysis.

These seminars may be repeated for credit if different subject matter is treated.

Psych. 431. Laboratories.

Each of the courses listed below corresponds to the particular seminar listed above.

A. Learning (3)

B. Comparative (3)

C. Vision (3)

D. Audition (3)

E. Physiological Psychology (3)

F. Perception (3)

G. Motivation-emotion (3)

H. Social Behavior (3)
I. Personality (3)

May be repeated for credit if different subject matter is treated.

Psych. 460. Special Study (3)
Study of some special topic not covered in the regular course offering.

Psych. 461. Non-thesis Research (3)
Original research not connected with master's or doctoral thesis.

RELIGION

Professor Eckardt
Associate Professor Fuessle

Religion 1. Basic Religion (3)
An introduction to the field of religion primarily through consideration of significant data selected from the Judeo-Christian tradition. First semester.

Religion 2. Basic Religion (3)
Elementary study emphasizing the questions religion seeks to answer and the place of religion in modern life. Exemplary problems: Can the existence of God be proved? Do religion and science conflict? Why do men suffer? Do miracles happen? How are the doctrines of the churches applied to such areas as sex and marriage, vocational decision, and socio-economic life? Second semester.

Religion 6. Old Testament (3)
Study of Old Testament writings, with emphasis on early religious traditions of the Hebrews; the history of Israel from the founding of the Kingdom through the post-exilic period; social, economic, and political influences on Jewish religion; the prophetic movement; the law; the Temple and its worship; and the importance of Jewish religion for Christianity and for mankind. First semester.

Religion 7. New Testament (3)
Study of New Testament writings, with emphasis on the four Gospels, the Acts of the Apostles, and the major Epistles. The life and teachings of Jesus and of St. Paul. The theological viewpoint of the primitive Church as reflected in the New Testament. Second semester.

Religion 13. Non-Christian Religions (3)
Study of selected faiths of India, the Orient, and the Near East. Similarities and differences between Western and Eastern religious traditions. Some attention to recent developments in the world religions. *Prerequisite: Sophomore standing.* First semester.

Religion 14. The Religions of America (3)

Analysis of the traditions, beliefs, and practices of the major faiths in America today. Some attention to recent trends in the church and synagogue. Second semester.

Religion 201. Scientific Theory of Religion (3)

Consideration of the possibilities and limits of scientific study in the field of religion. The relation of religion to magic, science, and morality. Empirical analysis of the dimension of the "sacred" or "ultimate" in human life, primarily from a psychological point of view. Study and appraisal of such interpreters as Sigmund Freud, William James, and Paul Tillich. *Prerequisite: Consent of the head of the department.* First semester.

Religion 202. Scientific Theory of Religion (3)

Scientific analysis of the religious dimension of man as an element of social life. Religion and the class structure, religion and social status, religion and political institutions, religion and socio-economic change. The functions of religion in different human societies and in American society. Among the interpreters considered are Karl Marx, Emile Durkheim, Max Weber, and Richard Niebuhr. Some attempt to formulate a general scientific theory of the nature of religion. *Prerequisite: Consent of the head of the department.* Second semester.

RESERVE OFFICERS TRAINING PROGRAM

The Reserve Officers' Training Program at Lehigh University consists of the Army Reserve Officers' Training Corps and the Air Force Reserve Officers' Training Corps. The activities of this program are conducted under the Department of Military Science and Tactics and the Department of Air Science.

A member of the University administrative staff, appointed by the President of Lehigh University, serves as coordinator for the Reserve Officers' Training Program.

By action of the trustees and faculty of the University, the four-semester course of instruction in either Basic Military Science and Tactics or Air Science is required for graduation with a baccalaureate degree. Normally those students who have served three months or more in any branch of the Armed Forces of the United States are relieved of this requirement and are neither required nor expected to substitute academic work therefore. Eligibility to membership in the Basic Program is limited by law to students who are citizens of the United States between the ages of 14 and 23 years. Upon recommendation of the director of the University Health Service, a student may be exempted by reason of physical disabil-

ity. Members of the University band are relieved from one semester of Basic Program for each semester of satisfactory participation in the band. However this credit cannot be used for entrance into the Advanced Course. Students transferring from other institutions may be exempt from part or all of the required number of hours in the Reserve Officers' Training Program, depending upon the amount of credit allowed at the time of admission. Students may request exemption from required Basic ROTC on the basis of membership in a religious group when participation in military training would be contrary to the principles of that group. Students pursuing Military or Air Science courses are eligible to be selected for deferment from induction under the Selective Service Law. The number of deferments which may be granted is limited by existing Department of Defense directives.

Qualified students may apply for and be accepted into the Advanced Program, with a commission as Second Lieutenant in the United States Army or Air Force Reserve as the objective. To be eligible for consideration and admission to the advanced program, a student must be a citizen of the United States between the ages of 14 and 25 for Air Force, and between the ages of 14 and 27 for Army, must be of good moral character, must have completed the Basic Course or received credit in lieu thereof, and must successfully complete the prescribed physical examination and officer qualification tests. The approval of the respective department head and the President of the University is also required for admission to the advanced program. All students enrolled in the advanced program are required to attend Summer Camp for a period of four weeks for the Air Force and six weeks for the Army, normally between the junior and senior years.

Students selected for admission to the advanced program are required to sign a written agreement to fulfill certain conditions prescribed by law and regulations. The student, by signing the contract, does not become a member of the Armed Forces of the United States.

Students in the Colleges of Arts and Science and of Business Administration may substitute advanced Military or Air Science credits for six hours of electives. The remaining six hours (or any portion thereof) of advanced Military or Air Science credits may, with the approval of the dean of the college, be substituted for

electives or options. If neither substitution nor overload is approved, an additional academic period may be required.

Students in the College of Engineering may substitute advanced Military or Air Science credits for six hours of General Study (elective) courses. The remaining six hours (or any portion thereof) of advanced Military or Air Science credits may, with the approval of the curriculum director and the dean of the college, be substituted for electives or technical subjects. If neither substitution nor overload is approved, an additional academic period may be required.

Uniforms, textbooks, and equipment are furnished by the government to basic students. Advanced students are furnished textbooks and equipment and given a uniform and subsistence allowance. A cash deposit of $25 is required of all students at the time of registration. The deposit is refunded to the student upon his return of all issued property.

DEPARTMENT OF MILITARY SCIENCE AND TACTICS

Colonel Stapleton
Lieutenant Colonel Butch
Captains Belnap, McCray, Queeney, Savage
Master Sergeants Podolsky, Liston, Perry
Sergeants First Class Fosselman, Kasper, Ebert, Mason
Sergeant Krupinski

The Army Reserve Officers' Training Corps was established at Lehigh University in September, 1919. The military courses are conducted under Department of the Army regulations as specified in their General Military Science Program.

The general objective of this course of instruction is to produce junior officers who by their education, training, and inherent qualities are suitable for continued development as officers in the United States Army. Instruction will cover military fundamentals common to all branches of the service. The aim is to provide a basic military education and to develop individual character and attributes essential to an officer.

Duration of the complete course of instruction comprises four years divided into Basic and Advanced.

Basic Course. The basic course consists of the freshman and

sophomore years. The uniform consists of a coat, trousers, cap, shoes, socks, shirts, belt, field coat, and necktie, and is worn as required to drills and designated classes.

During his sophomore year, the cadet is given an opportunity to apply for the advanced program.

Advanced Course. Students selected to pursue the advance course receive training in subjects which will prepare him for a commission in the officer corps and is given the fundamentals of leadership. The instruction is supplemented by application of various functions and procedures involving student participation in the operation of the ROTC program and in allied extra curricular activities.

At the beginning of the second year of Advanced Military Science, outstanding students are designated as Distinguished Military Students. If, upon graduation, these required standards are maintained, he is designated as a Distinguished Military Graduate. Distinguished Military Graduates may apply for and secure direct appointments in the Regular Army.

BASIC COURSES

M.S. 11. Basic Military Science (2)

Fundamental military training common to all branches of the Army to include an understanding of the organization of the Army, and orientation on ROTC, an introduction into the mechanical functioning and employment of individual weapons and marksmanship, an introduction into American military history. Leadership training provided through drill experience together with an indoctrination in military courtesy and customs of the service. Two recitations and two hours drill a week. First or fall semester freshman year.

M.S. 12. Basic Military Science (2)

Continuation of M.S. 11. Second or spring semester freshman year.

M.S. 21. Basic Military Science (2)

To make the student proficient in the use of maps and aerial photographs, to familiarize the student with all types of infantry crew-served weapons, to provide him with a knowledge of firepower potential and gunnery principles. Leadership training is continued emphasizing the functions, duties and responsibilities of junior leaders. Two recitations and two hours drill a week. First or fall semester sophomore year.

M.S. 22. Basic Military Science (2)

Continuation of M.S. 21. Second or spring semester sophomore year.

ADVANCED COURSES

M.S. 101. Advanced Military Science (3)

To develop an understanding of the principles, methods, and techniques which are fundamental to military instruction; to show the student proven practices and devices which tend to make the leader effective; to supply sufficient background information on the various branches of the Army to assist the student in selecting the branch of service he desires; to provide the student with the principles and fundamentals of small unit tactics and communications; to further develop leadership potential by emphasizing the functions, duties, and responsibilities of leaders of the first three non-commissioned and/or the junior officer grades. Four recitations and two hours drill a week. First or fall semester junior year.

M.S. 102. Advanced Military Science (3)

Continuation of M.S. 101. Second or spring semester junior year.

M.S. 103. Advanced Military Science (3)

To provide advanced military training to include the phases of operations, logistics, military administration and personnel management, service orientation, and school of the soldier and exercise of command. Four recitations and two hours of drill a week. First or fall semester senior year.

M.S. 104. Advanced Military Science (3)

Continuation of M.S. 103. Four recitations and two hours of drill a week. Second or spring semester senior year.

DEPARTMENT OF AIR SCIENCE

Colonel Strauss
Major Tierney
Captains Fordham, Grefe, McKenzie, Sara, Jakubowski
Senior Master Sergeant Laughlin
Master Sergeant Smith
Technical Sergeants Cockburn, Farr

An Air Force unit of the Reserve Officers' Training Corps was first established at Lehigh University in October, 1946. Upon implemention of the National Defense Act of 1947, the Air Force unit was organized and designated as the Air Force Reserve Officers' Training Corps. The Air Science courses are conducted under Department of the Air Force directives and consist of four semesters of Basic AFROTC instruction and four semesters of Advanced AFROTC instruction.

Qualified sophomore Air Science students, regardless of academic field of study, may submit applications for admission into the Advanced AFROTC course. Successful applicants pursue a

generalized AFROTC course of study with emphasis being placed upon leadership training in Air Science academic classes, leadership laboratories, and AFROTC extra-curricular activities. During the two years of the Advanced AFROTC program, the cadet serves as a cadet officer and progresses in rank commensurate with demonstrated leadership ability.

Orientation Flights. A comprehensive program of orientation flights in United States Air Force aircraft is offered during each school year. It is not mandatory for students to participate in these flights and AFROTC cadets may participate only with the consent of their parents or guardians. During these flights, students become familiar with the characteristics of aircraft in flight and they observe Air Force procedures at first hand. These flights are conducted by thoroughly experienced Air Force pilots.

Inspection Trips. Inspection trips to Air Force bases are required for the juniors and seniors in Air Science 101, 102, and 103 or 104. There will be only one required inspection trip in each year's work.

Extra Curricular Activities. AFROTC cadets normally extend their academic and leadership laboratory associations into extra curricular activities. AFROTC cadet organizations include the AFROTC Cadet Corps, the Arnold Air Society (including a crack drill team), and the AFROTC Rifle Team. Some of the cadet sponsored activities include the Military Ball, the awards and decorations ceremony, and the commissioning ceremony.

The parents and friends of AFROTC cadets are cordially invited to attend these social and military activities as guests of the Air Science department.

Basic Air Force ROTC Courses

A.S. 11. Freshman Air Science (2)

Foundations of Air Power—a general survey of air power designated to provide the student with an understanding of the elements and potentials of air power. It includes fundamentals of air power; military air powers of the world; military research and development; air vehicle industries; and airlines and airways.

A.S. 12. Freshman Air Science (2)

Foundations of Air Power—a general survey of air power to include, control, navigation, and propulsions systems; space vehicles; military instruments of national security; and professional opportunities in the United States Air Force.

A.S. 21. Sophomore Air Science (2)

Foundations of Air Power—a general survey of the roots and development of aerial warfare emphasizing the separate principles of war, concepts of employment of forces, and impact of changing weapons systems. Treatment of aerial warfare is undertaken to include targets and weapons.

A.S. 22. Sophomore Air Science (2)

Foundations of Air Power—treatment of aerial warfare is continued including aircraft and missiles, bases and facilities and operations.

Advanced Air Force ROTC Courses

A.S. 101. Junior Air Science (3)

Air Force Officer Development—knowledge and skills required of a junior officer in the Air Force. This includes staff organization and functions, communicating, instructing, and techniques of problem solving.

A.S. 102. Junior Air Science (3)

Air Force Officer Development—principles and practices of leadership. This includes basic psychology of leadership, the military justice system, and application of problem solving techniques and leadership theory to simulated and real Air Force officer problems.

A.S. 103. Senior Air Science (3)

Global Relations—Weather and Navigation; International Relations. Weather and Navigation is a study of weather and navigational aspects of airmanship, such as temperature, pressure, air masses, precipitation, weather charts, navigational charts and dead reckoning navigation. Introduction to International Relations is devoted to the study of major factors underlying international tensions—balance of power concepts, the League of Nations, the United Nations and regional security organizations; and the rise of the super-powers—the United States and the U.S.S.R.

A.S. 104. Senior Air Science (3)

Global Relations—Military Aspects of World Political Geography; and the Air Force Officer. Military Aspects of Political Geography includes maps and charts; factors of power; and the geographic influences upon political problems with a geopolitical analysis of the strategic areas. Adjustment to active duty as an officer of the United States Air Force is presented during the semester.

ROMANCE LANGUAGES

Professor Barthold
Assistant Professors Condon, Farne, Valenzuela
Messrs. Naveiro, Marcos

FRENCH

Fr. 1. Elementary French (3)

Basic conversational French illustrating essential grammatical principles. Emphasis on aural-oral learning with required laboratory practice.

Fr. 2. Elementary French (3)
Continuation of Fr. 1, with the addition of simple vocabulary-building tests. *Prerequisite: Fr. 1.* Second semester.

Fr. 11. Intermediate French (3)
Reading based on works of the nineteenth and twentieth century writers; formal review of French grammar; prose composition; outside reading. *Prerequisite: One year of college French or two units of entrance French.* First semester.

Fr. 12. Intermediate French (3)
Continuation of Fr. 11. *Prerequisite: Fr. 11.* Second semester.

Fr. 13. Types of French Literature (3)
Training in the ability to read and understand representative works from the Middle-Ages to the nineteenth century. Outside reading and reports. Conducted in French. *Prerequisites: Two years of college French or 3 units of entrance French.* First semester.

Fr. 14. Types of French Literature (3)
Reading and discussion of representative works of the nineteenth and twentieth centuries. Outside reading and reports. Conducted in French. *Prerequisites: Two years of college French or 3 units of entrance French.* Second semester.

Fr. 21. Seventeenth Century French Literature (3)
The age of classicism. Lectures, study of texts, collateral readings, and reports. *Prerequisites: Two years of College French or 3 units of entrance French.* First semester.

Fr. 22. Eighteenth Century French Literature (3)
The age of liberalism. Lectures, reports, study of texts, collateral readings and reports. *Prerequisites: Two years of college French or 3 units of entrance French.* Second semester.

Fr. 31. Nineteenth Century French Literature (3)
Main literary currents of the nineteenth century; romanticism and realism. Lectures, reports, collateral readings. *Prerequisites: Two years of college or 3 units of entrance French.* First semester.

Fr. 32. Nineteenth Century French Literature (3)
Continuation of Fr. 31. *Prerequisite: Fr. 31.* Second semester.

Fr. 41. French Oral and Written Composition (3)
For students who wish a greater opportunity for practice in the oral and written use of French than can be provided in the literature courses. *Prerequisites: Two years of college French or 3 units of entrance French.* First semester.

Fr. 42. French Oral and Written Composition (3)
Continuation of Fr. 41. *Prerequisite: Fr. 41.* Second semester.

For Advanced Undergraduates and Graduates

Fr. 221. French Literature before the Seventeenth Century (3)
Survey of French literature from its beginning through the sixteenth century. *Prerequisite: Fr. 42.* First semester. Mr. Barthold

Fr. 222. Contemporary French Literature (3)
Prerequisite: Fr. 42. Second semester. Mr. Farne

Fr. 223. Proseminar (3)
Study of the works of some author or group of authors or of a period. *Prerequisite: Fr. 42.* First semester. Mr. Barthold

Fr. 224. Proseminar (3)
Continuation of Fr. 223. *Prerequisite: Fr. 223.* Second semester. Mr. Farne

ITALIAN

Ital. 1. Elementary Italian (3)
Grammar; composition; rapid reading of easy modern prose. No previous study of Italian required. First semester.

Ital. 2. Elementary Italian (3)
Continuation of Ital. 1. *Prerequisite: Ital. 1.* Second semester.

Ital. 11. Intermediate Italian (3)
The age of Dante. Lectures in English on Dante and his contemporaries; readings in the *Divina Commedia. Prerequisite: One year of college Italian or two units of entrance Italian.* First semester.

Ital. 12. Intermediate Italian (3)
The Romantic Period—lectures in English, and selected readings from the works of Manzoni and Leopardi. *Prerequisite: One year of college Italian or two units of entrance Italian.* Second semester.

PORTUGUESE

Port. 1. Elementary Portuguese (3)
A study of Portuguese grammar and forms; practice in writing and speaking Portuguese. *Prerequisite: Consent of instructor.* First semester.

Port. 2. Elementary Portuguese (3)
Continuation of Port. 1. *Prerequisite: Port. 1.* Second semester.

SPANISH

Span. 1. Elementary Spanish (3)
Basic conversational Spanish illustrating essential grammatical principles. Emphasis on aural-oral learning with required laboratory practice. First semester.

Span. 2. Elementary Spanish (3)

Continuation of Span. 1, with the addition of the use of simple vocabulary-building and reading texts. *Prerequisite: Span. 1.* Second semester.

Span. 11. Intermediate Spanish (3)

Reading of modern Spanish prose, with a view to acquiring exactness and speed in reading; rapid review of grammar, composition, and conversation. *Prerequisite: One year of college Spanish or two units of entrance Spanish.* First semester.

Span. 12. Intermediate Spanish (3)

Continuation of Span. 11. *Prerequisite: Span. 11.* Second semester.

Span. 13. Cultural Evolution of Spain (3)

The historical and cultural evolution of Spain from its beginning to the present. Reading of representative Spanish authors. A term paper in Spanish is required. Conducted in Spanish. *Prerequisite: Span. 12 or three units of entrance Spanish.* First semester.

Span. 14. Cultural Evolution of Latin-America (3)

Continuation of Span. 13. The historical and cultural evolution of Latin America. Reading of representative Latin-American authors. A term paper in Spanish is required. Conducted in Spanish. *Prerequisite: Span. 12 or three units of entrance Spanish.* Second semester.

Span. 21. Introduction to Spanish Fiction (3)

Readings and discussion of selected novels and short stories; outside reading and reports. Conducted in Spanish. *Prerequisite: Span. 12.* First semester.

Span. 22. Introduction to Spanish Drama (3)

Reading and discussion of selected plays; outside reading and reports. *Prerequisite: Span. 21.* Second semester.

Span. 31. Spanish Conversation and Composition (3)

For students who wish a greater opportunity for practice in the oral and written use of Spanish than can be provided in the literature courses. Special attention given to the history and culture of Spain. Conducted in Spanish. *Prerequisite: Two years of college Spanish or three units of entrance Spanish.* First semester.

Span. 32. Spanish Conversation and Composition (3)

Continuation of Span. 31, with special attention given to Latin-America area studies. Conducted in Spanish. *Prerequisite: Span. 31.* Second semester.

For Advanced Undergraduates and Graduates

Span. 221. Spanish Fiction of the Golden Ages (3)

The Spanish novel of the sixteenth and seventeenth centuries, with special attention to Cervantes' *Don Quixote.* Lectures, collateral readings, and reports. *Prerequisite: Span. 22 or 32.* First semester.

Span. 222. Spanish Drama of the Golden Ages (3)

Selected plays by Lope de Vega, Tirso de Molina, Ruiz de Alarcon, and Calderon. Lectures, collateral readings, and reports. *Prerequisite: Span. 22 or 32.* Second semester.

Span. 223. Proseminar (3)

A study of the works of some authors or group of authors or of a period. *Prerequisite: Span. 221 or 222.* First semester.

Span. 224. Proseminar (3)

Continuation of Span. 223. *Prerequisite: Span. 223.* Second semester.

Span. 231. Spanish American Literature (3)

Reading and discussion of representative works of the literature of the Pre-Columbian, Conquest, and Colonial periods. Oral and written reports; term paper. Conducted in Spanish. First semester.

Span. 232. Spanish American Literature (3)

Reading and discussion of representative works of the literature of the nineteenth and twentieth centuries. Oral and written reports; term paper. Conducted in Spanish. Second semester.

RUSSIAN

Mr. Watt

Russ. 1. Elementary Russian (3)

Drill in the fundamentals of Russian grammar; pronunciation and dictation; extensive exercises in written translation; simple conversation; outside reading of graded texts. First semester.

Russ. 2. Elementary Russian (3)

Continuation of Russ. 1. *Prerequisite: Russ. 1.* Second semester.

SOCIOLOGY

See Economics and Sociology

SPANISH

See Romance Languages

SPEECH

See English

Division of Athletics and Physical Education

P. L. Sadler, *Director*
P. E. Short, *Assistant Director and Business Manager*
H. P. Campbell, *Assistant Director of Physical Education*

The Division consists of the Department of Intercollegiate Athletics and the Department of Physical Education and Intramural Sports. It has supervision over the entire field of intercollegiate athletics and physical education. Its activities consist of intercollegiate athletics, intramural athletics, required physical education, including corrective exercises.

Experience indicates that it is essential that the physical education program emphasizes the physical fitness and efficiency benefits to be derived from a well-rounded and athletic phase of the program. The purpose of the athletic, physical education, and intramural sports program is designed to:

a. Raise and maintain the physical standards of the University.
b. Develop and maintain a high level of all-around physical fitness so that the undergraduate student may more readily assimilate instruction.
c. Encourage regular and healthful exercise by the development of skills, techniques, and attitudes.
d. Foster an aggressive and cooperative team spirit, to increase the confidence of the individual, to develop sportsmanship, and to increase University pride through participation in vigorous competitive athletics.

Facilities for accomplishing this aim and purpose are afforded in Taylor Gymnasium, Grace Hall, the field house, the two playing levels of Taylor Field, and Lehigh Field.

DEPARTMENT OF INTERCOLLEGIATE ATHLETICS

Director Sadler
Assistant Director Short
Messrs. Leckonby, Packer, Cooley, Leeman, Christian, Garrett, Windish, Reno, Havach, Halfacre, Campbell

The Department of Intercollegiate Athletics offers opportunity to the undergraduate student body to participate in intercollegiate

competition both at home and away with institutions which are Lehigh's natural rivals and also other institutions which are at some distance.

The intercollegiate program consists of varsity teams in football, cross country, soccer, wrestling, basketball, swimming, tennis, track, baseball, golf, lacrosse, and fencing, junior varsity teams in football, wrestling, basketball, swimming, and baseball, as well as freshman teams in most of the above sports.

DEPARTMENT OF PHYSICAL EDUCATION AND INTRAMURAL SPORTS

Professor Sadler
Assistant Professors Christian, Halfacre, Leeman, Packer, Campbell
Messrs. Garrett, Cooley, Windish

The Department of Physical Education and Intramural Sports has supervision and control of the required recreational physical activities of the student body. The aim of the department is to insure the health and physical development of every student of the University.

Through its program in physical education and intramural sports the University endeavors to maintain among its students a high degree of physical fitness, to establish habits of regular and healthful exercise, to foster the development of such valuable by-products as self-confidence, good sportsmanship, and a spirit of cooperation, and to provide each student with ample opportunity for acquiring an adequate degree of skill in sports of the type in which participation can be continued after graduation.

Freshman and sophomore students are required to register for and engage in some form of activity under departmental supervision. This requirement calls for three hours a week in the gymnasium or participation in an organized sport. Junior and senior students are encouraged to continue their physical activities and participation in intramural sports.

Prior to his arrival on campus, each new or transfer student must submit to the Health Service a Record of Physical Examination form filled in and signed by a physician, and a completed Health History form. All such forms are carefully checked by the Health Service and each student thereby classified for activities

in the Department of Physical Education in accordance with his current health status.

All freshmen are required to take a physical efficiency test for the purpose of classification and development. All freshmen are required to take a swimming test during the first week of regularly scheduled classes. In the gymnasium, opportunity is offered in the following activities: physical development, recreational swimming, beginners' swimming, boxing, fencing, apparatus exercises, life-saving, badminton, and sports fundamentals. All undergraduate students must swim 75 feet before graduation. Students are encouraged to change their activities whenever it is thought best for their all-around development.

A comprehensive program in intramural sports is sponsored for the student body including fraternity, dormitory, interclass, town, and independent groups in touch football, tennis, soccer, badminton, handball, individual athletics, basketball, swimming, wrestling, track, softball, volleyball, and recreative games. Students are encouraged to participate in these sports, and awards are given for excellence in performance.

Individual exercises are prescribed for the correction of physical and functional defects. Students of this group are carefully examined and individually guided.

The University maintains a well-equipped dispensary for medical treatment. If a student is injured while engaged in any sport he must report as soon as possible to the first-aid room or to the University Health Service.

The following physical education courses are required of all physically qualified students:

P.E. 1. Physical Education
Freshman first semester. Three hours per week.

P.E. 2. Physical Education
Freshman second semester. Three hours per week.

P.E. 3. Physical Education
Sophomore first semester. Three hours per week.

P.E. 4. Physical Education
Sophomore second semester. Three hours per week

General Information

General Regulations

Eligibility for Degree

In order to be graduated, a candidate for a baccalaureate degree must achieve a minimum cumulative average of 1.50.

To be eligible for a degree from Lehigh University, a student not only must have completed all of the scholastic requirements for the degree, but also he must have paid all University fees, and in addition all bills for the rental of rooms in the dormitories, or for damage to University property or equipment, or for any other indebtedness to the University. It is understood, however, that this regulation does not apply to any indebtedness for scholarship loans or for loans from trust funds administered by the University which are protected by properly executed notes approved by the treasurer.

Unless exempted by the Faculty for some special reason such as poor health, a student must satisfy all physical education requirements and must complete four semesters of basic R.O.T.C. training, or its approved equivalent, in order to qualify for graduation.

Final Date for Completion of Requirements

For graduation all requirements, scholastic and financial, must have been met by 12 noon on the Friday preceding the graduation exercises.

Notice of Candidacy for Degree

Candidates for graduation on University Day file with the registrar on or before April 15 a written notice of candidacy for the degree; candidates for graduation in February file a notice of candidacy on or before January 5; candidates for graduation on Founder's Day file a notice of candidacy on or before September 10. Failure to file such notice by the dates mentioned debars the candidate from receiving the degree at the ensuing graduation exercises. If a petition for late filing is granted, a fee of $10 is assessed.

Graduating Theses

Undergraduate theses, when required, are accompanied by drawings and diagrams, whenever the subjects need such illustration. The originals are kept by the University, as a part of the student's

record, for future reference; but copies may be retained by students and may be published, provided permission has first been obtained from the faculty.

Credit and Grades

A semester hour of college work consists of one hour a week of lectures or class work, or two or three hours of laboratory work (or laboratory work combined with class work) a week for one semester. The normal assumption is that the student will be expected to do at least two hours of study in preparation for each hour of class work.

Final grades in courses are A, B, C, D, and F. A, B, C, and D are passing. F indicates failure. Physical education is marked P (passing) or F (failure) without hour credit.

A student who withdraws from a course during the first three weeks of instruction will receive grade of "W." A student who withdraws from a course after the first three weeks of instruction will receive "WF" unless the committee on standing of students, for cause, allows a grade of "W" to be recorded.

A student officially withdrawn from the University after the third week of instruction shall receive from each instructor a "WP" or "WF."

The letters "Abs." (absent) are used to indicate absence from a final examination in a course. The grade of "Abs." is reported with a letter grade in parentheses, such letter grade representing the department's estimate of the student's work up to the close of instruction with the provision that in cases where a department does not feel justified in reporting an estimated grade, a report of "Abs. (X)" will be returned.

The letters "Inc." are used to indicate that the work in a course is incomplete. The grade is accompanied by a letter grade. A student who incurs an "incomplete" in any course and fails to remove the "incomplete" within one calendar year, loses all equity in the course.

HONORS

Honors are of four kinds: class honors, graduation honors, special graduation honors, and college honors. (For college honors, see page 69.)

Class Honors

Upon completion of the work of the freshman and sophomore years, on recommendation of the registrar and by vote of the faculty, class honors are awarded to those individuals who have made an average of 3.00 or better during the preceding year.

The names of these students are announced at the Founder's Day exercises and published in the Founder's Day Program.

Graduation Honors

Degrees "with honors" are awarded by vote of the faculty to those students who have attained an average of not less than 3.00 in their last two years' work at the University.

Degrees "with high honors" are awarded by vote of the faculty to those students who have attained an average of not less than 3.50 in their last two years' work at the University.

Degrees "with highest honors" are awarded by vote of the faculty to those students who have attained 3.75 in their last two years' work at the University.

Candidates for graduation who have been in residence at the University for less than two years are not eligible for graduation honors.

Graduation honors are announced at the graduation exercises.

In computing the averages of candidates for graduation honors, semester grades are weighed according to the number of credit hours in the course concerned on the basis: A equals 4, B equals 3, C equals 2, D equals 1, and F equals 0.

Special Honors

Special honors are awarded at the end of the senior year, on recommendation of the head of the department concerned and by vote of the faculty, to students who have done advanced work of unusual merit in some chosen field. Candidates for special honors must indicate to the head of the department concerned and to the registrar during the junior year their intention to work for such honors. Awards are based on grades obtained in the subject chosen, the results in extra work assigned and the general proficiency of the candidate as evidenced either by a final examination or a thesis, as the head of the department involved may direct. Special honors are announced at the graduation exercises.

Latest Date for Registration

No registration is accepted later than the tenth day of instruction in any semester.

Financial Aid

Undergraduate Scholarships and Loans

General Statement

Lehigh University is desirous of extending tuition aid to deserving and promising students who otherwise would not be able to attend the University, to the extent that funds are available for such assistance. During the academic year 1959-60, over 500 students were assisted financially to the amount of $475,000.

Scholarship aid is awarded on the bases of established financial need, exceptional academic achievement and promise, commendable participation in activities outside of the classroom, and good citizenship. Scholarships are awarded on a yearly basis and for an entire scholastic year. Renewal of the scholarship is anticipated upon re-application in the spring of the year. However, continuation of an award assumes that the recipient will continue to show scholastic excellence and leadership activity commensurate with the promise evidenced when the scholarship was originally awarded. Continuing need and good citizenship are also requirements for continuation of awards.

Tuition Scholarship Loans are provided for students who are deserving and in need of aid, but for whom adequate free tuition scholarship aid is not available. The loan may be for a part or, in some instances, for the entire tuition fee, or may be used to supplement a partial free tuition scholarship. This plan enables many worthy and conscientious students to help finance their own way through college by deferment of the payment of part of their tuition. It is often better for a student to take out a partial tuition loan than to spend too many hours in outside work to support himself while in college.

Trustee Scholarships are scholarships covering the tuition charges in whole or part. These are authorized by the Board of Trustees to be paid from the general funds in order to supplement endowed tuition scholarships.

Leadership Awards, while still requiring evidences of genuine financial need, good scholarship, and good citizenship, place more emphasis on leadership attainments in non-academic activities. The available scholarships of this type include the Alumni Student Grants provided for good students with both aptitude and achievement in athletics and the Leonard Hall Scholarships for students who have evidenced both capacity and deep interest for the Christian ministry, with particular interest in the ministry of the Episcopal Church. These various scholarships are restricted in terms of the particular qualifications and interests of the applicants as indicated in each instance.

Endowed and Supported Scholarships are provided by individuals and by corporations either through endowments or by annual contributions. These scholarships in many cases provide more than tuition, ranging as high as $1,400 to $2,000 a year in a few cases. These awards are intended for very worthy students who otherwise would not be able to attend college. By earning some money themselves during the summers and, to some extent, during the college year, such students can, with the aid of these scholarships, win a college education. (See page 319 and following.)

ELIGIBILITY.

Entering freshmen may apply for financial aid in accordance with a special announcement obtainable from the Office of Admission.

A student transferring from another four-year college, unless he has been graduated, is not eligible to apply for a tuition scholarship until he has completed one year of residence at Lehigh University. A student entering from a recognized junior college with full transferred credits (junior standing) may be a candidate for a tuition scholarship on his junior college record.

Students who are already enrolled at Lehigh and have been in residence for one college year or more are eligible to apply for any of the scholarship or loan awards.

APPLICATION. Candidates not previously enrolled in the University should write for application forms to the Office of Admission; candidates who have been enrolled in the University one academic year or longer should apply in person to the Coordinator of Scholarships and Self-help. Dates for filing applications are:

1. For entering freshmen and junior college graduates, first

consideration will be given to candidates whose applications are filed before January 15.

2. For resident students, May 30. It is preferred that application be made to the Coordinator of Scholarships and Self-help as early as possible.

Any later application for scholarship aid can be given consideration only if funds are still available.

TUITION LOANS

New students must meet the same minimum qualifications to secure a tuition loan as to receive a tuition scholarship as described above. If an applicant does not receive a free tuition award adequate to cover his tuition needs, the supplementary tuition loan may still enable him to attend Lehigh University. Where it is deserved, this supplementary award generally will be made to the student without further application by him.

For students who have completed two or more semesters in residence at Lehigh, tuition loans are made on the basis of merit and need, at the discretion of the committee on scholarships and loans and to the extent that loan funds are available.

No loan can be made to a student on scholastic or disciplinary probation. The maximum indebtedness to the University that any student may normally incur will generally not exceed one-half of his total tuition obligations up to and including the semester for which he is seeking tuition aid.

Each student qualifying for a tuition loan is asked to sign a note, endorsed by his parent(s) or guardian. Repayment schedules satisfactory to the University may be arranged through the Coordinator of Scholarships and Self-Help. Tuition loans will bear interest at the rate of four per cent from the date of the note, with the provision that the rate shall increase to six per cent in the case of any note which falls into default.

Short-term Loans. Short-term loans are emergency loans and must be repaid, according to schedule agreed upon, before the end of classes of the semester for which they are granted. Short-term loans bear interest at the rate of four per cent per year from the date of the note. A minimum interest charge of fifty cents is made for each short-term loan granted.

The maximum amount for which a short-term loan may be granted, whether for tuition or for other purposes, is sixty per cent of the student's total bill to the University for that semester.

Every student incurring indebtedness to the University is required to undertake to pay his debt in full as rapidly as possible. Prompt repayment of loans insures the availability of a continuing fund for other student needs as they arise.

DESCRIPTIONS OF ENDOWED SCHOLARSHIPS

Atlas Equipment Corporation Scholarship Fund

Through its president, Paul B. Reinhold '13, the Atlas Equipment Corporation of Pittsburgh, Pennsylvania, has established this scholarship fund. The income from the Atlas Equipment Corporation Fund is used to provide scholarships covering tuition in such amounts as student need indicates, on the basis of character, intelligence, and leadership qualities.

Robert J. Bartholomew Memorial Scholarship Fund

This fund was established by the late Mary A. Bartholomew in memory of her husband, Robert J. Bartholomew '95. The gift is to be used for the purpose of providing scholarships for needy and deserving students with preference given to those who are residents of Bath, Pennsylvania, or of Northampton County, Pennsylvania. The awards are to be made by the Committee on Scholarships and Loans without restriction as to college or curriculum.

The J. D. Berg Scholarship Fund

This fund was established by Mrs. J. D. Berg in memory of John Daniel Berg, M.E. '05, who devoted many years to Lehigh University as alumnus and as trustee. An annual scholarship providing for tuition, fees, and an amount for books shall be awarded to a student who is in financial need and has prerequisites of character and personality, high scholastic achievement, and leadership qualities which merit the award. Preference shall be given to students residing in the West Pennsylvania District and who enroll in an engineering curriculum at Lehigh University.

Award of Bethlehem Fabricators, Inc.

Bethlehem Fabricators, Inc. have established a scholarship fund in honor of the late Parke Hutchinson, E.M. '04, at Lehigh Uni-

versity and in recognition of his forty years of service to the company and his devotion to his alma mater. It is hoped that these incentive scholarship awards from this fund will serve "to spread and implement his belief in the American tradition of private industrial development and his interest in the education of worthy young men to carry forward that tradition." This scholarship will be awarded annually to the senior engineering student who "has shown the most improvement during his sophomore and junior years," and under the rules of the Committee on Scholarships and Loans.

The Bethlehem Fabricators' Scholarship Fund

This fund was established by Bethlehem Fabricators, Incorporated, to provide tuition scholarships for students who are in need of assistance. Character and personality, high scholastic achievement, and leadership qualities shall be given consideration when these awards are made. Other qualifications being equal, preference shall be given to candidates applying from the counties of Lehigh or Northampton in Pennsylvania.

Frank Breckenridge Bell Memorial Scholarship Fund

This fund has been established by Mrs. Frank B. Bell as a memorial to Frank Breckenridge Bell, M.E. '98, Eng.D. '45 and trustee of Lehigh University from 1936 to 1949. The income arising from the fund is to be used for the purpose of awarding annually a scholarship to a student attending or about to attend Lehigh University. Primary consideration is to be given to the following factors: financial need, character and integrity, and capacity for creative or original thinking, preferably in the field of engineering.

George Raleigh Brothers Memorial Scholarship Fund

This fund has been established as a memorial to the late George R. Brothers, C.E. '09, a former trustee of the University and president of the Lehigh University Alumni Association. Before his death Mr. Brothers "remembered the debt he always felt he owed to Lehigh" and formed a philanthropic Trust from which Trust shall come the gifts making this scholarship possible.

The awarding of the scholarship shall be made by the Committee on Scholarships and Loans of the University to a freshman applicant to the College of Engineering. It shall be based on

financial need, character, personality, scholastic achievement, and leadership qualities, with preference given to an applicant from one of the southern states.

The Harvey M. Burkey Scholarship Fund
Endowed by the American Metals Company, Limited

The American Metals Company, Limited, established this fund in 1951. The income provides annual awards to be granted to students seeking a bachelor degree in mining, metallurgical, or chemical engineering, on the basis of character, scholarship, and the qualities which give promise of leadership.

Class of '04 Scholarship Fund

Members of the Class of '04, on the occasion of their Golden Anniversary in June '54, established this scholarship fund as a memorial to the class. The income from the fund is to be used to award a senior scholarship on the basis of character, scholarship, qualifications indicating promise of future leadership, and extra-curriculur activities. Financial need is not to be requisite for the award.

The William W. Coleman Fund

William W. Coleman, Met. '95, established this fund in 1951. The income provides annual awards in general equal to the amount of tuition, for undergraduates, preferably seniors in metallurgical engineering, on the basis of financial need, high scholastic achievement, character, personality, and leadership qualities.

The Stewart J. Cort Scholarship

A gift to establish scholarships was made by Stewart J. Cort, El. Met. '06, Eng. D. (Hon.) '48, president of the Alumni Association, 1937-1938, and a member of the Board of Trustees from 1942 until his death in 1958. The income from this fund is to be used for scholarships for students seeking degrees in one of the engineering departments, with preference being given to students in metallurgical engineering who meet the normal qualifications as to need, scholarship, character, and leadership.

The William S. Cortright Memorial Scholarship

Mrs. William S. Cortright established in 1938 a fund, the income from which provides a scholarship annually in memory of

her husband, who graduated from Lehigh University in 1872. By the terms of the bequest this money is to be used for the maintenance of a part-tuition scholarship, to be awarded to a student who is a resident of Bethlehem or the immediate vicinity and who is enrolled in the curriculum of mechanical engineering. The award is to be made by the Committee on Scholarships and Loans under the regular requirements governing the award of other University scholarships.

The George C. Coutant Scholarship Fund

This scholarship fund was established by a bequest from Hedwig A. Coutant in memory of her husband, George C. Coutant, M.E.'00, to provide scholarships for meritorious students in need of assistance. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The John R. W. Davis Memorial Scholarship Fund

This fund was established by Mrs. John R. W. Davis of Seattle, Washington, in memory of her husband, John R. W. Davis, C.E.'91. The income is to provide for scholarships in civil engineering for meritious students in need of financial assistance. Awards are to be made by the Committee on Scholarships and Loans, under the regular requirements governing the awarding of other University scholarships.

The Alban and Eleanor Eavenson Scholarship Fund

This fund was established by Alban Eavenson, Chem. '91, as an expression of his interest in helping young men obtain a Lehigh education. The income from the fund is to be used to award scholarships with preference to students enrolled in either the chemistry or chemical engineering curriculum.

The Natt Morrill Emery Scholarship

Established in memory of the late Natt Morrill Emery, vice-president and controller of Lehigh University, by an alumnus and former student of Dr. Emery's, the Natt Morrill Emery Scholarship covers the full tuition fee. It will be awarded by Lehigh University every four years (or whenever it becomes vacant) to that

graduate of the high schools of Richmond, Virginia, selected by the Richmond school authorities, who during his scholastic career has exemplified in character and conduct the qualities of loyalty and ability which marked the services of Dr. Emery to Lehigh University.

The John T. Fuller Memorial Fund

This fund was established by Esther Fuller Warwick in memory of her father, John T. Fuller '03. The income from the fund is to be used to provide scholarships in the field of mining engineering which are to be awarded to deserving Pennsylvania boys working their way through Lehigh University.

The Alfred R. Glancy Fund

The late General Alfred R. Glancy, M.E. '03, Eng.D. (Hon.) '43, established this fund in 1949. The income provides for undergraduate scholarship awards made by the Committee on Scholarships and Loans, in addition to the Alfred Noble Robinson Award of $1,000 annually to a selected faculty member in memory of General Glancy's grandfather.

The Granite City Steel Company Scholarship Fund

The Granite City Steel Company, Granite City, Illinois, established this fund in 1951. The income provides annual awards for undergraduates in the College of Engineering, on the basis of financial need, character and personality, scholastic achievement, and leadership qualities.

The Henry S. Haines Memorial Scholarship

Mrs. Henry S. Haines, of Savannah, Ga., established in 1889 a scholarship as a memorial to her son, Henry Stevens Haines, M.E. '87. By the terms of the bequest this scholarship is awarded to a student in the curriculum in mechanical engineering. The requirements governing the award of University scholarships apply likewise to this scholarship.

James Clark Haydon Memorial Scholarship Fund

Mary Haydon Hansen bequeathed the residue of her estate to Lehigh University as a memorial to her father, James Clark Haydon. The gift is to be used for the purpose of providing scholarships for needy and deserving persons. A substantial portion of

the gift is to be used for providing scholarships in the Mining Division of the University, otherwise the scholarship fund is without restrictions.

Albert George Isaacs '04 Endowed Scholarship Fund

This fund has been established by Kenneth L. Isaacs, M.E. '25, as a memorial to his father, Albert George Isaacs '04. The award covering tuition and an allowance for books and supplies will be made to a student selected by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The Anna Carpenter Richards Isaacs Scholarship

This fund was established by Kenneth L. Isaacs, M.E. '25, as a memorial to his mother, Anna Carpenter Richards Isaacs. The income from this fund shall be used to provide scholarships on the basis of financial need, character and personality, high scholastic achievement, and leadership qualities, without restriction as to college or curriculum.

The Kenneth L. Isaacs '25 Scholarship

Kenneth L. Isaacs, M.E. '25, established a fund to assist worthy young men to obtain the advantages of a higher education. The income is to be used to award scholarships to worthy students on the basis of financial need, character and personality, high scholastic achievement, and leadership qualities, without restriction as to college or curriculum.

The Reese D. Isaacs Memorial Scholarships

Kenneth L. Isaacs, M.E. '25, established this fund as a memorial in honor of his grandfather, Reese D. Isaacs, and to assist worthy young men to obtain the advantages of a higher education. The income from this fund is to be used to award scholarships on the basis of financial need, character and personality, high scholastic achievement, and leadership qualities, and without restriction as to college or curriculum.

The Bernard H. Jacobson Fund

This fund was established by Bernard H. Jacobson, El.Met. '17. The income is to be used to provide financial aid, usually to the amount of the tuition, for one or more students as the income

may provide, who shall show financial need, good character and personality, high scholastic achievement, and qualities of leadership.

The Henry Kemmerling Memorial Scholarships

These scholarships have been provided through the gifts of Henry Kemmerling, C.E. '91, M.S. '03. Preference in making the awards is to be given to graduates of the public senior high schools of Scranton, Pennsylvania. The scholarships are to cover the tuition fee of the holder thereof.

A scholarship award is to be renewed yearly to the initial holder thereof until he graduates, provided he remains in school and maintains a grade at least equal to the average of his class during the preceding year.

The following qualifications only are to be the basis of the award of the scholarship: (a) a good character, (b) need of financial assistance, (c) high scholastic ability. The awarding of these scholarships will be administered through the committee on scholarships and loans.

At the discretion of the president, each full scholarship may be divided into two or more partial scholarships so that two or more may benefit by any annual award.

If at any time the income from the funds should warrant, two scholarships may be awarded in one year. If at any time the accumulated income is not sufficient to pay the full amount of the tuition fee, the scholarship shall be awarded nevertheless, the balance being taken from the principal of the fund.

The Jacob B. Krause Scholarship Foundation

The Jacob B. Krause Scholarship Foundation was established under the will of Jacob B. Krause, B.A. '98, for the purpose of assisting needy students in the College of Arts and Science. Scholarships are to be awarded only to male students who maintain good scholastic standing and are in need of financial help. The awards are to be made by the Committee on Scholarships and Loans under the regular requirements governing the award of other University scholarships.

The J. Porter Langfitt Scholarships

The I. A. O'Shaughnessy Foundation, Incorporated, gave Lehigh University $50,000, the income from which is to be used

to establish scholarships in honor of J. Porter Langfitt, B.A. '24, M.E. (B.S.) '25, president of the Alumni Association, 1954-1955, and currently an alumnus member of the Board of Trustees. The income from this fund shall be used for scholarships ranging from $200 to $1,800 as needed, for students in any college or curriculum, and shall be awarded on the basis of financial need, character, personality, leadership qualities, and high scholastic achievement.

The Lehigh Portland Cement Company Scholarship Fund

The Lehigh Portland Cement Company established this fund in 1952. The income from the fund is to be used for the purpose of awarding scholarships to undergraduate students on the basis of financial need, character and well adjusted personality, intelligence, and above average potential for leadership.

Alvan Macauley Scholarship Fund

This fund was established by Mrs. Alvan Macauley in honor of her husband, Alvan Macauley '92, who was chairman of the board of the Packard Motor Car Company. The income from this fund is to be used to award scholarships to worthy students in need of financial assistance.

The Mart-Hammonton Scholarship

The late Leon T. Mart, M.E. '13, formerly president of the Marley Company of Kansas City, Missouri, established this scholarship fund in 1953. The income from the Mart-Hammonton Scholarship Fund is to support one continuous tuition scholarship in the College of Engineering at Lehigh University. Preference shall be given to graduates of Hammonton High School, Hammonton, New Jersey, or graduates of any of the public or private secondary schools of the greater Kansas City area—this shall include schools of Jackson County, Missouri, and Johnson County, Kansas. In the event that no suitable candidates from these areas are available the scholarship can be awarded at large. The award is made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

Alexander and Clara Maysels Scholarship Fund

Dr. Alexander Maysels of Bethlehem has established the Alexander and Clara Maysels Scholarship Fund as a memorial to his

wife, Clara Maysels. The awarding of the scholarship or scholarships shall be accomplished by the regular agency as determined by the Board of Trustees of Lehigh University. The basis of award shall be financial need, character and personality, high scholastic achievement, and leadership qualities regardless of race, creed, or color.

The amount of each award will in general be the amount of the annual tuition but the appropriate University agency in its discretion may award a lesser or greater amount where circumstances warrant such action. The scholarship, once awarded, may continue in force for the period of the student's residence at Lehigh University subject to the maintenance of a satisfactory scholastic average and qualifications of a good citizen and to the discretion of the appropriate University agency.

R. L. McCann Scholarship

Raymond L. McCann, E.M. '17, has established a fund to assist young men with limited financial support to obtain an engineering education. The scholarship is to be awarded to a student seeking a degree in one of the engineering departments with preference being given to Mining Engineering and Metallurgical Engineering. The bases of the award shall be financial need, character, personality, leadership qualities, and scholastic attainment. The award is to be made by the Committee on Scholarships and Loans.

Herbert Weymouth McCord Memorial Scholarship

Mrs. Celia M. Couch, Mrs. Henry Eccles, and Frank P. McCord have established this scholarship fund, as a memorial to their brother Herbert Weymouth McCord, C.E. '27. The income from this fund is to be used to award an annual scholarship to a senior student in the College of Engineering. The basis of the award shall be financial need, character and integrity, high scholastic achievement, and leadership qualities. The award is to be made by the Committee on Scholarships and Loans.

The Fred. Mercur Memorial Fund Scholarship

Friends of the late Frederick Mercur, of Wilkes-Barre, Pa., general manager of the Lehigh Valley Coal Company, desiring

to establish a memorial of their friendship and esteem, and to perpetuate his memory, contributed and placed in the hands of the trustees of the University a fund called the Fred. Mercur Memorial Fund. The income from this fund is awarded to students of the University. The requirements governing the award of University scholarships apply likewise to this scholarship.

The Mansfield Merriman Scholarship Fund

This fund was established under the will of Bazena T. D. Merriman to provide a scholarship in civil engineering in memory of her husband. Dr. Merriman served as professor of civil engineering at Lehigh University from 1878 to 1907, during which time his textbooks were widely adopted by engineering schools in the country and translated into many foreign languages.

The Theophil H. Mueller '18 Scholarship Fund

This fund was established by Theophil H. Mueller, a corporate trustee of the University. The income is to be used to assist in defraying the expenses of some worthy student or students who are in need of financial assistance, provided, however, that if it is possible and advisable the student or students selected to receive such financial assistance shall be of the Moravian faith and preferably from Bethlehem, Pennsylvania, or its environs. Awards are to be made by the Committee on Scholarships and Loans, under the regular requirements governing the awarding of other University scholarships.

The Ray Sands Nostrand Memorial Scholarship

The Ray Sands Nostrand Memorial Scholarship was established by the late Benjamin Nostrand Jr., M.E. '78, in memory of his son, Ray Sands Nostrand '17. The income from this fund is awarded to students of the University. The requirements governing the awards of University scholarships apply likewise to this scholarship.

C. Henry and Emily Nancy Offerman Scholarship

This fund was established by the late Emily N. Offerman in 1959. The income from this fund shall be used to provide scholarships to worthy students of good moral character, maintaining

satisfactory scholastic grades and who require financial assistance to enable them to further their education. The award shall be made by the Committee on Scholarships and Loans, without restriction as to college or curriculum.

The Murtha P. Quinn Scholarship

Mr. Murtha P. Quinn left one-thirtieth of his residual estate to Lehigh University for the purpose of establishing a free tuition scholarship in the amount of $400 annually. Preference is to be given to students whose homes are in south Bethlehem.

Isadore Raiff Memorial Fund Scholarship

The fund was established by the Raylass Department Stores, New York City, in honor and in memory of their late President, Isadore Raiff. The income from the fund is to be used to award a scholarship to worthy students in the College of Business Administration. Preference will be given to candidates from the states of Georgia, New York, North Carolina, South Carolina, Tennessee, and Virginia. The award is to be made by the Committee on Scholarships and Loans under the regular requirements governing the award of other University scholarships.

The Benjamin DeWitt Riegel Scholarship

This fund was established by Mrs. Benjamin DeWitt Riegel as a memorial scholarship in honor of her late husband, M.E. '98. This award is available to undergraduates of any college or curriculum who qualify on the basis of financial need, character and personality, high scholastic achievement, and leadership ability.

The Rust Engineering Company Fund

The Rust Engineering Company established this fund in memory of two of its co-founders, E. M. Rust, and E. J. Lee Rust, for the purpose of awarding scholarships to students of the engineering college of Lehigh University on the basis of financial need, character and well adjusted personality, intelligence, and above average potential for leadership.

Frederick C. Seeman, Jr., Scholarship Fund

This scholarship fund was established by a bequest from Aringdale D. Seeman of Baltimore, Maryland, in memory of his son,

Frederick C. Seeman Jr. '27, who was killed in an automobile accident in 1927. Income from the fund is to be used to award scholarships to worthy students from the state of Maryland who are in need of financial assistance.

Donald B. and Dorothy L. Stabler Scholarship Fund

Donald B. Stabler, C.E. '30, M.S. '32, established this fund in 1953. The fund is to be used to provide full tuition scholarships on the basis of character, intelligence, leadership qualities, and financial need. All factors being equal, preference is to be given first to candidates for the civil engineering curriculum; and secondly, to candidates for the other engineering curricula.

Lehigh Alumni of Tau Delta Phi Scholarship Fund

The Lehigh Alumni of Tau Delta Phi Foundation has established this fund for the purpose of awarding a part tuition scholarship on the basis of financial need, character and personality, scholastic achievement and leadership qualities, preference to be given to an undergraduate member of Tau chapter of Tau Delta Phi. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The David R. Thomas Memorial Fund

This fund was established by Professor and Mrs. Harold P. Thomas after their son's death in a plane crash on South Mountain in June, 1950. Donations from friends and family have been included in the fund. The income is to be used for tuition scholarships for one or more students who have completed at least one year at Lehigh University and are in need of financial assistance to complete their education. The award or awards will be made to students who exemplify in their lives the high ideals which were characteristic of David up to his untimely death.

The Herbert and Robert Tiefenthal-Dale Memorial Scholarship

The Dale Memorial Committee established this fund as a memorial to the honor of the brothers Herbert Dale, Bus.Ad. '33, and Robert Tiefenthal, Bus.Ad.'35. In recognition of the special opportunities offered by Lehigh University for the education and training of young men, the income from the fund is to be used

to award scholarships based on financial need, character and personality, scholarship achievement, and leadership qualities.

The Treadwell Engineering Company Scholarship

The Treadwell Engineering Company of Easton, Pennsylvania, has established at Lehigh University the Treadwell Engineering Company Scholarship Fund for annual tuition scholarships in such number and amounts as the income will support. The scholarships are for students in mechanical engineering, with preference given to candidates from Lehigh and Northampton counties in the state of Pennsylvania. The awards are made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The Samuel Foster York Memorial Scholarship Fund

This fund was established by Warren W. York, B.S. '24, as a memorial to his father, Samuel Foster York. The income is to be applied towards tuition scholarships for needy and worthy graduates of Allentown, Pennsylvania, secondary schools who desire to pursue business administration courses at Lehigh University. The award is to be made by the Committee on Scholarships and Loans under the regular requirements governing the award of other University scholarships.

York-Shipley Fund

This fund was established by York-Shipley Inc. of York, Pa., through its president, S. H. Shipley, Ch.E. '32. The income is to be used to provide scholarships to worthy students in need of financial assistance enrolling in the College of Engineering, with preference being given to students from the County of York in Pennsylvania enrolling in the mechanical engineering curriculum.

The Luther Rees Zollinger Memorial Fund

The sister of Luther Rees Zollinger left the residue of her estate to Lehigh University to establish this memorial fund to provide tuition scholarships for worthy students who are in need of financial assistance. The awards are to be made by the Committee on Scholarships and Loans, under the regular requirements governing the award of other University scholarships.

ENDOWMENT OF SCHOLARSHIP

Undergraduate or graduate scholarships named to honor an individual or corporation may be established in perpetuity by arrangement with the board of trustees of Lehigh University. The income from this donation will be paid to the holder of the scholarship to be applied toward the payment of University fees. The University does not, however, guarantee that this income will be forever sufficient to pay such fees in full.

DESCRIPTION OF SUPPORTED SCHOLARSHIPS

Alcoa Foundation Scholarships

The Aluminum Corporation of America supports at Lehigh University several undergraduate scholarships. The University also receives a grant-in-aid to the amount of $125 per student recipient. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The Allied Chemicals National Aniline Scholarship

The National Aniline Division of the Allied Chemical and Dye Corporation supports a scholarship at Lehigh University for students in chemistry or chemical engineering in the amount of tuition plus $100 for incidental fees. The award is to be made by the Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The American Society for Metals Foundation for Education and Research Scholarship

The American Society for Metals Foundation for Education and Research offers annually an undergraduate scholarship of $500. The scholarship is awarded on recommendation of the head of the department of metallurgical engineering and approval of the Committee on Scholarships and Loans, to a student entering his sophomore or junior year in that curriculum. High scholastic ability and financial need are considered in making the award.

The American Viscose Scholarship

The American Viscose Corporation of Philadelphia supports an annual award at Lehigh University of $500 for a junior-year stu-

dent in chemistry or chemical engineering. The award will be renewed for the student's senior year provided his scholarship is satisfactory. The University Committee on Scholarships and Loans makes the award under the established rules governing the award of University scholarships, but subject to the approval of the College Relations Committee of the American Viscose Corporation.

Armstrong Cork Company Scholarship

The Armstrong Cork Company Scholarship will be awarded to a junior or senior with no restriction as to curriculum choice. Each scholarship will cover the cost of tuition, required fees, and books for a full school year and will amount to a maximum of $1,100 per school year. The company will also provide a "cost-of-education" grant of $500 a year to the University.

The Walter A. Yates Scholarship

The Bell Foundation, Incorporated, established this scholarship in honor of Walter Ames Yates '19, one of the original directors of the Bell Aircraft Corporation. The scholarship carries $1,100 for the recipient and a grant of $500 to Lehigh University. The recipient shall be a student studying in business administration or in the general field of engineering and related sciences. The scholarship shall be awarded on the basis of financial need, scholarship, and character, with financial need a prime requisite.

Frank Breckenridge Bell Memorial Scholarship

The Edgewater Steel Charitable Trust has established an annual scholarship of $1,000 in honor of Frank Breckenridge Bell, M.E. '98, Eng.D. '45, former chairman of the board of Edgewater Steel Company, and a trustee of Lehigh University from 1936-1949. The award is available to a student in any college or curriculum, on the basis of financial need, character and integrity, and capacity for creative or original thinking, preferably in the field of engineering.

Bendix Aviation Corporation Scholarship

The Bendix Aviation Corporation has established a $1,000 undergraduate honors scholarship to be granted to a student entering his senior year who shows outstanding scholarship, ability, character, and promise, and who is majoring in electrical or mechanical engineering.

Blaw-Knox Company Scholarship

The Blaw-Knox Scholarship will be awarded to the son of a regular employee of the company. It will include an award to the recipient of $1,250 a year together with a grant-in-aid to the University of $250 a year.

The Byron Scholarships

Through the president, Byron Roudabush '29, Byron, Incorporated, Motion Pictures Studio and Laboratory in Washington, D. C., supports two scholarships at Lehigh University in the amount of $1,000 together with a grant-in-aid to the University of $500 a year. These scholarships are awarded to juniors in chemistry, chemical engineering, mechanical engineering, or engineering physics, with the expectation that the student will receive the award in his senior year also, provided his scholastic work continues satisfactory. A student membership in the Society of Motion Picture and Television Engineers, with which society the Byron Corporation joins to encourage trained engineers to enter the industry, is granted each recipient. The scholarship award is made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

California Oil Company Scholarship

The California Oil Company has provided a $750 undergraduate scholarship in the field of chemical engineering. The award is to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The Dravo Corporation Scholarships

The Dravo Corporation of Pittsburgh, Pennsylvania, supports at Lehigh University an annual scholarship award of $1,000 for a junior engineering student in civil, electrical, or mechanical engineering. The recipient of the award will receive a renewal of this scholarship in his senior year if his scholastic work continues to be satisfactory. The awards are made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships, by submitting recommendations of students to the Dravo Corporation, from which nominees the Corporation selects the recipient.

Fort Pitt Bridge Works Scholarships

The Fort Pitt Bridge Works Scholarship is to be awarded to a junior enrolled in the civil engineering curriculum who will major in the structural option. The award will be in the amount of $1,200 a year. Also in recognition of the fact that tuition does not cover the full cost of education of the student, the company will make an unrestricted gift to the University of $300 each year.

General Motors

The General Motors Corporation in its program of aiding private colleges has made available to Lehigh University several undergraduate scholarships. These scholarships will range up to $2,000 annually depending upon "demonstrated need." In addition the University will receive a grant-in-aid equivalent on the average to some $500 to $800 annually per student.

The Institute of Scrap Iron and Steel (Central Pennsylvania Chapter) Scholarship

The Institute of Scrap Iron and Steel, Incorporated, (Central Pennsylvania Chapter) offers annually an undergraduate scholarship of $500 to a member of the incoming freshman class. The basis for the award is financial need, character, personality, leadership qualities, and high scholastic achievement. The recipient shall be a candidate for admission to the College of Engineering and he shall be a resident of a community wherein a member of the Central Pennsylvania Chapter of the Institute of Scrap Iron and Steel, Incorporated, operates a business. The awarding of the scholarship shall be accomplished by the regular agency of Lehigh University.

Interchemical Corporation Scholarships

The Interchemical Corporation will provide $1,000 a year to be awarded to either juniors or seniors in the chemistry, chemical engineering, and engineering physics curricula. The number of awards will be from two to four each year and accordingly, the stipend will vary from $250 to $500.

The International Nickel Company Scholarship

The International Nickel Company has provided a scholarship covering tuition and fees and an annual allowance of $300 for books and a portion of living expenses. The scholarship may be renewed each year until the recipient thereof has graduated providing he continues to satisfy the University's requirements. The scholarship is restricted to engineering students and preference is given to those enrolled in mining, geology, and metallurgy. The Company also provides an unresticted grant of $500 annually to the University.

The Kift-Mullen Memorial Foundation Scholarship

The Kift-Mullen Memorial Foundation of Allentown, Pennsylvania, makes available to graduates of Allentown high schools four annual scholarships of $200 to students of junior standing in various teacher training institutions, who are preparing to enter the secondary school teaching profession. The University Committee on Scholarships and Loans makes recommendations of qualified Lehigh University students to the Kift-Mullen Memorial Foundation, which passes such recommendation from various teacher training institutions on to a committee of the Allentown high schools' representatives who make the final selection.

The Link-Belt Company Scholarship

The Link-Belt Company established an annual $1,000 scholarship for junior or senior engineering students in civil engineering, industrial engineering, or mechanical engineering who stand at least in the top half of their class and who are not currently the recipient of any other industrial scholarship assistance. The student must be an American citizen, of good character, and in need of financial aid.

Edward Magnuson Memorial Scholarship

In the interest of aiding both Lehigh University and a deserving undergraduate who is an initiated member of the local chapter of the Chi Phi Fraternity at Lehigh University, P. Edward Magnuson has established the Edward Magnuson Memorial Scholarship. The award is to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

Milton Roy Sheen Memorial Scholarship

Through its president, Robert T. Sheen, B.S. '31, Ch.E. '36, the Milton Roy Company of Philadelphia, Pennsylvania, has established a scholarship as a memorial to the founder of the company, Milton Roy Sheen. The Milton Roy Sheen Memorial Scholarship provides an annual award of $1,200. The scholarship is to be awarded to employees or sons of employees of the Milton Roy Company. If no candidates are available, the scholarship is to be awarded to either a junior or senior enrolled in the chemical engineering or mechanical engineering curriculum.

Modern Transfer Company Scholarship

The Modern Transfer Company of Allentown, Pennsylvania, through its president, Samuel L. Lebovitz, E.M. '23, has established a $1,000 a year scholarship at the University. The scholarship is awarded on the basis of high intelligence, financial need, and the qualities that give promise of leadership.

Pitcairn-Crabbe Christian Education Scholarship

These scholarships have been provided by the Pitcairn-Crabbe Foundation for students with strong Christian motivation, preministerial students, or those who plan to enter the fields of social work, religious education, or eleemosynary activities. Preference will be given to the sons of clergymen or educators. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the awards of University scholarships.

Pocahontas Fuel Company Incorporated Scholarships

The Board of Directors of the Pocahontas Fuel Company, Incorporated, has established two scholarships, one effective Septem-

ber, 1956 and the second September, 1958, in the amount of $1,500 a year to cover tuition, other University costs, and a part of the living expenses for a candidate for admission to the College of Engineering. The bases of the awards are financial need, character, personality, leadership qualities, and high scholastic achievement, with preference given to applicants with a background of interest in coal mining. Once awarded, the scholarships will continue in force for a four-year period subject to the scholar's maintenance of a satisfactory scholastic and personal record. The awarding and administration of the scholarships shall be accomplished by the regular agency of Lehigh University.

Procter and Gamble Fund

The Procter and Gamble Fund provides an annual scholarship covering full tuition, and an allowance for books and supplies. In addition the University receives a grant of $600 for each recipient. The awards are to be made to a student in the field of science or engineering selected by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

Pyramid Foundation, Inc.

The Pyramid Foundation, Incorporated, through Mr. Eli B. Cohen of Woodmere, New York, provides a $250 scholarship for a deserving student selected by the Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

The George Sall Metals Company Scholarship

The George Sall Metals Company Scholarships will be awarded to a freshman by the University's Committee on Scholarships on recommendations submitted by the Golden Slipper Square Club of Philadelphia. The scholarship will be in the amount of $1,000 a year. Also the company will make an annual grant-in-aid to the University of $250 each year.

The Alfred P. Sloan National Scholarships

The Alfred P. Sloan Foundation, Incorporated has granted Lehigh University four of its national scholarships, each for a

four year period, two beginning September, 1958 and two beginning September, 1959. Normally each scholarship will be for an amount equal to tuition plus $300 for other college expenses. However, the University may award a lesser or a greater amount depending upon the financial need of the recipient. In addition, the University receives each year $500 for "cost-of-education allowance" for each scholarship.

Recipients of this scholarship shall be preferably students pursuing studies in mathematics, the sciences, engineering, or business administration. They shall also meet the regular requirements of financial need, high academic achievement, good character, and promising leadership qualifications.

Sperry Gyroscope Company Scholarship

The Sperry Gyroscope Company of Great Neck, Long Island, provides $1,500 for scholarships at Lehigh University for junior or senior students in electrical or mechanical engineering. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

Texaco Scholarship

Texaco, Inc. has provided a four-year undergraduate scholarship available to entering students in any of several fields which would prepare them for a career in the petroleum industry. The total grant to the University is $1,500 annually. Of this amount a sufficient sum to cover tuition, fees, and textbooks has been allocated for the scholarship award; $100 for the sole use of the department of the student's major course of study; and the remainder as an unrestricted grant to the University. The scholarship is restricted to citizens of the United States who have been graduated in the upper third of their high school class and who give evidence of good health and financial need.

The Trane Scholarship

The Trane Scholarship will be awarded to a student for a senior year of study in the mechanical engineering curriculum. An exception can be made and an award can be given to a junior if, in the opinion of the University, he is especially deserving. The amount of the scholarship is $1,100.

The Union Carbide Scholarships

The Union Carbide Corporation, through the Union Carbide Education Fund, has established at Lehigh University sixteen annual scholarships in the amount of full tuition plus $100 for books and supplies, four to be awarded each year for four-year periods, to assist deserving students interested in a business or industrial career. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

John H. Ware, Jr., Scholarship Fund

John H. Ware, Jr., scholarships will be awarded by the University's Committee on Scholarships for needy and worthy students. Scholastic attainment is not a primary requirement in benefitting from this fund.

The Western Electric Company Scholarship

The Western Electric Company has established at Lehigh University three annual scholarships, to a maximum of $800 each, two to be awarded to undergraduate students in the College of Engineering, and one to an undergraduate in either the College of Business Administration or the College of Arts and Science. The scholarships may be granted to an upperclassman or to a first or second year student if the University desires. The recipient shall be a United States citizen without regard to color, creed, or national origin. The awards are to be made by the University Committee on Scholarships and Loans under the established rules governing the award of University scholarships.

Westinghouse Air Arm Division Engineering Scholarship

To provide recognition of achievement in undergraduate engineering education, the Westinghouse Air Arm Division at Baltimore has established a series of scholarships at Lehigh University. Each award is to be granted to an outstanding student who has successfully completed his first year of a four-year program and who is enrolled in electrical or mechanical engineering, engineering physics, or applied mathematics. Only citizens of the United States will be considered. The minimum academic achievement record a student must attain for appointment or for continuation of the scholarship is an over-all B average.

DESCRIPTION OF LOAN FUNDS

W. Appleton Aiken Memorial Loan Fund

The Residence Halls Council of Lehigh University has provided the sum of $3,000 as an undergraduate loan fund. The administration of the loan fund is under the usual University agencies. Preference in the granting of all loans is to be given to students residing in the residence halls of the University.

The Eckley B. Coxe Memorial Fund

In memory of the late Eckley B. Coxe, trustee of the University, Mrs. Coxe established a fund, amounting to $70,000, the interest of which is used, under the direction of the trustees of the University and subject to such regulations as they may adopt, for the assistance of worthy students requiring financial aid.

The Frazier and Ringer Memorial Fund

The Frazier and Ringer Memorial Fund was established in 1906 by the late Robert H. Sayre in memory of Benjamin West Frazier, A.M., Sc.D., former professor of mineralogy and metallurgy, and Severin Ringer, U.J.D., former professor of modern languages and literature and of history, each of whom served Lehigh University for one-third of a century. The income from the fund and payments made by the former borrowers are available for loans to cover the medical and surgical care of worthy students.

The Kenneth Hankinson, Jr., Memorial Fund

Mr. and Mrs. Kenneth Hankinson established this fund in memory of their late son, Bus. '50. The principal from this fund shall be used to grant emergency loans to deserving students of Lehigh University. Administration of the fund is at the discretion of the Dean of Students of the University.

George F. Pettinos Memorial Fund

An endowment fund has been established by George F. Pettinos, Jr. in memory of George F. Pettinos, M.E. '87. The income earned on the principal of the fund shall be used "to grant loans to students for tuition and fees." Repayments of the principal and interest on loans to students are also to be used to grant similar loans to students.

The awarding of loans to students shall be accomplished by the regular agency, as determined by and in accordance with the rules, regulations, and procedures of the Board of Trustees of Lehigh University.

The Edward W. Pratt Fund

Edward Williams Pratt, M.E. '90, bequeathed to Lehigh University the sum of $1,000 to be used "as a revolving fund for loans to students" to be administered at the discretion of the Dean of Students.

The President's Fund

The President's Fund was established during the early years of the University for the help of deserving students. As payments are made by former beneficiaries, they are immediately available for the assistance of students of the University.

The Frank Williams Fund

Frank Williams, B.S. '87, E.M. '88, bequeathed to the University the greater part of his estate to found a fund, now amounting to $300,000, the income of which is loaned to deserving students.

GRADUATE SCHOLARSHIPS AND FELLOWSHIPS

University Scholarships and Graduate Tuition Grants

The Board of Trustees has authorized the annual award to graduate students, on the basis of superior qualifications and need, of twelve University scholarships and twelve graduate tuition grants. The University scholarships provide free tuition for a full program of graduate study; the graduation tuition grants are awarded to accompany certain research fellowships and provide for the remission of graduate tuition.

Grants in Education

Lehigh University has made a limited number of graduate tuition grants available to students in the Department of Education for part-time study.

Awards will be made on the basis of competence, need, and funds available. Applicants should secure the necessary forms from the office of the Department of Education.

The William C. Gotshall Scholarships

A bequest from the late William C. Gotshall provides funds for as many as six scholarships to be awarded annually to worthy graduate students in any branch of engineering offered at Lehigh University. Appointment is for one year, with an annual stipend of $1,000 or more, depending on the qualifications of the applicant, plus remission of tuition fees. No duties other than graduate study are required of the holders.

ENDOWED RESEARCH FELLOWSHIPS

Graduates in appropriate curricula of colleges, universities, and technical schools whose requirements for graduation are substantially the same as those of Lehigh University are eligible to apply for any of the following research fellowships as may be available, excepting only the Student Chemistry Foundation Fellowship, which is restricted to graduates of Lehigh University.

Appointment to these fellowships is for a period of two semesters and may be renewed, provided the work of the holder is of such quality as to justify continuation of financial aid. Holders of the fellowships devote half of their time to graduate study, and the other half to research work in the department to which they are assigned.

Annual stipends for these fellowships are $1,000 or more, depending upon the qualifications of the applicant. Graduate fellows pay the regular tuition fees. However, the Committee on Graduate Scholarships and Fellowships, in awarding a fellowship, may award at the same time a graduate tuition grant. This grant provides remission of all tuition fees during the period for which it is awarded.

New Jersey Zinc Company Research Fellowship

The New Jersey Zinc Company provided funds in 1924 for a research fellowship to be known as the New Jersey Zinc Company Research Fellowship. Half of the time of the holder of this fellowship must be devoted to research work in the department to which he is assigned, the other half is to be devoted to graduate study.

The Henry Marison Byllesby Memorial Research Fellowships

In 1926, Mrs. H. M. Byllesby, widow of Col. H. M. Byllesby, M.E. 78, President of the Byllesby Engineering and Manu-

facturing Corporation, provided an endowment fund for the establishment of the Henry Marison Byllesby Memorial Research Fellowships in Engineering. Half of the time of the holders of these fellowships must be devoted to research work on some problem in electrical, mechanical, or hydraulic engineering, proposed by the President of the Byllesby Engineering and Management Corporation and approved by the Lehigh Institute of Research; the other half is to be devoted to graduate study leading to the degree of Master of Science. Usually two awards are made each year.

The James Ward Packard Research Fellowship

The income from a bequest made by James Ward Packard, M.E. '84, provides for a research fellowship in any field in which Lehigh University offers work for the doctorate.

The C. Kemble Baldwin Research Fellowship in Aeronautics

A fund established by Mrs. C. Kemble Baldwin as a memorial to her husband, C. Kemble Baldwin, M.E. '95, provides for the appointment of a research fellow in any branch of science having a bearing on the field of aeronautics. One or occasionally two appointments are available each year.

The Lawrence Calvin Brink Research Fellowship in Civil Engineering

A fund established by the late Mrs. L. C. Brink as a memorial to her husband, Lawrence Calvin Brink, C.E. '94, provides for the occasional appointment of a research fellow in civil engineering.

The Student Chemistry Foundation Fellowship

In the spring of 1927, members of the Class of 1930 established the Student Chemistry Foundation in honor of Harry Maas Ullmann, A.B., Ph.D., a member of the chemistry department from 1894 to 1938 and head of the department from 1912 until his retirement. Subsequent classes have contributed to this fund, which now provides an annual research fellowship in chemistry or chemical engineering. Only Lehigh graduates are eligible for this fellowship.

The Garrett Linderman Hoppes Research Fellowship in Civil Engineering

A fund established by the late Mrs. Maria B. Hoppes in memory of her son, the late Garrett Linderman Hoppes, C.E. '83, provides for the occasional appointment of a research fellow in civil engineering.

The William L. Heim Research Fellowship in Chemistry

A research fellowship in chemistry was established by William L. Heim, B.S. in Chem. '02.

The Roy R. Hornor Research Fellowship in Metallurgy and Inorganic Chemistry

The income from a bequest by Roy R. Hornor, B.S. '99, provides for a research fellowship in either metallurgy or inorganic chemistry, the holder of which devotes half his time to research under the direction of the faculty and half to graduate study. While the fellowship generally will be granted alternately to students in the two departments concerned, the appointment may be determined by the qualifications of available candidates.

The Katherine Comstock Thorne Fellowship in Biology

The late Gordon Comstock Thorne '16 endowed in memory of his mother a fellowship in biology, to be known as the Katherine Comstock Thorne Fellowship.

The Charles W. Parkhurst Research Fellowship

A fund established by Mrs. C. W. Parkhurst as a memorial to her husband, Charles W. Parkhurst, E.E. '93, provides for the occasional appointment of a research fellow in any field in which the University offers a graduate major. The stipend has usually been $750 per year.

ADDITIONAL FELLOWSHIPS

Certain fellowships are supported annually by various foundations, learned societies, and industrial organizations. For the most part these fellowships are reserved for applicants well along in the work towards the doctorate. Ordinarily the fellow devotes full time to academic work and receives a stipend ranging from $1,200 to $2,400, or occasionally more, plus remission of tuition fees. Appointments are for the academic year.

The following are currently available:

The Allegheny-Ludlum Fellowship
in Metallurgy.

The Allied Chemical and Dye Corporation Fellowship
in Chemical Engineering.

The Althouse Chemical Company Fellowship
in Chemistry.

The Armstrong Cork Company Fellowship
in Chemistry.

The Du Pont Company Fellowship
in Mechanical Engineering.

The Esso Education Foundation Fellowship
in Chemical Engineering.

The Howard Flint Fellowship
in Chemistry (for research relating to printing ink).

The Gordon Foundation Fellowship
in Metallurgy.

The Heat Exchange Institute Fellowship
in Chemical Engineering.

The Hercules Chemical Company Fellowship
in Chemical Engineering.

The George Gowen Hood Fellowship
(supported by the Catherwood Foundation) in any field leading to the doctorate.

The International Telephone and Telegraph Corporation Fellowship
in Communications.

The Linde Air Products Company Fellowship
in Metallurgy.

The Procter and Gamble Company Fellowship
in Chemical Engineering.

The Pure Oil Company Fellowship
in Chemistry.

The Socony Mobil Oil Company Fellowship
in Analytical Chemistry.

The Socony Mobil Oil Company Fellowship
in Chemical Engineering

The Texaco Inc. Fellowship
in Chemical Engineering.

The Union Carbide Corporation Fellowship
in Chemistry.

The United States Steel Foundation Fellowship
in Industrial Engineering.

The Westinghouse Electric Corporation Fellowship
in Mechanical Engineering.

ENDOWMENT OF FELLOWSHIPS

A research fellowship, named in honor of an individual or a corporation, offering opportunities for graduate work and training in research in any designated field of study, may be established in perpetuity through the payment to the Board of Trustees of an appropriate fund.

LOAN FUNDS

National Science Foundation Loan Funds

ELIGIBILITY. Graduate students are eligible to apply for NSF loans provided they are full-time graduate students who show themselves capable of "maintaining good standing" and can show financial need.

"Special consideration" is mandatory for (1) students with superior academic backgrounds who plan to become elementary or secondary school teachers, and (2) students whose academic backgrounds indicate a superior capacity for or preparation in science, mathematics, engineering, or a foreign language. This does not exclude other students.

AMOUNT OF LOANS. The maximum loan available is $1,000 in a fiscal year and a total of $5,000.

REPAYMENT. The student's note will be taken for repayment in ten equal installments, beginning one year after the date on which he stops being a full-time student. Interest is charged at the rate of three per cent starting with the first payment. In the case of death or disability, liability for repayment of any balance then due is waived.

TEACHERS If a graduate becomes a full-time teacher in a public elementary or secondary school, up to one-half of the loan (plus the interest on that portion) will be waived at the rate of ten per cent per annum.

Prizes and Awards

Prizes and awards are announced at commencement exercises on Founder's Day, the second Sunday afternoon in October, and on University Day in June.

William Appleton Aiken Award

This medal is awarded to the outstanding student in History 11 and 12 each year.

Alumni Prizes

Funds are provided by the Alumni Association for the annual award of four prizes of $25 each. Two prizes are awarded to the highest ranking juniors in the College of Engineering, one to the highest ranking junior in the College of Arts and Science, and one to the highest ranking junior in the College of Business Administration.

American Society for Testing Materials Student Membership Prize

The American Society for Testing Materials awards each year four student memberships to students who in their junior year have demonstrated interest and meritorious work in the engineering courses which are related to the American Society for Testing Materials.

The Robert W. Blake Memorial Prize

The Robert W. Blake Memorial Prize is awarded annually at the Founder's Day exercises to a freshman, upon his completion of one year of studies in the College of Arts and Science, who is recommended by the faculty of the College of Arts and Science as the most outstanding in high scholastic achievement and in promise of worthy leadership.

The John B. Carson Prize

An annual prize of $50 was established by Mrs. Helen Carson Turner, of Philadelphia, Pennsylvania, in memory of her father, John B. Carson, whose son, James D. Carson, was a graduate of the civil engineering curriculum of Lehigh University in 1876. It is awarded to that senior in civil engineering who shows the most marked excellence in the professional courses of his curriculum.

The William H. Chandler Prizes in Chemistry

Four annual prizes of $25 each, one in each class, for excellence in the chemistry and chemical engineering curricula were established by Mrs. Mary E. Chandler, of Bethlehem, Pennsylvania, widow of Dr. William H. Chandler who was professor of chemistry at Lehigh University from 1871 until his death in 1906. In memory of Dr. Chandler the faculty named the prizes the William H. Chandler Prizes in Chemistry.

The Choral Cup

The Choral Cup provided by Richard K. Burr, I.E. '53, John D. Kirkpatrick, Bus. Adm. '55, Donald E. Richert, Bus. Adm. '53, and Norman I. Stotz, Jr., Arts '52, is awarded to the outstanding senior participating in the vocal organizations of the Department of Music.

The Concert Cup

The Concert Cup provided by Richard K. Burr, I.E. '53, John D. Kirkpatrick, Bus. Adm. '55, Donald E. Rickert, Bus. Adm. '53, and Norman I. Stotz, Jr., Arts '52, is awarded to the outstanding senior participating in the instrumental organizations of the Department of Music.

The Cornelius Prize

The Cornelius Prize of $25, established by William A. Cornelius, M.E. '89, and endowed by a bequest by his widow, Mrs. Eleanor R. W. Cornelius, will be awarded annually to the senior student in mechanical engineering who is judged to have profited most by his opportunities at Lehigh University. The award will be based 70 per cent on scholarship, 20 per cent on attainment in general culture, and ten per cent on development in personality. To be eligible for the award, a student's scholastic standing must be in the top quarter of the class in the College of Engineering.

The Philip Francis du Pont Memorial Prize in Electrical Engineering

The Philip F. du Pont Memorial Prize Fund was established in 1929 by L. S. Horner, E.E. '98. The annual income of this fund is awarded each year in the way of prizes, two-thirds to the highest ranking senior and one-third to the second highest ranking senior in electrical engineering.

Yeyo Fabianni Award

This award is made annually to the student who is adjudged to have produced the most effective modern painting.

The Hamilton Humanities Award

The Hamilton Watch Company awards an engraved electric watch each year to the senior engineering student who has most successfully combined proficiency in his major field of study in engineering with achievements (either academic, extra-curricular, or both) in the social sciences or humanities.

The Bill Hardy Memorial Prize

An annual award of $100 is given by Mr. and Mrs. C. Edson Hardy in memory of their son to the junior who most nearly reflects the qualities that typified Bill Hardy, who was outstanding in many activities, academic and otherwise.

Haskins and Sells Foundation Award

An annual award of $500 is awarded to that accounting student in the College of Business Administration or the College of Arts and Science who after three years has demonstrated excellence in scholarship, professional potential, extra-curricular activities, and moral character.

The Harold J. Horn Prizes

The heirs of Harold J. Horn, E.E. '98, established a fund, the income of which is used in the award of a first and second prize of $40 and $20 respectively for the two highest ranking juniors in electrical engineering.

The Andrew Wilson Knecht III Memorial Award

This award is made each year to the member of the mechanical engineering class graduating in June who has exhibited the greatest potential for applying his technical training to practical application. The award is a specially designed medallion with hand engraving and enclosed in a leather folder and presentation case.

The McClain Award for Meritorious Painting

The McClain Award for Meritorious Painting, consisting of a trophy and a fifteen ($15) dollar purchase prize, and provided by Mr. A. V. McClain, shall be presented the student of

painting in the Department of Fine Arts studio classes who completes the most meritorious painting during the academic year.

The McClain Progress Award

The McClain Progress Award, consisting of a trophy and a fifteen ($15) dollar purchase prize, and provided by Mr. A. V. McClain, shall be presented to that student whose progress in painting in the Department of Fine Arts studio classes during the year shall be most marked.

The Elizabeth Major Nevius Award

The Elizabeth Major Nevius Award was established by Walter I. Nevius, E.E. '12, "in loving memory of his wife, who profoundly admired young men of diligence, intelligence, aggressiveness and sterling character." The award of $500 shall be made annually to that senior enrolled in any five-year combination curriculum leading to two baccalaureate degrees who, upon completion of his first four years at Lehigh University and upon graduation with his class, shall be adjudged the most outstanding of the seniors completing work for their first baccalaureate degree and continuing to a second baccalaureate degree at Lehigh University, judged upon the basis of leadership, citizenship, and scholarship.

The Pennsylvania Institute of Certified Public Accountants Prize

The Pennsylvania Institute of Certified Public Accountants awards each year an Accountants' Handbook to the senior in the College of Business Administration majoring in accounting who is outstanding in academic achievement and leadership.

Phi Sigma Kappa Scholarship Cup

PHI SIGMA KAPPA SCHOLARSHIP CUP. A scholarship cup, to be awarded for one year to the fraternity in the interfraternity council having the highest scholastic average for the preceding year and to become the permanent property of the fraternity winning it for three successive years, was provided by an alumnus of the Nu Chapter of Phi Sigma Kappa social fraternity in 1923. This cup was retired upon presentation to the Tau Delta Phi fraternity on Founder's Day, 1947, the winning group having had the highest scholastic average among those eligible for the prize for three successive years.

A new cup, to be known also as the Phi Sigma Kappa Scholar-

ship Cup and to be awarded on the same terms as the original, has been provided by the local chapter of Phi Sigma Kappa.

The Allen S. Quier Prize in Metallurgy

An annual prize of $15 has been provided by the daughters of the late Allen S. Quier in memory of their father, to be awarded to the senior who was adjudged by the staff of the department of metallurgical engineering to have made the most progress in his work in that curriculum. While high scholastic standing is a requisite, the prize is awarded on the basis of progressive achievement in scholastic work, rather than an average rating.

The T. Edgar Shields Cup

The Shields Cup was established by the late Dr. T. Edgar Shields, former director of music at Lehigh. It is awarded annually to the student who is considered most outstanding in over-all musical activities.

Thornburg Mathematics Prize

The Thornburg Mathematics Prize is made possible through a bequest by the late W. P. Tunstall ('03) in honor of the late Professor Charles L. Thornburg. The prize, consisting of a credit slip in the amount of forty dollars to purchase books in the field of mathematics or allied disciplines at the Book Store, shall be awarded to the senior with the most outstanding record in an advanced course in mathematics. The winner will be selected by the Department of Mathematics to receive the award at the June commencement.

Trustees' Scholarship Cup

The trustees of the University have provided a scholarship cup which is awarded for one year to the living group having the highest scholarship average for the preceding year. The trustees' scholarship cup becomes the permanent property of any living group winning it for three successive years.

The Elisha P. Wilbur Prizes

A fund was established by the late E. P. Wilbur for distribution in prizes as the faculty might determine. The income from this fund beyond that necessary to award the Wilbur Scholarship Prize is used to provide awards as follows:

Wilbur Mathematics Prizes. A first prize of $50 to be awarded annually to the highest ranking freshman engineer in the first year of freshman engineering mathematics completed at Lehigh University, as recommended by the Department of Mathematics.

A second prize of $25 to be awarded annually to the second highest ranking freshman engineer in the first year of freshman engineering mathematics completed at Lehigh University, as recommended by the Department of Mathematics.

The Wilbur Scholarship Prize

The Wilbur Scholarship was founded in 1872 by Elisha P. Wilbur, trustee of Lehigh University from 1871 until his death in 1910, the University's first treasurer, and also twice Secretary of the Board. It provides the sum of $200 which is awarded annually to the sophomore with the best record for the sophomore year.

The Williams Prizes in English

The late Professor Edward H. Williams, Jr., an alumnus of the University of the Class of 1875, established prizes for excellence in English composition and public speaking. The freshman, sophomore, and junior prizes are awarded by the faculty on the recommendation of the Department of English.

Freshman Composition Prizes. A first prize of $75, a second prize of $50, and a third prize of $25 are awarded annually for the three best compositions submitted by freshmen of regular standing as required work in their English courses.

Sophomore Composition Prizes. A first prize of $75, a second prize of $50, and a third prize of $25 are awarded annually for the three best compositions submitted by sophomores of regular standing as required work in their English courses.

Junior Composition Prizes. A first prize of $75, a second prize of $50, and a third prize of $25 are awarded for the three best essays submitted by juniors as part of the required work in their courses in English.

The Williams Prizes in Extempore Speaking

A first prize of $75 and a second prize of $50 are awarded to freshmen of regular standing who excel in a contest in extempore speaking held in May of each year.

A first prize of $75, a second prize of $50, and a third prize of $25 are awarded annually to the winners in a contest in extempore speaking for sophomores, juniors, and seniors. Winners of first prizes are not eligible to compete in subsequent years

The Williams Prizes in Intramural Debating

Sums totaling $250 are awarded annually as prizes in intramural debating. Students engaged in this activity are organized under the direction of the department of English into teams, which compete as units in a series of debates held throughout the year. The sum of $150 is divided equally between the two members of the winning team, the sum of $100 between the two members of the runner-up. Winners of first prizes may not compete in the next year.

The Williams Senior Prizes

The Williams Senior Prizes are awarded by the faculty on the recommendation of the committee on Williams Senior Prizes.

1. First prizes of $150, second prizes of $100, and third prizes of $50 are awarded annually in each of the five fields of economics, English, philosophy, psychology, and history and government for dissertations submitted by regular members of the senior class on or before April 15.

2. The committee on Williams Senior Prizes publishes, before the close of the academic year, a list of recommended subjects for dissertations; but a senior may submit a dissertation upon any other subject in the respective field if the subject has received the approval of the committee.

3. Each senior entering the competition shall submit to the committee his choice of subject and plan of work by November 15.

4. The awards are made by the faculty upon recommendation of the committee, but no award is made if in any case a dissertation does not meet the standards of merit established by the committee. This standard includes such points as excellence in thought, plan, development, argument, and composition.

The Theodore B. Wood Prize

A prize of $50 is awarded, annually, under the terms of the will of the late Theodore B. Wood, to the student who has made the greatest scholastic improvement during the first two years of his college course.

Prizes Awarded by Student Organizations

In recognition of Professor Emeritus Alpha Albert Diefenderfer's long service as faculty adviser to the organization, the Lehigh University Chemical Society establisheed in 1947 the Alpha A. Diefenderfer Award for the highest ranking sophomore in analytical chemistry. Each winner is presented with an engraved certificate, and his name is inscribed on a plaque given by the Society and displayed in the Chemistry Building.

Alpha Epsilon Delta Award. Alpha Epsilon Delta places the name of the pre-medical biology freshman with the highest cumulative average on a plaque in the Department of Biology.

Alpha Kappa Psi Key. The Alpha Sigma Chapter of Alpha Kappa Psi, a professional fraternity in commerce, awards annually the Alpha Kappa Psi Scholarship Key to the senior student pursuing a degree in the College of Business Administration, who has attained the highest scholastic average for three years of collegiate work at Lehigh University.

The Alpha Pi Mu Prize. The Alpha Pi Mu honorary fraternity in industrial engineering awards each year an industrial engineers' handbook to the highest ranking freshman in the industrial engineering curriculum.

American Chemical Society Award. The Lehigh Valley Section of the American Chemical Society awards a membership in the American Chemical Society and a subscription to a journal of this society to the highest ranking junior in chemistry or chemical engineering.

American Society of Civil Engineers Prize. The Lehigh Valley Section of the American Society of Civil Engineers offers a prize of a junior membership in the American Society of Civil Engineers to the outstanding senior in civil engineering holding membership in the student chapter.

American Society of Mechanical Engineers Junior Membership Prize. The Anthracite-Lehigh Valley Section of the American Society of Mechanical Engineers awards annually a prize of the value of $10 to an outstanding member of the Lehigh Student Branch of the ASME. This prize takes the form of junior membership for one year in the parent society.

Eta Kappa Nu Prize. The Eta Kappa Nu honorary fraternity in electrical engineering awards a handbook in electrical engineering to the highest ranking freshman in the curriculum in electrical engineering.

Phi Eta Sigma Award. The Lehigh chapter of this national freshman honor society for men offers an award to the residence halls section with the highest freshman average for the fall semester each year. The trophy is a gift from Professor Harold V. Anderson of the Department of Chemistry.

Pi Tau Sigma Prize. The Pi Tau Sigma honorary fraternity in mechanical engineering awards each year a mechanical engineers' handbook to the highest ranking sophomore in the curriculum in mechanical engineering.

Tau Beta Pi Prize. The Tau Beta Pi honorary engineering fraternity awards each year a slide rule or other prize of equivalent value to the engineering freshman having the highest scholastic average.

Summer Sessions

The courses offered during the 1959 Summer Session were arranged as follows: (1) two undergraduate sessions of six weeks each from June 17 through July 25 and from July 28 through September 5; (2) the regular graduate session of six weeks, June 18 through 25; (3) the post session, July 27 through August 11, designed primarily for graduate students; (4) the workshops, June 16 through July 3, consisting of programs in the field of health education and the elementary curriculum, exclusively for teachers; (5) the special engineering courses and camps including civil engineering, June 8 through June 27, industrial engineering, June 8 through June 26, and August 17 through September 4, and mining engineering, June 8 through June 27; (6) the reading and study development laboratory, July 20 through August 7 designed primarily for high school students, and August 10 through August 28 designed primarily for college entrants; and (7) The Reading Laboratory School, June 22 through July 31, a program for disabled readers, ages 8 to 17.

The SUMMER SESSION ANNOUNCEMENT, containing a full description of courses to be offered in 1960 together with information concerning admissions, fees, etc., will be sent on request addressed to the director of the Summer Session.

General College Division

The General College Division, plans for which were approved by the faculty on April 6, 1942, was organized to supplement the work of the established undergraduate curricula by meeting the educational needs of certain special groups of students. The division aims to provide an opportunity for young men not planning a four year program to pursue such work, either of a general or a more specialized nature, as their preparation and interests make desirable; a trial period for those who wish to become candidates for baccalaureate degrees but whose preparatory training does not fully satisfy the entrance requirements for the curricula of their choice; and facilities for qualified male adults to continue their education without being committed to a restricted or specialized program.

Although all work available through the General College Division will be found at present among the regular offerings of the several departments, the work taken by students enrolled in this division is not regarded as primarily preparation for admission to the upper classes of the University; rather, the courses are looked upon as complete in themselves. As time indicates certain needs not recognized at the moment, consideration will be given to the development of special courses for the General College Division group.

Each student in the General College Division has an individual program, one not subject to distribution or curriculum requirements, yet one limited by the student's ability to meet the prerequisites of the courses which he desires to take. With but few exceptions, the student enrolled in this division enjoys the same privileges as all other undergraduates in the University, including eligibility to unrestricted prizes, access to student aid, and the right of petition; and he is also subject to the same general regulations, those pertaining to scholastic probation not excepted. The

General College Division student will not, however, be a candidate for a degree, save in those instances where transfer to one of the undergraduate programs of study leading to degrees is approved by the Committee on Standing of Students.

Bureau of Educational Service

The Bureau of Educational Service was organized in 1953 to coordinate the many educational services rendered by the University to public and private schools and to provide further professional assistance to schools and school groups.

Among its purposes are the rendering of professional assistance to educational agencies in the cooperative study of their problems, the fostering of educational research, and the making more readily available the educational research facilities of the University. In fulfilling its purposes, the services of specialists—local, state, and national—in the several fields of education, both subject matter and professional, are made available.

Detailed information concerning the organization and operation of the Bureau will be provided by the Director upon request.

Adult Education Program

The Adult Education Program is committed to serving the needs and interests of people in all walks of life. It is limited to special courses offered in the afternoon, evening, and Saturday sessions, but is open alike to men and women students of twenty-one years of age and older.

A wide variety of courses is included in the present program. Some are intended to meet specific needs of special groups. Others attempt to serve the general public in such fields as art, literature, history, government, and international relations. Still others result from cooperative arrangements with business and industry, and with service and welfare agencies.

The Adult Education Program, approved by the faculty on March 6, 1944, is a recognition of the principle that social institutions have service responsibilities within their spheres of influence. As a private educational institution, Lehigh University's interest is as great but its area of operation properly more restricted than that of a publicly supported institution of higher

learning. It is the desire of the University to meet the increasing demand for this new service through a flexible program closely adjusted to individual needs and interests.

University Library

Two principles underlie the operation of the Lehigh University Library: the building of sound, balanced collections, and the provision of reference and circulation service to meet the needs of both faculty and students.

General and special collections now number some 380,000 volumes, with annual accessions of about 10,000 volumes. Over 3,500 current periodicals and serials are received, including seventeen newspapers, both foreign and domestic. The Library is a depository for a wide selection of U. S. government documents. Collections are particularly strong in the physical and natural sciences, mathematics, engineering, British Colonial history, and English and American literature. The Honeyman Collection of rare books in both literature and the History of Science is available to the undergraduate.

The Library may be used either as a passive memory of recorded knowledge, or as an active agent in the processes of formal education. In either case, a policy of open access to the general collection furnishes the Lehigh student with the maximum opportunity for exploiting the literature of his field. In addition, instruction in the effective use of the Library is provided to all freshmen, and to upperclass students in a number of curricula, including engineering. Reference service is available at all times, and until 10 p.m. on weekdays during the term.

Religious Observances

On each Sunday of the academic year, chapel services are held at 4 p.m. in Packer Memorial Church, with the chaplain of the University in charge, with the exception of Sunday in Freshman Week and the Houseparty Sundays when the service is held at 11 a.m. Outstanding leaders of the Christian Church fill the pulpit approximately once a month. Music for these Sunday services is furnished by the Lehigh University Chapel Choir. In addition, Holy Communion services are held every Sunday at 10 a.m.

There are also a number of special religious observances, such as the Chapel Service and Convocation, which opens Freshman Week; the annual All-University Memorial Observance in November; and the annual Christmas Vesper Choral Program.

Attendance at all religious services is voluntary.

Student Personnel Services

General counseling of individual students, especially in the freshman year, is largely the responsibility of the student personnel services—a group of cooperating agents and agencies. For the new student and his parents, such services begin in their earliest discussions with the Director of Admission and his staff. Most of the student's early contacts after his entrance are with the Residence Hall Counselors. These counselors are carefully selected upperclassmen and graduate students, appointed by the President of the University, who help the freshman and who direct him to more highly specialized aid when needed. The resident House Officer in each of the three freshman residence halls works closely with the Counselors; the Head Counselor is a graduate student working in the field of psychology. The entire program is conducted under the supervision of the Director of Residence Halls and the Dean of Students.

Freshmen whose problems transcend the competence of the Residence Hall Counselors come to other advisers for guidance in many areas of student life and welfare and, at all levels, academic questions, personal problems, social adjustment difficulties, financial needs, and many other troubles are dealt with daily. Problems of vocational choice and academic adjustment are not uncommon during the freshman and sophomore years.

Each student in the College of Arts and Science is considered from the beginning of his course as an individual and his choice of studies is carefully organized in terms of his specific backgrounds of preparation and his future objectives. The dean of the College and his colleagues have individual conferences with each freshman (and often his parents) at the start of his first year, beginning during the preceding summer, in order to plan the freshman's academic program. This individual counseling continues throughout the student's four years in the College. In the College of Business Administration and in the General College

Division, faculty advisors work with the individual student and his individual problems for the same purposes. Similarly, the director of the freshman engineering curriculum spends much time with the freshman engineering students and often with their parents in an effort to help in the adjustment of academic difficulties and in better definition of vocational objectives. These forms of advisement are carried on through the following years with the students' curriculum advisors.

A student's problems often reveal the need of more highly specialized attention, whereupon the student is referred to the particular service which he should consult. Problems of mental or physical well being are, of course, referred to the University Health Service which is described in another section. The University Chaplain is available for the student with religious, moral, or personal concerns that are interfering with his peace of mind and his studies.

If a student is not certain about his vocational or professional choice, he needs to know both more about his own capacities and interests and more about the professions and their demands. The Counseling and Testing Service is available without charge. A large library of occupational information is there for the student's use and study. Later, in his senior year, the question of prime importance is the decision of a position after graduation. The Director of Placement, in personal and group conferences, advises on applying for a position, on being interviewed, and on the relative advantages and disadvantages in working for the different business and industrial firms seeking the services of college graduates. (See page 365.)

Financial problems can become a serious hazard for a student. The Coordinator of Scholarships and Self-Help may find other related concerns. If the student is a veteran of military service and has questions involving relations with the Veterans Administration, he will find the Registrar informed in this field. The Registrar also is an advisor on the draft and military service, on matters of transferred credits, graduation requirements, and allied topics.

A serious hazard to success in a student's academic life may be in poor study habits or reading skills. The Reading and Study Clinic can provide help. (See page 367.)

Not all student problems are individual problems. Many are group problems, having to do with group living in the residence

halls, with student activities, student organizations of many kinds, fraternity life, and campus social life in general. The associate deans of students give much of their time to this area of student life.

Many members of the teaching faculty are deeply interested in students and student life and spend a great deal of time working with students and student groups. They contribute their services as academic advisors, activity sponsors, group sponsors and advisors, chaperones at social affairs, by entertaining in their homes, and in friendly personal relationships with students. Their contributions are invaluable and appreciated all the more because they are largely voluntary.

In these and in other ways Lehigh University endeavors to maintain the close contacts with students which characterize the smaller institutions. Services are available for all student needs, and the student need only turn to his nearest residence hall counselor, professor, or closest campus friend to learn where he can receive the help he needs.

Students' Health Service

A dispensary is maintained which is equipped and staffed for routine medical and minor surgical care. Twelve beds are available for short periods of observation. Dispensary hours are from 8:30 a.m. to 5 p.m. weekdays; 8:30 a.m. to 12:30 p.m. Saturdays; and 10 a.m. to 12 noon on Sundays. During vacation periods and during the summer sessions, no Sunday hours are held.

Patients requiring more than a few days bed care are sent home or to a local hospital when indicated. Any expenses so incurred must be paid by the student.

A night medical attendant is on duty through the fall and spring semesters from 5 p.m. to 8 a.m. Facilities are available during these hours for the treatment of minor injuries and illnesses. A physician is on call at all times during the fall and spring semesters.

Due to limited staff and multiplicity of dispensary duties, Health Service physicians are not able to make professional calls on students in living groups or in rooms, except in cases of absolute emergency. If unable to visit the dispensary in the event of illness or injury, students are advised to call a local physician

for treatment. Such physicians' fees will be paid by the student, his family, or his Health Insurance Plan.

Ambulatory Dispensary Services

Medical and minor surgical problems of students are dealt with by the dispensary. A necessarily limited emergency service is also extended by the Health Service to those faculty members and other employees who wish to avail themselves of it.

Physical Examinations

Prior to arrival on campus each new undergraduate student is required to submit a Health History Form and Record of Physical Examination completed and signed by his own physician. At the appropriate time these forms are mailed to new students with specified date for completion and return to the Director of the Health Service.

Late return of these forms results in incomplete records and necessitates special handling in order to bring them to completion. A fine of $10 is charged against any student whose completed form is not returned within the time specified. In addition, any further delay in completion and delivery to the Health Service of this form after arrival on campus, following notification of such deficiency by the Health Service, will result in an additional fine of $10 for each successive failure to comply. A fine of $10 also will be levied against any student who fails to respond to an official summons from the Health Service, or who fails to appear for a regularly and officially scheduled Health Service procedure in which he is involved.

All new employees are expected to have a physical examination before beginning their duties at the University. Such pre-employment examinations may be done by the Health Service staff, or by the applicant's chosen physician (at the applicant's expense) on Health Service forms supplied for that purpose. All completed forms are to be returned to the Director of the Health Service as soon as possible for confidental analysis and filing.

The physicians of the Health Service carefully analyze the results of all physical examinations in order to detect any latent or obvious physical, emotional, or mental abnormality. When found, the person involved may be invited for a conference and his disability discussed with him confidentially.

Close cooperation between the Department of Physical Education and the Health Service permits the establishment of rehabilitation measures, etc., as indicated. All students are graded for the physical education program according to their abilities to participate in physical activities.

In addition, students who are unable to meet the physical requirements for participation in the Reserve Officers Training Corps program are disqualified from that unit by the Health Service.

The Health Service wishes to work closely with the student's family physician and, as far as possible, will continue any treatments or follow-up studies requested by him.

Tuberculosis Survey

A 70 mm. Chest X-ray is made of each incoming student routinely. Any departure from the normal noted during the reading of these films calls for a 14″ x 17″ chest X-ray and further investigation.

Immunizations

All new and transfer students are required either to show evidence of vaccination against smallpox within three years, or to submit to such vaccination prior to the beginning of classes.

Immunization with Tetanus Toxoid and the Salk Vaccine is strongly recommended before coming to Lehigh.

Laboratory

Facilities are available for routine laboratory procedures. Additional procedures are performed at a local hospital at the expense of the student.

X-ray Services

The X-ray equipment of the Health Service includes a diagnostic unit, a 70 mm. Chest X-ray unit, and necessary developing and drying apparatus. X-ray services are limited to bone and chest films. No X-rays are taken of any body organs which involve the use of dyes, barium, etc.

A small charge is made to cover the cost of reading the X-ray by a local radiologist.

Physiotherapy

A well-equipped physiotherapy section is a valuable adjunct to the University Health Service. A well-trained technician ad-

ministers treatment under the supervision of the University physicians with such equipment as diathermy, whirlpool, ultra-violet and infra-red lamps.

Personnel

Full-time Health Service personnel normally includes two physicians: the director, and the assistant director; a physiotherapist, a laboratory and X-ray technician, two nurses, a night medical attendant, a secretary, an administrative assistant, and a receptionist.

Health and Accident Insurance

The University offers students a choice between two kinds of insurance policies against illness and/or injury. One policy covers both illness and accident, and the other accident only. The latter policy, of course, costs less. Both kinds are offered for a nominal fee, and on an entirely voluntary basis.

The Health Service recommends highly these insurance plans to both present and prospective students. Much experience has emphasized the importance of such protection, and we urge all students to participate in one or the other of these plans throughout their college careers.

All foreign students and others who, in the opinion of the administrative officers of the University, may not be in a position to meet the costs of sickness or injury are usually required to carry both health and accident insurance.

Placement, Counseling, and Testing Services

In order to prepare the student for the exigencies of college life, the University maintains a placement, counseling, and testing service. This service functions to help the student make satisfactory adjustments to his college environment and to provide counseling and aid in obtaining employment upon graduation.

Counseling and Testing Services

The primary aim of counseling is to aid the student to gain a better understanding of himself and how his personal characteristics bear on his present and future adjustments. Students who avail themselves of the professionally administered techniques of psy-

chological testing and personal counseling profit by establishing realistic guideposts by which to direct their courses of action.

Psychological tests, including those administered during Freshman Week, are used to assess a student's aptitude, achievement, skills, interests, and personality characteristics. Interpretations of these tests are made with the student to help him orient his course work, study, and campus life toward achieving his maximum effectiveness. When the student feels that a more extensive evaluation of his situation is needed, further testing and personal counseling aimed at helping him understand his direction and motivation are undertaken. Also, cross communication with other University personnel agencies is maintained in gathering together information and expediting plans made cooperatively with the student. The counseling service maintains a library of educational and occupational information to which students can refer as they attempt to develop a clear conception of the educational and vocational world and their place in it. These services are available, without cost, to all University students.

The counseling service is also the administrative center of a variety of local and national testing programs in which students might be asked to participate during their college career. The most frequently administered of these programs are the Graduate Records Examinations, Law School Admissions Test, Medical College Admission Test, Graduate Study in Business Tests, National Teacher Examination, and Millers Analogies Tests.

The Service also engages in research on tests, counseling, and other personnel functions. The results of such research are ultimately useful in the counseling of individual students.

Placement Services

Assistance is given to seniors seeking positions, underclassmen seeking summer jobs, and alumni looking for employment or a change of positions.

This office places particular emphasis upon the techniques of job seeking and interviewing. A well-developed vocational material file is maintained. Descriptive literature concerning many different companies is also available.

During the college year representatives of several hundred industries and business houses visit the campus to recruit graduates.

Reading and Study Clinic

There are many factors which influence the performance of college students. An important one is the expertness with which they master the skills necessary for college work. High level skills are needed in preparing assignments, note-taking, outlining, listening, recalling information and facts, taking examinations, preparing written and oral reports, and reading critically and accurately. The Reading and Study Clinic, Department of Education, offers Lehigh men an opportunity to develop satisfactory reading and study habits. The following services are available to all students:

Analysis of reading and study skills
Reading and study improvement programs
Individual guidance on problems of academic adjustment.

First-year students, particularly, are encouraged to arrange for a conference so that they can be assisted in making an evaluation of their learning tools and in planning for more effective work.

The improvement programs are offered periodically during the fall and spring semesters. Small group instruction is scheduled for interested students three hours a week for six consecutive weeks. The instruction is adapted to the needs of the individual in well-equipped classrooms.

Academic Observances

Baccalaureate Sunday

Baccalaureate Services were held Sunday afternoon, June 14, 1959, in Packer Memorial Church. The sermon entitled "Adventuring Allies," was delivered by Dr. Ralph W. Sockman, pastor of Christ Church Methodist, New York, N. Y.

University Day

University Day was observed Monday, June 15, 1959. The 91st Commencement Exercises were held in Eugene Gifford Grace Hall. The address to the graduating class was delivered by Dr. Arthur S. Flemming, Secretary, U. S. Department of Health, Education and Welfare, Washington, D. C. Honorary degrees and degrees in course were conferred, commissions in the United States Air Force Reserve and the United States Army Reserve were

awarded, and graduation honors and prizes for members of the Class of 1959 were announced.

Founder's Day

The 81st annual exercises in honor of Hon. Asa Packer, founder of the University, were held Sunday afternoon, October 11, 1959 in Packer Memorial Church. The Commencement Address, "The World We Live In," was delivered by Dr. Ernest Kidder Lindley, Senior Editor, Newsweek. Degrees were conferred, and graduation honors, class honors, and prizes announced.

Alumni Association

The Lehigh University Alumni Association, which has been in existence since 1876, was incorporated in 1917. The offices of the association are located in the Alumni Memorial Building. Along with the regular alumni activities, the association is largely concerned with fund raising to meet the needs of the University.

The officers of the Alumni Association for 1959-60 are:
President, Edwin H. Snyder, '23, West Orange, N. J.
1st Vice-President, Frank C. Rabold, '39, Bethlehem, Pa.
2nd Vice-President, G. Douglas Reed, '33, Baltimore, Md.
Treasurer, J. K. Conneen, '30, Bethlehem, Pa.
Archivist, James D. Mack, '38, Bethlehem, Pa.
Immediate Past-President, Edwin H. Snyder, '23, West Orange, N. J.
Executive Secretary and Editor of the *Lehigh Alumni Bulletin,* Robert A. Harrier, '27, Pen Argyl, Pa.

Over seventeen thousand Lehigh alumni throughout the country who maintain an active interest in the University are afforded opportunities for frequent social contact with Lehigh men of all classes through thirty-six alumni clubs established in areas of alumni concentration. Important outposts of the University, these clubs hold meetings and carry on activities that mirror the activities of the University in its cultural, social, financial, and recreational phases.

The following are the alumni clubs: New York Lehigh Club, Philadelphia Lehigh Club, Pittsburgh Lehigh Club, Chicago Lehigh Club, Washington, D. C. Lehigh Club, Detroit Lehigh Club, Northeastern Pennsylvania Lehigh Club (Scranton and Wilkes-

Barre), Maryland Lehigh Club (Baltimore), Youngstown (Ohio) Lehigh Club, Lehigh Club of Northern New England (Boston), Lehigh Club of Central Pennsylvania (Harrisburg), Lehigh Club of Northern New York (Schenectady), Lehigh Club of Northern Ohio (Cleveland), Lehigh Club of Southern New England, Lehigh Club of Western New York (Buffalo), Lehigh Home Club (Bethlehem, Pa.), Lehigh Club of Southeastern Pennsylvania (Reading), Lehigh Club of Central Jersey (Trenton), Lehigh Club of York-Lancaster (Pa.), Lehigh Club of Northern New Jersey (Newark), Lehigh Club of Northern California (San Francisco), Lehigh Club of Southern California (Los Angeles), Lehigh Club of Delaware (Wilmington), Lehigh Club of Monmouth County, N. J., South Jersey Lehigh Club (Camden), Bergen-Passaic Lehigh Club (N. J.), Central Ohio Lehigh Club, Twin-City Lehigh Club (Minneapolis), Lehigh Club of St. Louis (Mo.), Lehigh Club of Milwaukee (Wis.), Lehigh Club of Rochester (N. Y.), Lehigh Club of Atlanta (Ga.), Watchung Area Lehigh Club (Plainfield, N. J.), Southern Anthracite Lehigh Club (Pottsville, Pa.), Pacific Northwest Lehigh Club (Seattle, Wash.), Allentown (Pa.) Lehigh Club, Florida West Coast Lehigh Club, Kansas City Lehigh Club.

Organizations

National Honor Societies — General

Beta Gamma Sigma (business administration)
Omicron Delta Kappa (student leadership)
Phi Beta Kappa (scholarship)
Phi Eta Sigma (freshman scholarship)
Sigma Xi (scientific research)
Tau Beta Pi (engineering)

National Honor Societies — Departmental

Alpha Epsilon Delta (pre-medical)
Alpha Pi Mu (industrial engineering)
Chi Epsilon (civil engineering)
Eta Kappa Nu (electrical engineering)
Phi Alpha Theta (history)
Pi Gamma Mu (social science)
Pi Mu Epsilon (mathematics)
Pi Tau Sigma (mechanical engineering)

National Recognition Societies

Alpha Phi Omega (campus service)
Arnold Air Society (Air Force)
Eta Sigma Phi (classics)
Pershing Rifles (military)
Pi Delta Epsilon (college journalism)
Psi Chi (psychology)
Scabbard and Blade (military)

COURSE SOCIETIES

Intellectual interest in various fields of study and professional spirit among arts, business, and engineering students is promoted by a group of organizations commonly called course societies. The first of these organizations historically was the Chemical Society, established in 1871. The list now includes:

In Arts and Science

Delta Omicron Theta (debating)
International Relations Club
Newtonian Society
Psychology Club
Robert W. Hall Pre-Medical Society

In Business Administration

Alpha Kappa Psi (business administration)
Beta Alpha Psi (accounting)
Lambda Mu Sigma (marketing)
Lehigh Accounting Society

In Engineering

American Chemical Society (chapter of student affiliates)
American Institute of Chemical Engineers (student chapter)
American Institute of Electrical Engineers and Institute of Radio Engineers (combined, student branch)
American Institute of Industrial Engineers (student branch)
American Institute of Physics (student section)
American Society of Civil Engineers (student branch)
American Society of Mechanical Engineers (student branch)
Howard Eckfeldt Society and Geological Society (student branch of the American Institute of Mining and Metallurgical Engineers)

Metallurgical Society
Society of American Military Engineers
Student Chemical Society

Other Student Organizations

Alpha Chi Epsilon (Episcopal pre-theological honorary society)
Alpha Lambda Omega (Allentown group)
Arcadia, the Student Council
Band
Brown Key Society
Camera Club
Canterbury Club
Chapel Choir
Chess Club
Christian Council
Combined Musical Club (Glee Club, Cliff Clefs, Collegians, Brass Choir)
Cosmopolitan Club
Cut and Thrust Society (fencing)
Cyanide Club (junior honorary society)
Ernest W. Brown Astronomical Society
Evangelical & Reformed Student Group
Flying Club
Gryphon Society
Hillel Society
Hockey Club
Interfaith Council
Interfraternity Council
Intervarsity Christian Fellowship
Lutheran Student Fellowship
Methodist Student Fellowship
Mustard and Cheese (dramatic club)
Newman Club
Political Science Assembly
Radio Society
Residence Halls Council
Roger Williams Fellowship
Sailing Club
Skiing Club
Town Council

Varsity "L" Club
Westminster Fellowship

The following Greek letter national social fraternities have chapters at Lehigh University: Alpha Chi Rho, Alpha Sigma Phi, Alpha Tau Omega, Beta Theta Pi, Chi Phi, Chi Psi, Delta Chi, Delta Phi, Delta Sigma Phi, Delta Tau Delta, Delta Upsilon, Kappa Alpha, Kappa Sigma, Lambda Chi Alpha, Phi Delta Theta, Phi Gamma Delta, Phi Kappa Theta, Phi Sigma Kappa, Pi Kappa Alpha, Pi Lambda Phi, Psi Upsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi, Sigma Phi Epsilon, Tau Delta Phi, Theta Chi, Theta Delta Chi, Theta Xi.

Student Publications and Radio

The students of Lehigh University publish a semi-weekly college newspaper, *The Lehigh Brown and White,* and a yearbook, *The Epitome.* The students' modern radio station, WLRN, 640 kc., has a broadcast day of eighteen hours. The Radio Workshop which broadcasts weekly programs over local commercial stations provides practical experience for students taking certain courses in the Division of Speech.

Music and Lecture Series

Student Concert-Lecture Series. Founded in 1936, the Student Concert-Lecture Series is the major concert series presented during the academic year by Lehigh University for the student body, the faculty and staff, and the community. Included are presentations by symphony orchestras, noted soloists, and dramatic groups.

Cooperative Lecture Series. The Cooperative Lecture Series presents programs on a variety of subjects throughout the school year which are open without charge to the student body and the public. Sponsored by the Cooperative Lecture Series Committee in conjunction with various departments on campus, the series originated in 1956.

Cleaver Concerts. A series of musical programs called the Cleaver Concerts are presented each year to further the appreciation of music among the student body and the community. The programs are endowed through the gift of Mrs. Elizabeth K.

Cleaver and are named for her husband, the late Albert N. Cleaver, a former trustee of the University.

Lehigh Institute of Research

The Lehigh Institute of Research was organized in 1924 to encourage and promote scientific research and scholarly achievement in every division of learning represented in the organization of the University, and in recognition of the need for further and more exact knowledge in science and in the application of science to the affairs of modern life. The Institute was reorganized in 1945 in order to cooperate more effectively with industry and government agencies.

The purposes of the Institute of Research include the training of men for research work, the publication of results of investigations, the conduct of general research, the conduct of cooperative research, and advisory service.

Detailed information concerning the organization and regulations of the Institute of Research will be provided by the Director upon request.

INSTITUTE OF RESEARCH APPOINTMENTS

Lehigh University cooperates with industrial concerns, technical associations, and government agencies in carrying on basic research and applied research designed to develop new and to improve old products and methods of production. Cooperative research projects usually provide every year a number of research assistantships which are available to qualified graduate students. These assistantships provide stipends which vary from $150 to $350 per month, depending upon the qualifications of the appointee and the time assigned to the project. Appointments are for one year and may be renewed or extended. Part- or full-time employment on research projects is frequently available during the summer, and whenever possible it is desirable for entering students who hold research appointments to begin their employment in June or July before the commencement of formal graduate study in the fall. Applications for research assistantships should be accompanied by evidence of the candidate's qualifications for the appointment sought and sent to the Director of the Lehigh Institute of Research or to the head of the department concerned.

Among the cooperative research programs in progress at present are those sponsored by the following agencies:

Aluminum Company of America
American Cyanamid Company
American Institute of Steel Construction
American Iron & Steel Institute
American Marietta Company
American Steel & Wire Division of U. S. Steel Corporation
Armstrong Cork Company
Association of American Railroads
Babcock and Wilcox Company
Bethlehem Steel Company
Chrome Producers Association
  Columbia-Southern Chemical Corporation
  Diamond Alkali Company
  Mutual Chemical Company
Column Research Council
Corn Industries Research Foundation
Esso Education Foundation
Federation of Paint and Varnish Production Clubs
Fisher Scientific Company
Folding Paper Box Association
Foster Wheeler Corporation
Heat Exchange Institute
E. I. du Pont de Nemours and Company
Ingersoll-Rand Corporation
International Nickel Company
Interstate Commission for the Delaware River Basin
John A. Roebling's Sons Corporation
Kentile, Incorporated
Leather Technology Association
  S. B. Foot Tanning Company
  A. F. Gallum and Sons Company
  The Ohio Leather Company
  Pfister and Vogel Tanning Company
  Fred Rueping Foundation, Incorporated
  A. Trostel and Sons Company
Maryland State Roads Commission
William S. Merrell Company
Minerals and Chemicals Corporation of America

National Aniline Division of Allied Chemical and Dye Corporation
National Lead Company
National Printing Ink Research Institute
Nopco Chemical Company
Pennsylvania Department of Highways
Pennsylvania Power and Light Company
Petroleum Research Fund of the American Chemical Society
Pressure Vessel Research Council
Purolator Products, Incorporated
Radio Corporation of America
Reinforced Concrete Research Council
Research Corporation
Reynolds Metals Company
Rohm and Haas Company
Technical Association of the Pulp and Paper Industry
United States Government:
Air Force—Office of Research and Development
Air Force—Wright Air Development Command
Army—Corps of Engineers
Army—Office of Ordnance Research
Army—Signal Corps
Bureau of Public Roads
National Institutes of Health
National Science Foundation
Navy—Office of Naval Research
United States Steel Corporation
V & E Products, Incorporated
Welding Research Council
Westvaco Chemical Division of Food Machinery and Chemical Corporation
Willson Products Division of Ray-O-Vac Corporation

Buildings and Grounds

The University occupies thirty-two buildings, exclusive of the fraternities on campus, which are located on a tract of land covering one hundred eighty acres on the north side of South Mountain, overlooking the valley of the Lehigh River and the city of Bethlehem. In addition, the University has an athletic field, seven

and one-half acres in area with field house, gymnasium, and covered grandstand, located about a mile from the University campus. The University recently acquired additional land on the western slope of South Mountain and in Saucon Valley south of Bethlehem, bringing the total acreage to almost 700.

Alumni Memorial Building

The Alumni Memorial Building, which is used as the administration building of the University, was erected as a memorial to 1,921 Lehigh men who served in World War I and especially to the forty-six who gave their lives. The cost of erection was raised by subscription from about 1,700 alumni. The Memorial Hall contains the records of the Lehigh men who served and those who died, together with mementos of the war.

In the south wing of the building are the offices of the president, vice-president, treasurer, dean of students, registrar, and superintendent of buildings and grounds, and the accounting office. The north wing contains the offices of the bursar, director of admission, public information, publications, development, and alumni association.

The lobby of the building contains art galleries in which are presented several exhibitions annually. There is one automatic elevator in the building.

A collection of boxwood trees and shrubs, donated by the late Robert Parke Hutchinson, Class of '04, landscapes the building and the nearby President's Home.

The Arboretum

The Arboretum is a tract of about eleven acres adjoining Sayre Park. It was established by a friend of the University as a tree nursery for the purpose of furnishing illustrative specimens of American trees and of cultivating trees and shrubs for the beautifying of the park. All of the more important species of North American trees are to be found in the Sayre Park and the Arboretum. A tract of seven acres adjoining the Arboretum has been planted with a variety of indigenous trees as an exhibition growth of tree culture.

The Chemistry Building

The Chemistry Building is a three-story fire-proof sandstone edifice, 259 feet long and 44 feet wide, with a wing 62 feet long and 42 feet wide, and with a three-story extension, 60 feet long

and 37 feet wide. An additional three-story wing, 116 feet long by 52 feet wide, has been added to the east of the original building.

Laboratory space and equipment are provided for qualitative and quantitative analysis, inorganic chemistry, organic chemistry, sanitary chemistry, industrial biochemistry, colloid chemistry, X-ray analysis, gas analysis, the furnace assay of ores, industrial chemistry, chemical engineering, and research in chemistry and chemical engineering.

The trustees of the University named this building, exclusive of the new east wing, the William H. Chandler Chemistry Laboratory in recognition of Dr. Chandler's thirty-five years' service as professor of chemistry, 1871-1906. The east wing was named the Harry M. Ullmann Chemistry Laboratory, in recognition of Dr. Ullmann's service as head of the chemistry department.

A special Hydrogenation building annex has been erected on the outside S. W. corner of the court adjacent to the stairway, for the prevention of spark explosions. The access is from the main lobby of the Chandler building.

Christmas-Saucon Hall

Christmas-Saucon Hall is a three-story brick and stucco building. It has historic interest as the first building of Lehigh University. Asa Packer bought it from the Moravians. It was originally a church.

Renovation of Christmas-Saucon Hall was completed in 1958. The remodeled facilities provide headquarters for the departments of English, mathematics, and philosophy.

The Office of Placement and Counseling occupies the east wing and the north center section of the first floor.

On the first floor west wing are the common room, statistics laboratory, waiting room, and mathematics department offices.

The second and third floors provide a lecture room, seminar and conference room, and classrooms for the departments housed in the building.

Coppee Hall

Coppee Hall is a three-story stone and stucco building. It contains the recitation rooms and offices of the departments of history and government, international relations, and fine arts. There is one large lecture room for common use.

The Eckley B. Coxe Mining Laboratory

The Eckley B. Coxe Mining Laboratory is a two-story sandstone building, 100 feet long and 75 feet wide, occupied exclusively by the department of mining engineering.

The building contains the offices of the department, two classrooms, a shop, a drafting room, various laboratories, and a utility room in the basement.

The utility room houses the air compressor, suction pump, and motor generator set. The offices and classrooms are on the first floor together with the laboratories for engineering geophysics and rock mechanics, a dust measurement room, and a calorimetry room. The geophysics laboratory is equipped with the standard prospecting and research equipment for electrical, seismic, magnetic, and gravitational study. The rock mechanics laboratory has equipment for determining the physical properties of rocks.

The second floor is composed of the fuel technology and mineral preparation laboratories. In the former, equipment is available for the analysis of solid and liquid fuels. One portion of the mineral preparation laboratory houses the sizing, screening, and crushing equipment. In the remainder of the laboratory are the conventional units for mineral preparation: ball mills, classifiers, jigs, shaking table, cyclone, spiral, filters, flotation machines, magnetic separators, and a Chance-sand coal cleaner; there is also available a float and sink apparatus.

The drafting room and ventilation laboratory are on the third floor. The drafting room contains the drafting tables and storage files for use in preparing mine maps. The ventilation laboratory contains a fan-duct system for making air measurements, safety lamps, and gas detectors.

The building was named in memory of Eckley B. Coxe, a pioneer and leader in mining engineering in this country. He was a close associate of the founder of the University and served as a trustee from its early days until his death in 1895. His widow established an endowment fund for this building.

Drown Memorial Hall

Drown Memorial Hall was erected by friends and alumni as a memorial to the late Thomas Messinger Drown, L.L.D., fourth President of the University, who served from 1895 to 1904. The

building now houses the offices, lecture rooms, classrooms, and laboratories of the College of Business Administration.

The Education Building

The Education Building, headquarters of the department of education, is a rebuilt, temporary, one-story frame structure, 76 feet long and 30 feet wide. The building has a classroom with a capacity of approximately thirty, a seminar room, and six offices.

The Fritz Engineering Laboratory

The Fritz Engineering Laboratory, headquarters for the department of civil engineering, was established on the campus in 1909 by the late John Fritz of Bethlehem, known as the father of the steel industry in the United States, who served as trustee of the University for 35 years.

The original building, which was designed and erected under the personal supervision of Mr. Fritz, has been used by the department for various research and industrial projects and for laboratory instruction in mechanics of materials and hydraulics.

In October 1955, a new addition to the laboratory was dedicated. It houses the world's largest universal hydraulic testing machine capable of applying a 5,000,000-lb. load to tension or compression members up to 40 feet in length and flexure speciments up to 120 feet long.

The new addition consists of a seven-story section 130 ft. by 70 ft., plus a four-story section 114 ft. by 24 ft. The new building is a steel structure with reinforced concrete flooring and yellow brick and granite exterior. Two large aluminum-framed solex glass windows permit a maximum amount of natural light to enter the 50 ft. by 130 ft. crane bay which houses the huge vertical testing machine and the Amsler repeated load equipment, another outstanding feature of the new addition. The repeated load bed is a heavily reinforced concrete structure measuring 70 ft. by 14 ft. in plan, and 6½ ft. deep. Carefully machined steel plates in the top surface are designed to transmit shear and direct forces under all types of repeated loads.

A floor-controlled 20-ton capacity crane, 70 feet above floor level, services the new south bay and the 5,000,000-lb. testing machine. A 10-ton crane serves the original north bay with its 800,000-lb. machine, 2,000,000 inch-pound torsion machine, and other machines of smaller capacity.

Research and student instructional laboratories in hydraulics, soil mechanics, concrete, structural models, and sanitary engineering, as well as a separate student laboratory for materials testing, are provided.

The concrete laboratory includes storage bins for aggregates, together with equipment for making and storing all types of plain, reinforced, and prestressed concrete specimens.

The hydraulics laboratory has three levels, with pumps, tanks, turbines, weirs, and other appropriate apparatus used both for student instruction and industrial tests. Space is available for model test of spillways, rivers, channels, etc.

The laboratory machine shop is completely equipped with lathes, millers, drill-presses, grinders, power saws, and miscellaneous tools and equipment. The welding shop provides facilities for both electric arc and gas welding.

Other facilities include photoelastic stress analysis equipment, a photographic darkroom, research library, staff offices, seminar rooms, and a conference room.

Eugene Gifford Grace Hall

Eugene Gifford Grace Hall, named for the donor, who served as president of the Board of Trustees from 1924 to 1956, is a stone structure 120 feet wide and 180 feet long used for sports and recreation. The building contains an athletic palestra, which also serves as an assembly hall for the University, with a seating capacity of 3,000. The second floor is a large drill floor which is available for the major University dances and receptions. In addition, there are classrooms for the music department, dressing rooms for athletic squads, and classrooms and offices for the departments of air and military science. Promenade terraces at the level of the dance floor on three sides of the building afford views over the Lehigh Valley and of south Bethlehem.

The Health Services Building

The Health Center is located on University Avenue diagonally across from Taylor Hall. Built in 1955, it is a three-story building constructed of native stone with the main entrance on University Avenue.

The main floor contains a waiting lounge, record office, clinical laboratory, examining offices, dispensary, X-ray, observation rooms, and an ear, nose, and throat room. On the ground floor

are the physiotherapy department, library and conference room, director's office, and administrative offices.

The second floor contains two physicians' apartments and several rooms which are used for storage and filing of inactive medical records. The Reading and Study Clinic occupies the basement.

Lamberton Hall

Lamberton Hall, named after Lehigh's second president, Robert A. Lamberton, was built in 1907. Originally built as a University Commons, it was renovated in 1958. It serves as the language headquarters of the College of Arts and Science, and provides rehearsal and practice facilities for Lehigh musical organizations.

The first floor contains a modern language laboratory and a large classroom as well as the headquarters for the department of Romance languages. The second floor provides classrooms for all language departments and offices for the departments of German and classical languages.

Two indoor rifle and pistol ranges used by the military department are located in a section of the ground level. The remainder of the ground floor is used as headquarters for Mustard and Cheese, Lehigh's student dramatic organization.

Lehigh Field and Field House

An additional athletic field seven and one-half acres in area, with field house, gymnasium, and covered grandstand, is located about a mile from the University campus. The field house has dressing rooms, lockers, and shower baths; the gymnasium is equipped with basketball and volleyball courts. Here are eleven tennis courts for intercollegiate and intramural tennis. This field includes a playing ground for intercollegiate soccer and a field for intramural baseball and other intramural activities.

The University Library

The University Library is a five-story building of native stone, with limestone trim, in the collegiate Gothic style of architecture. It incorporates a part of the original library building, erected in 1877 by Asa Packer and named in memory of his daughter, Lucy Packer Linderman. The more modern section of the building was opened in 1929.

The main floor is occupied by the reading room, offices of the

library staff, a portion of the book stack, and the large lobby, where the loan desk, reference department, and public card catalog are located. The upper floors contain seminar rooms, the Rare Book Room, the Honeyman Collection, and the Art Gallery. The office of the Vice President and Provost and the Institute of Research is located on the ground floor, east end; and the office of the Dean of the College of Arts and Science may be found on the ground floor, west end. The remainder of the building is devoted to book stacks, of which there are four floors.

The Ordnance Laboratory

The facilities of the Departments of Air and Military Science and Tactics, located in Eugene Gifford Grace Hall, have been augmented by a temporary one-story frame structure, 60 feet long and 25 feet wide. This building contains Army and Air Force ROTC supply storage facilities and garage space.

The James Ward Packard Laboratory of Electrical and Mechanical Engineering

The late James Ward Packard, who was graduated from Lehigh University in 1884 with the degree of mechanical engineer, and was the designer of the first Packard motor car and founder of the Packard Motor Car Company of Detroit, Michigan, and of the Packard Electric Company, of Warren, Ohio, donated $1,200,000 for the erection and equipment of an electrical and mechanical engineering laboratory, which was completed in 1929.

This building, named for the donor, is a five-story steel-framed sandstone structure 225 feet long and 180 feet wide. The lobby is finished in Italian travertine. The halls throughout the building are wainscoated with Tennessee marble. An auditorium on the first floor with a seating capacity of 622 is equipped with still- and motion-picture apparatus.

The western half of the building contains the offices, classrooms, research rooms, and laboratories of the department of electrical engineering. The eastern half of the building houses the departments of mechanical and industrial engineering with classrooms, drawing rooms, offices, research rooms, shops, laboratories, instrument rooms, and a photographic dark room.

The laboratories of the electrical engineering department include the dynamo laboratory, which is equipped with a variety of rotating machines, transformers, circuit components, and instru-

ments; the transient laboratory, which includes a surge generator, artificial lines, and oscillographs; a high voltage laboratory; an A.C. network analyzer with six generators, sixteen load units, and sixteen transmission line sections; and an electronics laboratory equipped with sine wave and square wave generators, oscilloscopes, vacuum-tube voltmeters, and components for the experimental study of vacuum-tube and transistor circuits in the audio and R.F. range. A fifteen amplifier analog computer is also available.

The main mechanical engineering laboratory contains a modern oil-fired steam boiler, turbo-generator sets with condensers and auxiliaries, dynamometer test stands for steam turbines and reciprocating engines, steam jet refrigeration equipment with a barometric condenser, along with various types of pumps and flow-measuring instrumentation. Equipment associated with the compression and flow of air includes two reciprocating compressors, an axial flow fan with adjustable blades on rotor and stator and dynamometer drive, ventilating fans, and an air conditioning unit adapted for extensive testing. The internal combustion engine laboratory features a supercharged variable compression engine of the CFR type, completely instrumented for tests. Another variable compression CFR type engine may be adapted for either spark or compression ignition. Strain gage-type pick-ups are available for study of pressure variations. Dynamometer equipment is available for tests of engines of the automotive type. A diesel test stand has fuel-measuring facilities and a strain gage-type torque meter. An instrumentation laboratory provides means for studying the characteristics of the instruments associated with the measurements basic to mechanical engineering. For work in experimental stress analysis a 60,000 lb. universal testing machine is available, along with strain gage equipment, oscilliscopes, and two polariscopes for photoelastic investigations. For vibration and balancing studies, the equipment includes vibration velocity meters, a displacement indicator, recording vibrometer, electromagnetic torque meter, and portable balancing equipment.

The manufacturing processes laboratory contains the most modern machine tools including two 20-h.p. 16″ engine lathes, a 20-h.p. turret lathe, two milling machines, large drill press, and auxiliary grinding equipment for the maintenance of cutting tools. This laboratory is fully equipped with machinability analog com-

puter, profilometer, dynamometers and recorders, optical comparator, and other precision measuring equipment for laboratory and experimental work in metal machining.

The computer laboratory has a Royal McBee LGP-30 high speed electronic digital computer and is equipped with seminar facilities and a conference room so as to permit maximum use of the computer for educational purposes.

The Packer Memorial Church

The Packer Memorial Church, in which religious services are held, was the gift of the late Mrs. Mary Packer Cummings, daughter of the founder of the University. It was built in 1887. Occasional musical recitals and the annual Bach Festivals are held in this building which now contains the Starkey Memorial Organ.

The Physics Building

The Physics Building is a four-story sandstone structure, 240 feet long and 44 to 56 feet wide. This building is devoted entirely to the department of physics. In addition to offices, recitation rooms, and lecture rooms, there are fully equipped laboratory rooms for undergraduate and graduate classes, a number of smaller laboratories for research, a reading room, machine shop, woodworking shop, glass-blowing room, constant-temperature room, storage battery room, and dark rooms.

Psychology Building

The psychology department is temporarily housed in a former residence immediately adjoining the campus at 103 E. Packer Avenue. The building is a three-story brick structure, 55 feet long and 35 feet wide. It contains departmental and staff offices, a class room, a seminar and library, a photographic dark room, rooms for statistical machine calculation, psychometric testing, and research.

Psychology Laboratory Building

This two-story stone building, 70 feet by 20 feet in plan, temporarily houses the elementary and advanced instructional laboratories, together with student and staff shop facilities of the psychology department. Adjoining the building is a one-story annex, 25 feet long and 20 feet wide, which contains the machine shop.

Sayre Observatory

The Sayre Observatory was the gift of the late Robert H. Sayre, one of the original trustees of the University.

The observatory contains an equatorial telescope of six inches clear aperture and of eight feet focus, by Alvin Clark, and mounting by Haines; and other auxiliary pieces of equipment.

The land upon which the observatory stands, consisting of seven acres adjoining the original grant, was presented to the University by the late Charles Brodhead of Bethlehem.

Sayre Park

A development of the mountainside on the University grounds was affected through the donation in 1909 of the sum of $100,000 by the children of the late Robert H. Sayre, to be used in the development of Sayre Park as a memorial to their father, who was a trustee of the University from its foundation until his death in 1907.

Service Building

The Service Building, headquarters of buildings and grounds, consists of one main building, a five-story brick structure 160 feet long by 40 feet wide and an annex, a one and one-half story brick structure 160 feet long by 40 feet wide. Located at Adams and 4th Streets, it is two blocks from the University campus.

The main building is used chiefly for the storage of maintenance materials and supplies, lumber, building materials, plumbing and heating supplies, and electrical supplies. A freight elevator 20 feet by 10 feet is used to handle materials to the various levels. The annex houses the various maintenance shops, carpenter shop, tinsmith shop, paint shop, and cement masons shop, along with the materials used by the trades.

Taylor Field

An athletic field more than nine acres in area is provided for the accommodation of students who participate in the various outdoor sports. The stadium, located on the lower level, provides football and baseball fields, surrounded by concrete stands having a seating capacity of 12,000. New steel stands were erected in 1953 above the south concrete stands providing 4,000 more seats for a total seating capacity of 16,000. A new press box, rest rooms, and con-

cession booths under the steel stands were erected. On the upper level there is a practice field for football, baseball, lacrosse, and soccer; also a quarter-mile track and a 220-yard straight-away.

Taylor Gymnasium and Field House

In 1913, Charles L. Taylor, E.M. '76, donated to the University the funds required for the erection of a gymnasium and field house.

These buildings were recently remodeled, re-equipped, and expanded as one of the major projects of the Lehigh Progress Fund.

Taylor Gymnasium, which adjoins the athletic field, is a building 222 feet long and 73 feet wide. It has been expanded by the addition of a new swimming pool measuring 75 by 42 feet, and a new gymnasium measuring 94 by 77 feet. The new swimming pool ranges in depth from five to ten feet, and includes a large gallery for spectators, an observation room below the water line, and the latest filtration equipment.

Included in the renovation of the old buildings and in the new construction are locker facilities for 2,600 students, a faculty locker room, coaches locker room, five basketball courts, boxing room, fencing room, golf practice room, wet and dry steam rooms, and a specially designed wrestling room. Also included are a well-equipped first aid room for physical education activities, corrective exercise gymnasium, modern trainer's room with latest facilities, and class and meeting rooms.

Athletic, physical education, and business offices were incorporated in the new construction. Improved heating is furnished by electric blowers. Framed pictures of all athletics teams grace the halls of this floor and stair halls.

The former entrance way has been transformed into a trophy room measuring 26 by 55 feet as a repository for athletic prizes and awards. The third floor addition known as the Samuel E. Berger Room, the gift of Mr. Samuel Erwin Berger, B.A. '89, has also been remodeled.

The University Center

The University Center unites the original exterior lines of Packer Hall (215 feet long, by 60 feet wide), eliminating most

of the original structural wood construction, and substituting therefor steel girders, steel columns, and I beams, with a new three-story stone addition connected and running parallel with new-windowed, old Packer Hall, this addition being 185 feet long, by 53 feet wide.

The basement section of the east wing contains the offices and classroom of the Division of Journalism and the facilities of *The Brown and White, The Epitome,* and radio station WLRN.

In addition to executive and business offices for each of the publications and radio stations, the facilities include a large news room with twenty typewriters, a photographic darkroom, a teletype room, three modern, fully-equipped broadcasting studios, an engineering control room, an electronic workshop, and a library containing some ten-thousand recordings and tapes.

To the west of the publications area is a large game room, a music practice room, and the headquarters of the Lehigh Radio Society (W3AEQ). The basement of the new section is taken up entirely by service areas for the dining services.

On the main floor, east end, of Packer Hall, are the information desk, the Student Activities Office, and the offices of the Chaplain and the Associate Dean of Students. The remainder of the floor is devoted to the dining services, including the main kitchen, cafeteria, two dining rooms, each of which will accommodate approximately two hundred and seventy-five people.

The second floor houses the central files of student organizations, and provides eight meeting rooms. The Snack Bar, student lounge, bookstore, hi-fi room, and the room for cards and chess are together on this floor, thus providing an ample, centrally located area for recreation and relaxation. There is a balcony, affording a fine view of Bethlehem, north of the lounge, and the building may be entered on the south side at the level of this floor.

The faculty lounge, card and writing room, and a private dining room are on the third floor, east, of Packer Hall, and in the center section is the faculty and guest dining room which retains some of the architectural features of the room's initial use as the University Chapel. The third floor of the addition includes a completely equipped kitchen for service to the several dining areas

on this floor, and two large multi-purpose rooms which can be used for dances, lectures, recitals, meetings, and banquets. Folding partitions permit one room to be divided into two smaller rooms and the other room into four. Both rooms are equipped with public address facilities and one has in addition projection equipment, a sound system, and a permanently installed screen for motion pictures. At the west end there is an additional meeting room which may also serve as a private dining room. There is a balcony north of one multi-purpose room, and in the tower of Packer Hall is a small, handsomely appointed private dining room.

There is a fourth floor of Packer Hall at the east end only. The facilities here include two small meeting rooms, a large meeting room, and a small television lounge.

There are three automatic elevators in the building.

The W. A. Wilbur Engineering Laboratory and Power House

The W. A. Wilbur Engineering Laboratory and Power House is a two-story sandstone building, 188 feet long and 44 feet wide.

The Power plant contains four Babcock and Wilcox straight-tube cross-drum boilers, each rated at 300 boiler horse-power, one coxe chain grate stoker, one turbine driven Sturtevant blower and coal-, water-, and ash-handling equipment of modern design. Two boilers are equipped with Petro oil burners and are fully automatic-controlled. A third boiler has been equipped with a B. & W. oil burner also fully automatic-controlled. Four 15,000 gal. fuel oil storage tanks are installed at convenient locations for receiving oil supply.

The plant is designed and equipped to provide steam at 250 pounds pressure to the engineering laboratories, in addition to heating the University buildings. It is so arranged that any boiler can be isolated for laboratory tests for long periods if necessary. From this plant a six inch line carries steam to the Packard Laboratory at the pressure desired for the laboratory work. Modern safety appliances and measuring equipment have been incorporated.

A coal-storage yard has room for two months' supply of coal and a system of belt-conveyers and bucket-elevators is provided for receiving coal, dumping it on the storage pile, and conveying it into the boiler room as needed.

Williams Hall

Williams Hall, the donation of the late Dr. Edward H. Williams, Jr., of the Class of 1875, was so named by the trustees of the University in recognition not only of this gift but also of Dr. Williams' long, continued, and important service to the University as professor of mining and geology.

Originally a three-story brick building, 186 feet long and 70 feet wide, Williams Hall was rebuilt as a four-story building after it had been severely damaged by fire in January, 1956. It contains the offices, classrooms, laboratories, departmental libraries, and special collections of the departments of biology, geology, and metallurgical engineering.

Williams Hall Annex contains some of the research facilities of the departments of biology and psychology. This concrete and brick structure is connected to Williams Hall by a bridge passage between the third floor of the annex and the second floor of Williams Hall.

The northern portion consists of a three-story section, 35 feet long and 25 feet wide, which houses animal quarters together with aquatic-biology, virology, and bacteriology laboratories of the biology department. The entire third floor is a green house.

The southern portion, a single-story section, 35 feet long and 21 feet wide, contains the bioelectric research laboratory of the psychology department. This laboratory has electrically shielded and sound proofed recording and instrument rooms, an operating and work room, photographic darkroom, and an electronics shop.

THE RESIDENCE HALLS

Six residence halls are located on the campus. These modern structures provide living accommodations for approximately 1,200 students. They are located near the center of the campus within walking distance of the Student Health Service Building, the University Center, and the classroom buildings.

Dravo House

Dravo House, a five-story fireproof residence hall completed in 1948, provides accommodations for approximately 280 students. The building was made possible by the alumni and friends of the University through their contributions to the Progress Fund. It is named in memory of Francis R. Dravo and Ralph M. Dravo, former University trustees. Each of the four-wing structures which

compose the building has its own lounge, and the center unit has a lounge and reception room for visiting friends. There are rooms for one, two, and three students.

The Henry Sturgis Drinker House

The Henry Sturgis Drinker House, named for the University's fifth president, was completed in 1940. It is a four-story fireproof residence hall with accommodations for 190 students. It has rooms for two and three students, and a spacious lounge.

McClintic-Marshall Hall

The McClintic-Marshall Hall was completed in 1956, providing accommodations for 296 upperclass students. The building consists of three student living floors each with 48 double rooms, two section-president rooms, a lounge, and two special purpose rooms. The ground floor holds the office of the Director of Residence Halls, the House president's and Residence Hall Council president's suite, and a large recreation room.

The Henry Reese Price House

The Henry Reese Price House, named in honor of Dr. Henry Reese Price, an alumnus of the University of the Class of 1870 and late president of the board of trustees, furnishes accommodations for 35 students.

The Charles Russ Richards House

The Charles Russ Richards House, named in honor of the sixth president of the University, was completed in 1938. It is a four-story fire-proof residence hall with bedrooms and studies accommodating a total of approximately 210. The building contains a spacious lounge.

The Charles Lewis Taylor House

The Charles Lewis Taylor House, the gift of Mr. Andrew Carnegie, is a three-story concrete residence hall with accommodations for approximately 190 students, the majority of whom are housed in three-room suites, three to each suite. The building was named Taylor Hall by Mr. Carnegie in honor of Charles L. Taylor, his former partner in business, a graduate of the University in the Class of 1876 and a trustee of the University. The building was completed in 1907.

SUMMARY OF STUDENT REGISTRATION

Spring 1959

Students in the University

Undergraduate Students	2548
Graduate Students	828
Total	3376

Students in Undergraduate Curricula

Curriculum	Seniors	Juniors	Sophomores	Freshmen	G.C.D.	Total
Arts and Science	97	117	129	144	—	487
Arts and Engineering	39	48	37	48	—	172
Business Administration	161	171	177	129	—	638
Chemical Engineering	48	29	38	—	—	115
Chemistry	8	6	6	—	—	20
Civil Engineering	23	26	28	—	—	77
Electrical Engineering	55	79	58	—	—	192
Engineering Mechanics	7	7	7	—	—	21
Engineering Physics	22	14	19	—	—	55
Industrial Engineering	43	39	31	—	—	113
Mechanical Engineering	63	47	64	—	—	174
Metallurgical Engineering	28	23	18	—	—	69
Mining Engineering	9	11	7	—	—	27
Unclassified Engineers	—	—	—	378	—	378
General College Division	—	—	—	—	10	10
Total	603	617	619	699	10	2548

Summer 1959

Students in the University

Undergraduate Students	746
Graduate Students	351
Total	1097

Fall 1959

Students in the University

Undergraduate Students	2681
Graduates Students	838
Total	3519

Students in Undergraduate Curricula

Curriculum	Seniors	Juniors	Sophomores	Freshmen	G.C.D.	Total
Arts and Science	107	127	167	124	—	525
Arts and Engineering	52	34	31	72	—	189
Business Administration	133	191	172	103	—	599
Chemical Engineering	35	27	37	3	—	102
Chemistry	6	7	13	—	—	26
Civil Engineering	31	22	29	5	—	87
Electrical Engineering	67	60	69	1	—	197
Engineering Mechanics	7	10	13	—	—	30
Engineering Physics	20	23	26	—	—	69
Industrial Engineering	44	34	40	4	—	122
Mechanical Engineering	42	61	72	—	—	175
Metallurgical Engineering	26	20	25	—	—	71
Mining Engineering	11	8	8	—	—	27
Unclassified Engineers	—	—	—	451	—	451
General College Division	—	—	—	—	11	11
Total	581	624	702	763	11	2681

GEOGRAPHICAL DISTRIBUTION OF STUDENTS

Fall 1959

Alabama	5	South Carolina	2
Alaska	1	Tennessee	1
Arizona	1	Texas	2
California	9	Utah	1
Connecticut	96	Vermont	2
Delaware	12	Virginia	27
District of Columbia	16	West Virginia	7
Florida	15	Wisconsin	3
Hawaii	1	Argentina	1
Illinois	9	Canada	2
Indiana	2	Canal Zone	1
Kansas	1	Ceylon	1
Kentucky	1	Colombia	1
Louisiana	1	Cuba	7
Maine	1	England	1
Maryland	78	India	1
Massachusetts	37	Indonesia	1
Michigan	5	Italy	1
Minnesota	2	Korea	2
Missouri	4	Lebanon	1
New Hampshire	4	Puerto Rico	1
New Jersey	665	Saudi Arabia	2
New York	478	Spain	2
North Carolina	1	Syria	1
Ohio	41	Thailand	1
Pennsylvania	1113	Turkey	1
Rhode Island	6	Venezuela	3

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