YOUNGSTOWN
STATE
UNIVERSITY
BULLETIN

GRADUATE
CATALOG ISSUE
1969-70

Effective October 2, 1969
Youngstown, Ohio

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YOUNGSTOWN STATE UNIVERSITY

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The School of Education
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The William Rayen School of Engineering
    M. Jean Charignon, Ph.D., Dean

The Dana School of Music
    Charles H. Aurand, Jr., Mus.M., Dean

The Technical and Community College
    Nicholas Paraska, Ph.D., Dean

THE GRADUATE SCHOOL
218 Arts and Sciences Office Building

Earl E. Edgar, Ph.D., Dean

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Frank J. Tarantine, Mechanical
  Engineering
Duane Sample, Music

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The Academic Calendar

FALL QUARTER 1969

Date to be announced		Registration and Orientation
October 2	Thursday 8 a.m.	Classes Begin
October 9	Thursday 8 p.m.	Last day to enroll in a class
November 12	Wednesday 8 p.m.	Last day for withdrawing with a W
November 26	Wednesday 8 p.m.	Thanksgiving Vacation Begins
November 26	Wednesday 10 p.m.	Last day to apply for admission or readmission for winter quarter
December 1	Monday 8 a.m.	Thanksgiving Vacation Ends
December 15	Monday 8 a.m.	Final Exams Begin
December 20	Saturday 1:30 p.m.	Final Exams End

WINTER QUARTER 1970

Dates to be announced		Registration and Orientation
January 5	Monday 8 a.m.	Classes Begin
January 10	Saturday 12 noon	Last day to enroll in a class
February 14	Saturday 12 noon	Last day for withdrawing with a W
February 20	Friday 8 p.m.	Last day to apply for admission or readmission for spring quarter
March 16	Monday 8 a.m.	Final Exams Begin
March 21	Saturday 1:30 p.m.	Final Exams End

SPRING QUARTER 1970

Dates to be announced		Registration and Orientation
March 30	Monday 8 a.m.	Classes Begin
April 4	Saturday 12 noon	Last day to enroll in a class
May 9	Saturday 12 noon	Last day for withdrawing with a W
May 22	Friday 8 p.m.	Last day to apply for admission or readmission for summer quarter
May 30	Saturday	Legal Holiday No Classes
June 8	Monday 8 a.m.	Final Exams Begin
June 13	Saturday 1:30 p.m.	Final Exams End
June 17	Wednesday 8 p.m.	Spring Commencement

SUMMER QUARTER 1970

Dates to be announced		Registration and Orientation
June 18	Thursday 8 a.m.	Classes Begin—Summer Quarter and First Term
June 20	Saturday 12 noon	Last day to enroll in a class—First Term
June 24	Wednesday 8 p.m.	Last day to enroll in a class—Summer Quarter
July 4	Saturday	Legal Holiday No Classes
July 8	Wednesday 8 p.m.	Last day for withdrawing with a W—First Term
July 29	Wednesday 8 p.m.	Last day for withdrawing with a W—Summer Quarter
July 25	Saturday 1:30 p.m.	First Term Ends (Final Exams during periods)
July 27	Monday 8 a.m.	Second Term Begins
July 29	Wednesday 8 p.m.	Last day to enroll in a class—Second Term
July 31	Friday 8 p.m.	Last day to apply for admission or readmission for fall quarter
August 15	Saturday 12 Noon	Last day for withdrawing with a W—Second Term
August 27	Thursday 8 a.m.	Final Exams Begin—Summer Quarter
September 2	Wednesday 10 p.m.	Final Exams End—Summer Quarter
September 2	Wednesday 10 p.m.	Second Term Ends (Final Exams during periods)
September 2	Wednesday	Summer Commencement

General Information

Youngstown State University

Youngstown State University is located in downtown Youngstown, a major industrial center in northeastern Ohio midway between Pittsburgh and Cleveland.

Youngstown State University had its beginning in 1908 with the establishment of the School of Law of the Youngstown Association School, sponsored by the Young Men's Christian Association.

In 1920, the State of Ohio empowered the school to grant the degree of Bachelor of Laws; in the same year the school offered a four-year course in business administration. In 1921, the school changed its name to The Youngstown Institute of Technology, and liberal arts classes were offered, in the evening, for the first time.

In 1926, the College of Arts and Sciences, offering daytime classes for the first time, was established. In 1928, the Institute changed its name to the Youngstown College, and in 1930, the College conferred the degree, Bachelor of Arts, for the first time.

Dana's Musical Institute, founded in nearby Warren in 1869, became the Dana School of Music of the College in 1941. In 1946, the engineering department, organized several years before, became the William Rayen School of Engineering; two years later the business administration department became the School of Business Administration; and in 1960, the department of education became the School of Education.

In 1944, the trustees of the Young Men's Christian Association transferred control of the institution to members of the Corporation of Youngstown College, and in 1955, the corporation was rechartered as The Youngstown University. In 1967, the University joined the Ohio system of higher education and the name was changed to Youngstown State University. A Board of Trustees of nine members was appointed by the Governor with concurrence by the Senate. As in the case of other state-assisted institutions in the Ohio higher education system, the University is also responsible to the Ohio Board of Regents.

From 1931 to 1966, Dr. Howard W. Jones, now president emeritus, served as chief executive of the University. In September

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1966, he was succeeded by Dr. Albert L. Pugsley, former administrative vice president at Kansas State University. Dr. Pugsley was inaugurated in November 1966 as the University's second president. The University offers complete curriculums in the liberal arts and in many technical and professional undergraduate fields. The degrees Bachelor of Arts, Bachelor of Engineering, Bachelor of Music, Bachelor of Science, Bachelor of Science in Education, and Bachelor of Science in Business Administration are granted. A rapidly expanding selection of two-year programs leading to the Associate of Arts degree is offered in the new Technical and Community College. The University is accredited by the North Central Association of Colleges and Secondary Schools and by appropriate professional accrediting bodies. A co-educational institution, it had an enrollment of 300 students in 1930, grew to 2,000 in the 1940's, tripled by the 1950's, reached 10,000 in the mid-sixties, and recorded over 14,000 in the fall of 1968.

The Campus

During its earlier years the institution had a number of homes. Starting in the old Central YMCA Building, it occupied various sites on Wick Avenue until the completion of the Main Building in 1931, renamed Jones Hall in 1966. Additional buildings have been constructed and nearby properties converted to University use, so that today the campus extends through much of an area four blocks long and three blocks wide. In 1952 and 1953, the Library and the adjoining John Tod Hall were built; in 1959, the Science Building was completed.

In addition to the 19 major buildings already in use on the campus, the University is currently engaged in an eight-year $35-million campus development program. The 84-acre campus will include such structures as a health and physical education building, a music and fine arts building, a technical and community college building, several liberal arts classroom buildings, residence halls, and other related structures.

The first major step in the development program was the completion in 1966 of the $1.8-million Kilcawley Student Center. The building contains dining and snack bar facilities, a large student lounge, faculty lounge, meeting rooms, a dormitory unit for 210 men, and space for numerous other student activities.

In 1967, the $1.7-million Ward Beecher Science Hall was com-

pleted. Started in December of 1965, the building contains laboratories, classrooms and offices for chemistry, biology, physics, natural science, geology, and astronomy. It also features four large lecture halls and a planetarium classroom. The planetarium is the largest in Ohio in seating capacity, and ranked 18th in size in the country at the time of its completion.

The University opened its $5-million Engineering Science Building in January of 1968. This building houses the William Rayen School of Engineering and the mathematics department. There are 48 laboratories, 30 classrooms, eight research and development laboratories, office space for six department chairmen plus 48 faculty and staff members, and an auditorium seating 288. The air-conditioned and mechanically-ventilated structure contains an incompressible-flow type laboratory that extends two stories, a chemical engineering chamber that extends three floors and contains absorption and distillation equipment, a lead-lined radiation laboratory for students studying nuclear activity, and a "floating floor" in the computer room to eliminate vibration from the heavy machines and from outside sources.

Ground will be broken before the end of 1969 for the erection of a $3.5-million health and physical education building to be named the Beeghly Physical Education Center. Housing the physical education department, the building will have a gymnasium with a seating capacity of nearly 6,000. There will be 17 classrooms, including laboratories for health research and kinesiology. Separate gymnasiums will be provided for wrestling, weight lifting, gymnastics, and physical education for the handicapped. Other facilities will include six handball and squash courts, a rifle range, office space for the physical education and athletic faculty members, and an Olympic-sized swimming pool which will make possible instruction in swimming, lifesaving, first aid, water polo, canoeing, and water skiing.

FACILITIES AND SERVICES

The Library

The Youngstown State University Library is a centralized facility which serves all departments. At present it offers 190,000 books and 2,400 periodicals, as well as microfilms, microcards and

recordings. Study carrels in each aisle of the library's open stacks allow the student to work in the area of the subject he is studying. Built-in display cases in the halls provide places for exhibitions of various kinds, and the Purnell Room on the third floor is a browsing and smoking room. Coin-operated book copying machines are on each floor, and there are booths for typewriters and adding machines.

The main building of the Public Library of Youngstown and Mahoning County is on Wick Avenue at Rayen Avenue near the University campus.

The Computer Center

Another centralized facility, located in the Engineering Science Building and servicing the entire University, is the Computer Center. Under an unusual arrangement, the Center operates a pair of computers as a unit under the Attached Support Processor (ASP) system: one IBM 360/40 computer serves another in an input-output capacity via a direct cable connection. These computers are served by a battery of peripheral equipment: disk memories, magnetic tape memories, card readers, high-speed printers, paper tape reader, card punch, remote typewriter terminals, and remote television terminals. Access to the computers is direct at the central site or by remote terminal. In most cases, the graduate student will be able to use Computer Center services in connection with his course work or special research projects. Computer Center services are administered by the director, Dr. Ronald Jonas.

The Bookstore

The Youngstown State University Bookstore, located in Central Hall Annex, sells textbooks and other required supplies. Other stores in the Youngstown area do not stock most University textbooks and are not authorized to issue books or materials on Veteran Administration book orders except in certain cases. On the other hand, the Bookstore does not attempt to compete with other stores in the area and carries only a few items beyond those prescribed for courses. It does, however, stock in limited quantities a wide selection of standard works in inexpensive editions, because of their value as collateral reading. The Bookstore will order any book on specific request and a suitable down payment.

Health Service

Registered nurses are on duty in the Health Clinic, located on the second floor of Central Hall. Outpatient services are provided for faculty and students from 8 a.m. to 10 p.m., Monday through Friday, and on Saturday from 8 a.m. until noon. The Medical Director, Dr. John Hyland, is available at all times for consultation in any Health Service matters. Group insurance to cover hospital and/or surgical care is made available to all students at the time of registration, at a semiannual fee payable in advance. Foreign graduate students are required to subscribe to this insurance; otherwise the plans are voluntary. They are community-sponsored and nonprofit, with no occupational restrictions, and membership may be retained after leaving the University. There is an anti-tuberculosis program for all faculty and students.

Placement Service

With the cooperation of the Ohio State Employment Service, a full-time Placement Office is maintained to assist enrolled students and alumni of the University in securing permanent employment (including teaching positions) or part-time work. The services of the Placement Office, located on the second floor of East Hall, are free. Music students also have available to them the placement services of the Dana School of Music.

Housing

The University provides a list of approved off-campus housing for men. These establishments have been inspected and have met the minimum University standards. In accord with the basic principles of the University concerning human rights, no off-campus housing that discriminates on the basis of race, color, or creed will be recommended to students. The University does not place students in off-campus houses; personal arrangements, therefore, must be made for these facilities. For further information, contact the Office of the Director of Housing Services.

There are several privately operated residence hall facilities in the immediate University area which have been approved for women student occupancy. Information concerning these and other off-campus housing is available by contacting the Dean of Women's Office.

The University currently has limited residence hall facilities for men only. For information, write to the Director of the Housing Services.

International Student Office

The International Student Office, 11 East Hall, provides the foreign student with those special services necessary and unique to his educational pursuit and his stay in the United States. All new students should contact the International Student Adviser, Mrs. Edna McDonald, immediately upon arrival in Youngstown.

The International Student Organization is a voluntary organization providing the foreign student with opportunities for contacts with students from other countries, with his own fellow countrymen, with American students and with many faculty members. Presently there are over 30 countries represented on campus. Meetings are held every Friday night.
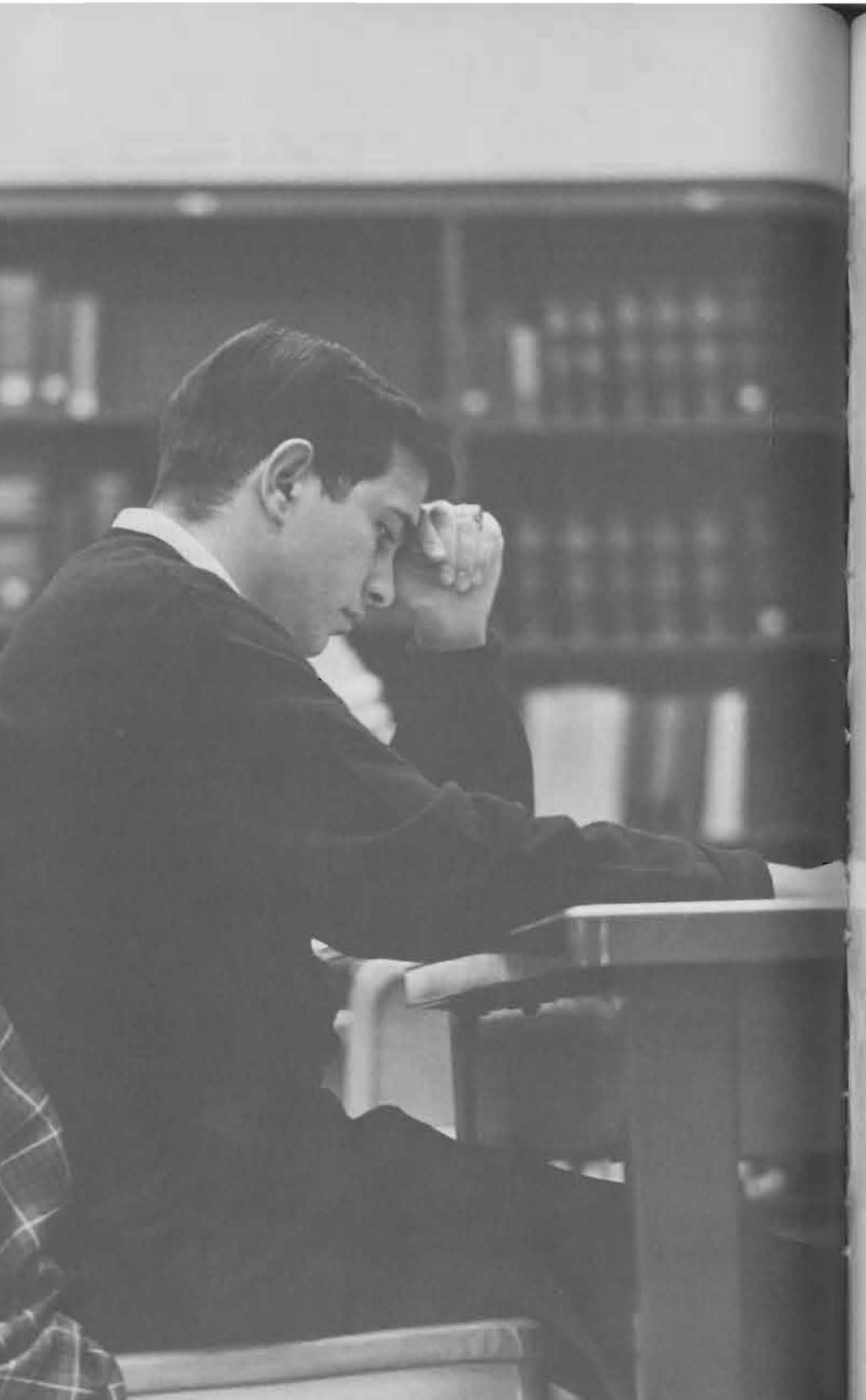
The Graduate School

DEVELOPMENT AND ORGANIZATION

On March 28, 1967, the Trustees of The Youngstown University authorized the president and faculty of the University to begin the process of developing graduate programs at the master's degree level, such programs to commence in the fall Quarter of 1968. In its meeting of May 1967, the Faculty Senate of The Youngstown University considered and authorized the development of master's degree programs in various academic departments of the University. The Youngstown State University Board of Trustees, at its first meeting on August 15, 1967, established the office of the Dean of the Graduate School and the general regulations governing the appointment of a Graduate Faculty. It also identified and authorized specific graduate degree programs (see below). These programs were approved by the Ohio Board of Regents on December 15, 1967, and received preliminary accreditation by the Commission on Colleges and Universities of the North Central Association of Colleges and Secondary Schools in July 1968.

The Graduate School is administered by a Dean who is also a member of the Graduate Council. The elected members of the Graduate Council consist of one representative of each of the academic units of the University which offers graduate programs, and four faculty members-at-large elected by the Graduate Faculty. Standing committees of the Graduate Council are Committees on Curriculum, Policy, Graduate Faculty Membership, and Scholarships, Assistantships, and Awards.

MASTER'S DEGREES

The master's degree programs offered by Youngstown State University are as follows:

Master of Arts (English, History)
Master of Science (Chemistry, Mathematics)
Master of Music (Applied Music; Woodwind or Brass Speciali-

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zation; Sacred Music; Music Education; Theory and Composition; Musicology)

Master of Science in Engineering (Civil, Electrical, Mechanical, Metallurgical)

Master of Science in Education (Master Teacher Program for Elementary and Secondary School Teachers; Principalship Program, Elementary and Secondary Schools; School Counseling and Guidance; and Special Education for Slow Learning Children).

ADMISSIONS

Students are admitted to the Graduate School by the Dean of the Graduate School on recommendation of the department in which the applicant wishes to do his major work. Acceptance for admission is required before registration in any course for graduate credit.

The complete application for admission, including all supporting materials, must be received by the Graduate School at least four weeks before the beginning of the term in which the applicant plans to register. Youngstown State University will admit graduate students in the fall, winter, spring, and summer Quarters.

The attention of foreign students is called to the special requirements governing their application for admission.

It is anticipated that, in the first years during which the graduate program at Youngstown State University will be offered, provision will usually be made only for part-time study. The student who wishes to enroll as a full-time graduate student should discuss this possibility with the faculty member in charge of the program in which he wishes to enroll before making application for admission.

Application Procedure

Application for admission must be made on a form provided by the Graduate School, following the procedure outlined below. The materials necessary for making application can be secured by writing to the Dean of the Graduate School, Youngstown State University, Youngstown, Ohio 44503.

1. Complete the application form and return it to the Dean of the Graduate School.

2. An application fee of $15.00 is charged each student making application to the Graduate School whether or not the student has paid this fee at the undergraduate level. This fee is not refundable. Make check payable to Youngstown State University, label the check "Graduate Application Fee," and include it with the application.

3. Return the two reply cards, properly addressed, with your application. These cards will help us keep you informed on the status of your application.

4. Request the Registrar of each college or university you have attended, *except* Youngstown State University, to send *directly* to the Dean of the Graduate School two copies of an official transcript of your work. Personal copies of transcripts will not be accepted. Official transcripts will not be returned.

Applications for admission cannot be reviewed until the official transcripts of all previous college or university work, and the application fee of $15.00, are received. It is imperative, therefore, that the applicant see that these reach the Graduate School at the earliest possible date. Omission of information called for on the application form will necessitate requests for the additional information and therefore delay processing of the application, so the applicant should take care to provide all the information requested in his first submission of materials.

As soon as possible after receipt of application materials, the Graduate Dean will notify the student of the action taken on his application, and if the student is admitted, will provide him with information on registration procedures.

Admission Requirements

Requirements for admission to the Graduate School are:

1. A bachelor's degree from an accredited college or university.

2. A cumulative grade point average in undergraduate work of 2.5 (on a 4.0 scale) or above.

3. Satisfactory preparation for the graduate program in which the student wishes to enroll, as specified by the department of the major. (See below for regulations on foreign student admissions.)

The applicant is reminded to check the specific admission requirements of the program in which he wishes to enroll, as these may have requirements in addition to those outlined above.

Classification of Graduate Students

Students may be admitted with either *regular* or *provisional* status.

Students will be admitted with regular status who satisfy the admission requirements for the master's program in which they wish to enroll.

On recommendation of the faculty member in charge of the program involved, and subject to the approval of the Graduate Dean, a student may be accepted with provisional status if his undergraduate record shows slight deficiencies in comparison with the admission requirements of the program to which he seeks entrance. Students who are admitted on provisional status may be required to make up deficiencies by taking the appropriate undergraduate courses without graduate credit.

Non-Degree Students

Students may take graduate courses without planning to become candidates for a degree. Such students must, however, first be admitted to the Graduate School on the same basis as those entering a degree program. If non-degree students decide later to work toward a degree, they must request approval from the Dean of the Graduate School for a change of status. The decision on acceptance of the credit earned while in non-degree status toward a master's degree will be made by the department in which the student wishes to earn a degree.

Transient Students

A student may be admitted as a transient graduate student who is in a degree program at an accredited graduate school and who submits a graduate transient student form signed by the Dean of the Graduate School to which he wishes to transfer his credits showing that he is a graduate student in good standing. The form to be used in such cases may be secured from the Office of the Youngstown State University Graduate School. If a graduate transient student later wishes to become a regular graduate student, he must be admitted to a degree program by following the usual admission procedures.

Test Information

In certain master's programs test results must be submitted as part of the admissions procedure. The registration forms for both the Graduate Record Examination and the Admission Test for Graduate Study in Business may be secured from the Testing Office, Ford Hall, Youngstown State University; but the applicant must register for the test with The Educational Testing Service, Box 955, Princeton, New Jersey 08540. The student should check with the Youngstown State University Testing Office to learn the deadline dates for registering for these examinations.

Transfer Credits

Up to nine quarter hours (six semester hours) of graduate work completed at other accredited institutions may be applied toward a master's degree at Youngstown State University, provided the student earned at least a B grade in such courses. The number of transfer credits to be accepted in each case is to be determined on the basis of evaluation and recommendation by the department of the student's major. It is the responsibility of the student to initiate a request for the approval of transfer credits.

Foreign Student Admissions

A graduate of a foreign university must submit with his application:

1. Official certification of the degree he has earned and the level of scholarship he has achieved;

2. Copies of all course and examination records beyond the secondary school level, including grades received, that are certified as official by the home institution or institutions in which such records were made;

3. Evidence of ability to support himself during the period of his study at Youngstown State University;

4. A physician's certification of his health;

5. Scores on the aptitude section of the Graduate Record Examination administered by the Educational Testing Service, Princeton, N. J.;

6. An interview with and/or an application referral from an Institute of International Education representative where feasible.

After a review of these materials, and the judgment by the Graduate School of Youngstown State University that he is other-

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wise acceptable for admission, the foreign student must demonstrate proficiency in the use of the English language by earning satisfactory scores on the Test of English as a Foreign Language (TOEFL) administered in the student's home country by the Educational Testing Service, Princeton, N. J., or on the test administered by the English Language Institute, Ann Arbor, Michigan, or by providing such other evidence as is required by the Youngstown State University Graduate School. At the time evidence of proficiency is required, the applicant will be informed as to the procedure applying in his case.

Only after providing the required evidence of satisfactory mastery of the English Language will the foreign student be granted admission to the Graduate School of Youngstown State University. A foreign student who is accepted may, upon recommendation of the department in which he is to carry on his graduate study, be required to take another test in English after arriving at Youngstown State University, to help determine the necessity for remedial work in English and the reduction in the credit hour load of graduate course work resulting therefrom.

While doing graduate work at Youngstown State University, all foreign students must enroll in the plan of group insurance to cover hospital and/or surgical care that is available to students at Youngstown State.

REGISTRATION

Advisement

Before registration, the student should consult with the faculty member in charge of the program to which he has been admitted, or with an advisor to whom he is assigned, for advice in developing a program of study leading to the desired degree.

Registration

Registration for each quarter is to be completed in person during the registration period. A late registration fee is charged those students who, under exceptional circumstances, are allowed to register late. Under no circumstances is registration allowed after the last day for entering classes.

Change of Registration

Schedules may be changed during the proper time (see schedule for last date) by completing the necessary forms available in the Registrar's Office, securing the proper signatures, and paying the necessary fee at the Student Accounts Office. A grade of F will be recorded for any course not attended if the above procedure is not followed, since non-attendance is not an official withdrawal. (See catalog for withdrawals and grades of W).

OTHER REGULATIONS

Time Limit

All work (including transfer credits) offered in fulfillment of the minimum credit hour requirement for the degree must have been taken within the six-year period immediately preceding the date on which the last requirement is completed. When graduate study is interrupted by military service, the six-year limit may be extended.

Graduate students who fail to take courses or otherwise to pursue their graduate education for a period of two years, will be automatically retired from the active files of the Graduate School. Reapplication for admission under regulations in force at the time of reapplication will be required for reactivation of the student's records.

Graduate Courses

Courses in which graduate credit may be earned are of two types.

1. 900-level courses that are open to graduate students only. *At least one half* of the credits applied toward the degree must be earned in courses in the 900-series.

2. Upper-division undergraduate courses (700- or 800-series courses) in which the student may enroll for graduate credit only with the approval of his advisor.

Not all upper division undergraduate courses may be taken for graduate credit. Those that are in this category are listed in the "Courses" section of this catalog.

Academic Standards

A quality point average of at least a B will be required for graduation. No grade less than C will be accepted, although all grades will be counted in computing the student's quality point average.

Good academic standing for graduate students is a cumulative grade point average of 3.0 (on a 4.0) scale. Any graduate student not in good academic standing may be required to withdraw from a graduate program on the recommendation of the department concerned and the approval of the Dean of the Graduate School.

Full-Time Status

A full-time student is one carrying 12 or more credit hours in courses that give credit toward the degree.

Reduced Load for Employed Students

The Graduate School reserves the right to reduce the class load of employed students. Normally the student employed full-time will not be allowed to enroll for more than six quarter hours of graduate course work.

Graduate Credit for Undergraduates

An undergraduate student who has senior standing and a cumulative grade point average of 2.7 or above, and who does not require a full schedule to complete his baccalaureate degree requirements at Youngstown State University, may enroll in 900-level courses for graduate credit, provided such enrollment does not cause his total schedule for the quarter to exceed 16 quarter hours. Before registering for the courses the student must have the approval of his advisor, the instructor of each course in which he wishes to enroll, and the Dean of the Graduate School. The credit earned cannot be counted toward fulfillment of the requirements for a bachelor's degree, and may not be used for graduate credit at Youngstown State University until the student is admitted to the Graduate School and the credit is accepted by the department in which the student continues his graduate work. The amount of such credit that will be acceptable at Youngstown State University is 15 hours.

Permission to undergraduates to enroll in graduate courses for undergraduate credit will be granted only to students with proven

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exceptional academic ability; such permission will be based on a petition prepared by the student's major department containing a statement of criteria used to determine "exceptional" and approved by the department offering the course and the Dean of the Graduate School.

Grading System

The following grading system is used in reporting a final evaluation of the work of graduate students in courses or thesis research: A, B, C, D, F. The grade point equivalents are 4, 3, 2, 1 and 0 respectively.

Grades of D and F carry no graduate credit but will be used to determine the student's grade point average. Failure will normally be indicated by a D; a grade of F means the instructor doubts the student's ability to do work at the graduate level. A student has the privilege of repeating a course once, but the repetition is treated merely as another course, along with the first, in calculating the student's grade point average.

The grade of I may be given to a student who does satisfactory work in a course but who, for reasons beyond his control and deemed justifiable by the teacher, does not complete all requirements for a course by the time grades are submitted. A written explanation of the reason for the I will be forwarded to the Records Office for inclusion in the student's permanent record, with copies to the student, department chairman, and dean of the school. Until the I is converted, it will not be included in the calculation of the student's point average.

The grade of W will be given for all withdrawals properly processed during the first six weeks of any quarter (or first three weeks of either split summer session). ("Properly processed" describes withdrawals made in conformity with the instructions on the official Change of Registration form.) A withdrawal made after the three- or six-week period will be recorded as an F unless the withdrawal was the result of circumstances over which the student had no control, as shown by evidence presented by the student in a petition to the Dean of the Graduate School. Any grade of F assigned because of absence may be reviewed upon petition to the Graduate Dean. Where withdrawals change the status of a student from full-time to part-time, the student immediately forfeits any privileges contingent upon full-time status, and notice of the change

is sent to those legally requiring it (draft boards, scholarship or loan-supporting agencies, etc.).

In the case of thesis work still in progress at the time grades for the quarter are to be reported, a PR may be reported in place of a quality grade. This symbol indicates that the student is working in a manner which merits his being allowed to continue, but does not indicate a specific quality of work. In the quarter when the work is completed, the instructor will report an A, B, C, D, or F that will apply to all the work done in the preceding quarter or quarters as well.

Aud signifies that the student has attended the class as an auditor. This mark may be given only to a student who has begun a course as an auditor or who has changed his status to that of auditor before four weeks of a regular quarter or two weeks of a summer session have elapsed.

Change of Curriculum

A student may transfer from one graduate program to another when an advisor in the program to which he is transferring has been appointed and has accepted the student as an advisee, and when the change has been reported to and approved by the Dean of the Graduate School. In such cases of transfer, courses taken in the original curriculum that also apply toward the degree in the new curriculum will be accepted and the credit hours and quality points earned in such courses will be counted in computing the student's grade point average. None of the credit hours or quality points earned in other courses in the original curriculum will be taken into account in the new curriculum.

Auditing Courses

A student may register for and attend any course as an auditor, subject to the approval of the instructor. An auditor is not held responsible for the regular classwork and preparation of assignments and receives no credit for the course. However, he pays the regular fees for the course, as well as any other applicable fees. A student who has registered for a course for credit may not change his status to that of auditor after four weeks of a regular quarter or two weeks of a summer session have elapsed. Audited courses are not counted as part of the student's official load.

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Foreign Language Proficiency Examinations

The Department of Foreign Languages administers proficiency examinations in the following languages: French, German, Greek, Hebrew, Italian, Latin, Russian, and Spanish. The graduate student should consult his major department to learn specific requirements. These examinations are offered only in foreign languages currently taught at this institution.

The *advanced* proficiency examination tests the student's ability to read scholarly material in his general field through translation. The passage to be translated is chosen by the major department in consultation with the Department of Foreign Languages. The examination will be 60 minutes in duration. A dictionary may be used. The *advanced* proficiency examination will be administered on the first Mondays in December and May only.

The time and place of all proficiency examinations will be announced in advance by the Department of Foreign Languages and the Office of the Dean of the Graduate School.

Students planning to take a proficiency examination must register with the Department of Foreign Languages in Jones Hall, Room 312 no later than two weeks prior to its administration.

A grade of "pass" or "fail" on the proficiency examination will be registered with the Office of the Dean of the Graduate School.

It is not the responsibility of either the University or the Department of Foreign Languages to tutor students for these examinations or to recommend tutors.

Commencement

At the beginning of the quarter prior to the quarter in which he expects to receive his degree, the student must notify his advisor of his intention to apply for graduation on a form provided for this purpose by the Graduate School, a copy of which must be filed with the Office of the Graduate School. Formal application for graduation must be filed by or before 12 noon on the Saturday ending the first full week of the graduating quarter, on a form provided by the Office of the Graduate School.

There are two graduation ceremonies each year: Spring Commencement, in May or June, at the end of the third quarter of the academic year; and Summer Commencement, in August, at the end of the summer session. A student who completes the requirements for a degree at the end of the first or second quarter receives

his degree in June and is present, if at all possible, at Spring Commencement. If it is not possible to be present, a request in writing to receive the degree *in absentia* must be made to the Dean of the Graduate School.

COSTS AND FEES

The charges for graduate work depend upon whether the student is a full-time or part-time student, and upon his legal residency.

Per Quarter

FOR FULL-TIME STUDENTS
(12–17 credit hours)

Instructional Fee	$120.00
Student Services Fee (Comprehensive)	30.00
Non-Resident Tuition Surcharge	125.00
Charges per Credit Hour above 17 hours	
Instructional Fee	12.00
Non-Resident Tuition Surcharge	16.00

FOR PART-TIME STUDENTS
(Below 12 credit hours)

Instructional Fee per Credit Hour	12.00
Student Services Fee (Comprehensive)	10.00
Non-Resident Tuition Surcharge per Credit Hour	16.00

FOR STUDENTS (FULL-TIME) IN THE DANA SCHOOL OF MUSIC
(12–17 credit hours)

Instructional Fee	$120.00
Student Services Fee (Comprehensive)	30.00
Music Fee	75.00
Non-Resident Tuition Surcharge	125.00
Charges per Credit Hour above 17 hours	
Instructional Fee	12.00
Non-Resident Tuition Surcharge	16.00

FOR STUDENTS (PART-TIME) IN THE DANA SCHOOL OF MUSIC
(Below 12 credit hours)

Instructional Fee per Credit Hour	12.00
Student Services Fee (Comprehensive)	10.00
Applied Music Fee per Credit Hour	40.00
Non-Resident Tuition Surcharge per Credit Hour	16.00

The University reserves the right to change any fee without notice.

Special Fees

Late Payment Fee. A fee of $15.00 will be charged any student who pays his bill after the due date but before the payment cut-off date. Registration is considered complete only at the time of payment. Tuition and fees shall be due and payable in full 10 days prior to the opening of classes or as otherwise shown in the academic calendar of the University. (Note: The late payment fee will also be assessed those students receiving financial aid who have not returned their payment notice by the due date, thereby failing to indicate that they plan to attend.)

Late Registration Fee. A fee of $15.00 will be charged any current student who failed to register during the assigned period and registers late with new and former students.

Change of Registration Fee. A fee of $2.00 is charged anyone changing his registration unless he does so at the request of the administration, or unless he completely withdraws from the University. Appeals will be subject to consideration by the Finance Committee. (Note: Increased charges resulting from changes in registration will appear on a revised bill to be paid within 10 days after the revision. Failure to make the additional payment before the due date on the revision will result in an assessment of a $5.00 late fee.)

Registration Withdrawal Fee. A fee of $5.00 is charged when a student withdraws from all his courses, and the terms under Withdrawals and Refunds (further on in this section) are waived by the Business Office.

Reinstatement Fee. A fee of $5.00 is charged anyone re-admitted to classes after suspension for financial reasons.

Special Check-Handling Fee. A fee of $5.00 is charged any student who pays the University with a check that is not accepted by the bank against which it is drawn. A returned check intended for payment of registration fees will draw, in addition to the returned check fee, a late registration fee. If these penalties are not paid within four days after the student is notified, he shall be suspended from classes.

Fee for Credit by Examination. Fees are charged, at the regular University rate, for each hour of credit honored for gradua-

tion when such credit is given as the result of examination or equivalency evaluation without the student's having attended the regular classes for the course of instruction. The credit by examination may be granted under special circumstances to students who can demonstrate proficiency in certain subjects. The subjects in which such examinations may be given and the nature of the examinations are to be determined by the departments and divisions concerned and must be approved by the Dean of the Graduate School.

Fee for Proficiency Examination. When a student is given permission to take an examination to demonstrate proficiency in a subject (in a foreign language, for example), he is charged a fee of $10.00 except when he elects to pay the fee for Credit by Examination and receive course credit for the work covered by the examination.

Fee for Irregular Examination. When a student is given permission to take an examination at a time other than the scheduled one, a fee of $5.00 is charged at the discretion of the Dean, except in the case of illness, when the student must present a letter from his physician.

Graduation Fee. A fee of $20.00 is charged anyone who is to receive a degree or title. The fee, which includes cap and gown rental and diploma, and which helps defray the general expense attendant to the commencement exercises, must be paid at the time the official application for graduation is submitted to the Recorder. No reduction in this fee may be made for graduation *in absentia* or for approved use of non-academic apparel.

This fee applies for each degree or title granted (unless honorary); when two degrees are to be conferred at the same commencement, the total fee is $25.00 ($5.00 plus the regular $20.00).

Transcript of Credits Fee. A fee of $1.00 is charged for each transcript.

Comprehensive Fee. This fee helps defray the cost of student services and activities such as health services, library, counseling and a portion of parking lot maintenance which is not covered by the parking fee. It also aids in the support of student associations, student government, lecturers, entertainment and extracurricular activities. *After the first day of classes there can be no reduc-*

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tion or pro-ration of this fee. This fee is not refundable except for administrative reasons.

Vehicle Registration Fee. Each student, faculty, administration and staff member is required to register his automobile and purchase a parking permit at the beginning of each academic year. Only one parking sticker will be issued to each individual; however, it is transferable from one vehicle to another, when necessary.

WITHDRAWALS AND REFUNDS

A student may not enroll for less than a full term. If a student withdraws from a course or from the University, he must fill out an official Change of Registration form and present it to the Business Office. Failure to attend class, or merely notifying the teacher, the Registrar, or some other staff member is not an official notice of withdrawal.

If a student is permitted to withdraw from a course or from the University, the account will be revised and charges made according to the following schedule.

Date of Acceptance by Student Accounts Office*	Quarters	Summer Terms 5½ Weeks
1–6 school days**	25%	50%
7–12 school days	50%	100%
13–18 school days	75%	
19th school day	100%	

* Figured from opening date of classes.
** Excludes Sunday, for each specified time period.

If a course is cancelled by the University, fees paid will be refunded in full, or in the event of a full scholarship or grant, proper credit will be made to the specified fund. See additional policies and procedures shown below under Exceptions.

EXCEPTIONS

A student who withdraws from the University or from a portion of his schedule for reasons beyond his control, such as illness, military service, job transfer or shift change imposed by his employer, may have his fees revised in proportion to the number of

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weeks attended. He must withdraw officially and present evidence to validate his change: a certificate from his physician, for example, giving the date he advised the student to withdraw from classes or reduce his academic load, copies of military active duty orders, or a letter from an employer giving the date working hour changes were imposed and a listing of former and current working hours. Charges will be prorated proportionately to the number of weeks enrolled. All requests for this action must be handled by mail. Correspondence should be addressed to Youngstown State University Finance Committee Chairman.

STUDENT RESIDENT STATUS

Residence, for tuition purposes, will be determined at the time of admission or readmission by the Dean of the Graduate School on the basis of the guidelines shown below and information supplied on the "Application for Admission" Form.

The resident or non-resident status of a student will generally remain the same throughout his attendance at the University although such status may be reviewed at any time.

If there should be any doubt on the part of the student regarding the appropriate classification, it should immediately be brought to the attention of the Dean of the Graduate School for a review. Any student who registers improperly with respect to residence, will be required to pay the non-resident tuition surcharge. Retroactive refunds and charges may be made to any student improperly classified.

RESIDENT STATUS APPEALS

Appeal for a change in classification should be made in writing to the Director of Admissions, 101 Jones Hall, who may require the student to complete a form "Application for Non-Resident Fee Exemption" available from that Office. The Director's reviewed decision will be communicated in writing to the student. A student may appeal his classification by requesting a personal interview with the Director of Admissions.

He also may request the Director of Admissions to arrange an appearance before the Residence Classification Board. Appearances before the Residence Classification Board generally will be held within two weeks of the request, if possible. The Residence

Classification Board is the formal appeal authority in such matters and its decision is final.

GUIDELINES FOR RESIDENCY

The following guidelines will be observed in making a determination of Ohio residency: (These guidelines have been recommended by the Ohio Board of Regents and adopted by the Youngstown State University Board of Trustees. They are subject to change by the University at any time. Any subsequent changes to these guidelines will supersede those shown in this catalog.)

1. An adult student, 21 years of age or older, is considered to be an Ohio resident if he has resided in the state for a minimum of twelve consecutive months preceding the date of enrollment, or if he is gainfully employed and residing in the State of Ohio and pursuing a part-time program of instruction and there is reason to believe that he did not enter the state from another state for the primary purpose of enrolling in an Ohio public institution of higher education.

2. A minor student under 21 years of age is considered to be an Ohio resident if his parents or his legal guardian have resided in Ohio for a minimum of twelve consecutive months preceding enrollment, or if the parents or legal guardian are residing in Ohio and if at least one parent or guardian is gainfully employed in Ohio.

3. An emancipated minor under 21 years of age may be considered as an adult student in determining residence, provided such minor presents satisfactory evidence that his parents, if living, do not contribute to his support and do not claim him as a dependent for federal government income tax purposes.

4. The residency of a married woman is determined by the rule which would apply to her husband if he were to seek enrollment; except that a woman who would have been classified as an Ohio resident immediately prior to her marriage may continue to be classified as an Ohio resident if she continues to live in the state.

5. A student classified as a non-resident of Ohio shall not be reclassified as a resident during his continued period of enrollment unless he satisfies the conditions of items 1 or 2 above.

6. A student classified as a resident of Ohio shall be considered to have lost his status after he, or in the case of a minor, his

parents or legal guardian move their legal residence to another state.

7. Persons in military service who entered such service as residents of Ohio and their dependents shall be considered residents if they provide proof of continued Ohio domicile or of continuous voting in Ohio.

8. Persons in military service and their dependents shall be considered to be Ohio residents during the period when the actual duty assignment is in Ohio and they actually reside in Ohio.

9. Aliens holding immigrant visas may establish Ohio residency in the same manner as citizens of the United States. Alien students admitted to the United States on student visas or other visas shall be classified as non-resident students.

ASSISTANTSHIPS, SCHOLARSHIPS, AND LOANS

Financial assistance is available to graduate students enrolled in specific degree programs in the form of graduate assistantships, scholarships, and student loans. Applications for financial aid must be accompanied or preceded by application for admission. Under no circumstances will financial aid be awarded until the student has been admitted to the Graduate School.

Application for an assistantship or a scholarship should be made to the Office of the Graduate School by March 1st prior to the fall quarter for which the student seeks aid. Late applications will be considered only if additional funds become available. Appointments to assistantships and scholarships are made by the Dean of the Graduate School upon recommendation of the department concerned. Should an award not be made for the specific aid requested, the application will automatically be considered for another form of financial assistance. Notification of the award will be made no later than April 15. After that date, a student who has accepted an award is committed not to accept another appointment without first obtaining formal release for this purpose.

Arrangements for a student loan are made through the Office of the Director of Financial Aids.

Types of Appointments: Two types of appointments are made by the Graduate School: graduate assistantships and scholarships.

Graduate Assistantships: The assistantship program is predicated on the idea that graduate students, when given the oppor-

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tunity to assist the faculty, not only provide a service to the institution but also gain valuable experience through this work in association with the faculty.

Graduate assistants will be assigned three kinds of duties:

(1) *Instruction.* Youngstown State University is committed to the maintenance of high standards of instruction in all courses. Master's degree candidates therefore will be assigned to classroom or laboratory duties only under the direct supervision of a full-service faculty member who will retain full responsibility for maintaining high academic and pedagogical standards. Graduate students will be assigned to instructional duties on the basis of teaching experience or other appropriate background.

(2) *Research.* A limited number of assistantships are available which afford students the opportunity to participate in authorized faculty or University research programs. These assistantships are normally not awarded to entering students.

(3) *Other academic services.* These are determined by the department of the student's major and approved by the Dean of the Graduate School.

Normally, graduate assistantships are awarded for a period of three quarters beginning with the fall quarter. To remain eligible for the assistantship, a student must discharge his duties satisfactorily and maintain good academic standing. Appointees must maintain enrollment in at least seven (7) quarter hours of degree credit course work per quarter; approval to carry more than twelve (12) quarter hours must be obtained from the department concerned and the Dean of the Graduate School. A graduate student awarded an assistantship may not accept employment at the University, or elsewhere, during the period for which service to the University is required under the appointment.

The stipend for a first-year assistantship is $2600 plus remission of tuition and fees.* In recognition of outstanding performance an increment of up to $400 may be awarded a student who is appointed for a second year. The appointee is expected to devote approximately twenty (20) hours per week to his assistantship duties. In the event that research duties culminate in a thesis, the time required to compose and prepare the thesis shall be additional.

* Except for the Student Services (Comprehensive) Fee.

Scholarships—Scholarships in varying amounts for varying periods are awarded on the basis of the student's academic achievement, his potential for graduate work, and financial need. They are available to both entering and enrolled students carrying at least twelve (12) quarter hours of degree credit work. To remain eligible for the scholarship, a student must maintain good academic standing. The student performs no service for the University.

COURSE NUMBERING SYSTEM, ABBREVIATIONS, AND REFERENCE MARKS

It is important that the student familiarize himself with the University's course-numbering system and its significance, and with the abbreviations used to indicate the amount of credit.

Hyphen. A hyphen between numbers (*e.g.*, 501–502–503) indicates that credit is not given toward graduation for the work of the first and second quarter until the work of the third quarter is completed, except when special permission is granted by the chairman of the department in which the course is given. *The first quarter of such a course is prerequisite to the second and the second quarter prerequisite to the third.*

Comma. Ordinarily, a comma between numbers (*e.g.*, 501, 502, 503) indicates that the course extends throughout the year, but that credit toward graduation is given for one or two quarters. If one quarter of such a course is prerequisite to another, it is so designated.

The abbreviation "*q.h.*" at the end of a course description stands for "quarter hours of credit." Thus, credit for a three-quarter course is indicated by the notation $3 + 3 + 3$ *q.h.* meaning "three quarter hours of credit each quarter."

The abbreviation *n.c.* means "no credit." Thus, 2 *n.c.* indicates that the course offers no quarter hours of credit but that the course is regarded as two hours for load and billing purposes.

"Prereq." stands for "prerequisite." Though the prerequisite for a course is usually listed in the course description, it may be given in the general information at the beginning of each departmental section.

An asterisk or other reference mark used in a curriculum ordinarily refers to a note immediately following that curriculum. Occasionally, however, such a note may be at the foot of the page.
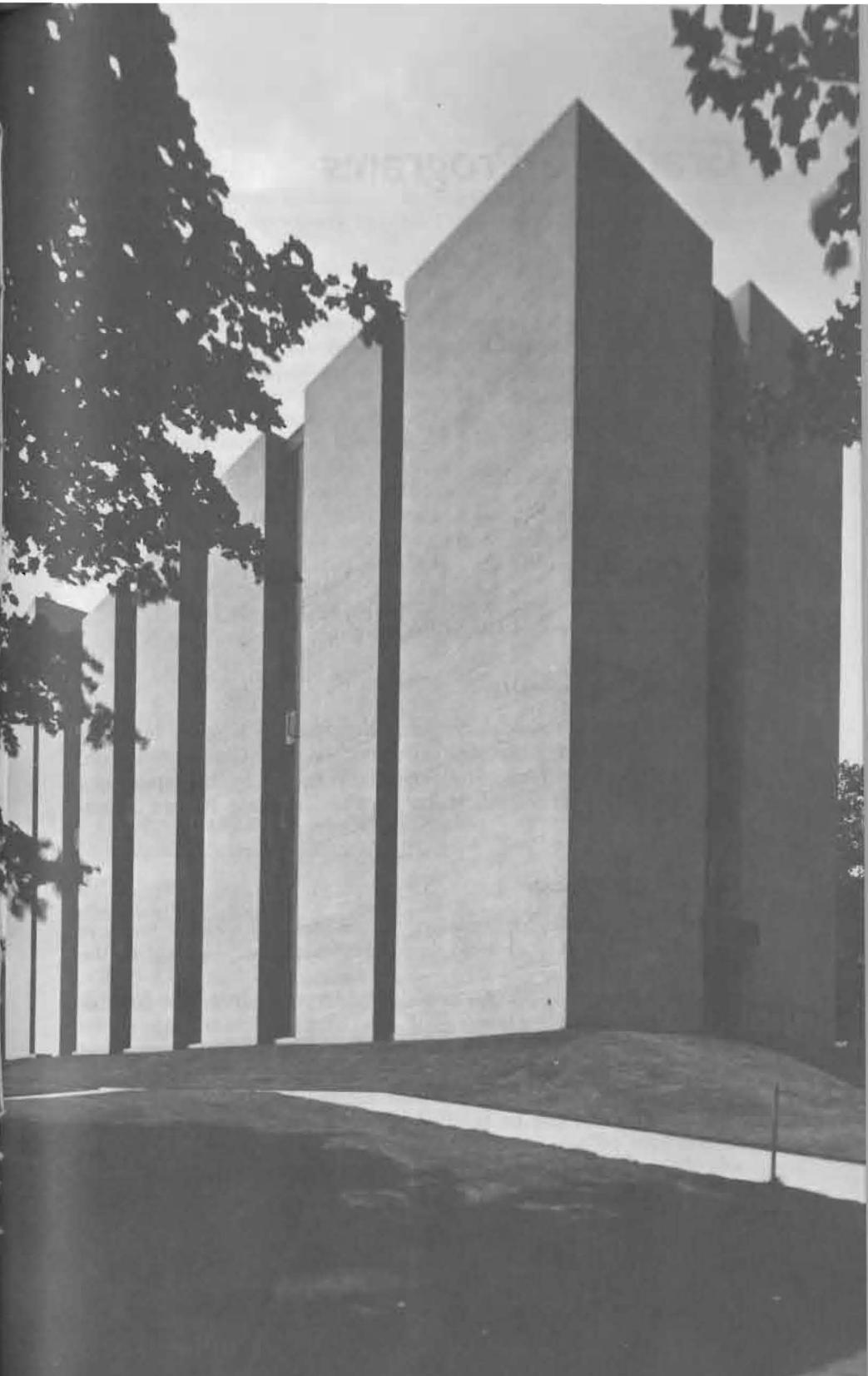
Graduate Programs

In the following pages, the general requirements of the various master's degree programs are described. The admission requirements that are stated are in addition to the requirements for admission to the Graduate School.

MASTER OF ARTS

ENGLISH

Ward L. Miner

In Charge of Graduate Studies in English
303 Arts and Sciences Office Building

Admission Requirements

The student should have an undergraduate English major or equivalent and/or a satisfactory score on the Graduate Record Examination. All entering students should submit to the department their aptitude and English scores on the Graduate Record Examination.

Degree Requirements

1. All students are expected to complete 45 quarter hours in courses at the 900 level; exceptions must have the approval of the department.
2. Students who enter without undergraduate credit for English 751, 752, 753 (History of the English Language) or its equivalent must make up the deficiency. English 900 is required of all candidates for the M.A. degree in English.
3. Reading knowledge of one foreign language is required. This requirement can be fulfilled by satisfactory completion of the second-year college course (or four years of one language in high school) within seven years of admission to the Youngstown State

University Graduate School; or by successful achievement on a standardized test approved by the Department of Foreign Languages.

4. Students must submit two satisfactory (B or better) graduate seminar papers which conform with department standards of form and style and are from two different instructors.

5. A written comprehensive examination will be required for the degree. This examination will be divided into three parts: questions on (a) specific literary works announced at least four weeks prior to the examination, (b) and (c) two areas selected by the student from the following:

1) Old and Middle English Language and Literature
2) English Renaissance Literature
3) Restoration and 18th Century English Literature
4) Romantic and Victorian English Literature
5) American Literature before the Civil War
6) American Literature from the Civil War to World War I
7) Recent British and American Literature
8) Linguistics

HISTORY

Leslie S. Domonkos

In Charge of Graduate Studies in History
211 Arts and Sciences Office Building

Admission Requirements

The student must have a grade point average in undergraduate study of 2.75 (on a 4.0 scale) or above and a minimum of 24 quarter hours of study in the field of history as an undergraduate (this may be waived upon petition to the Department of History).

Degree Requirements

The total number of credit hours for the Master of Arts degree with a major in history is a minimum of 45 quarter hours. Twenty-four quarter hours of the total requirement must be earned in his-

tory, including History 900 (Historiography). Fifteen quarter hours shall be in the field of concentration. If the candidate is inadequately prepared for the required graduate courses, either in the major or minor subjects, additional courses must be taken to supplement the undergraduate work.

A thesis is required of all candidates for the degree. The Department of History expects that the thesis shall display a capacity for research in a variety of historical sources, the ability to interpret factual information, and shall constitute a properly documented report of the completed research.

A foreign language is required of all candidates for the degree. This requirement can be met by demonstrating a reading knowledge of a foreign language. The following languages are approved for the M.A. requirement: German, French, Russian, Spanish, Greek, Italian, Hebrew, and Latin. Another language may be substituted if it is pertinent to the person's special field of study.

Candidates for the Master of Arts with a major in history must pass an oral and written examination in his major field. The primary purpose of this examination is to determine the student's mastery of his major field; the examination will require factual and interpretative material as well as bibliography and historiography.

A written examination is also required for the minor field.

MASTER OF MUSIC

Donald W. Byo

Acting Dean
103 Dana School of Music

The following programs of study lead to the degree of Master of Music: Applied Music; Woodwind or Brass Specialization; Sacred Music; Music Education; Theory and Composition; and Musicology.

Admission Requirements

Applicants for admission to graduate study for the Master of Music degree should present a baccalaureate degree in music from an accredited college or university. Admission will require an undergraduate grade point average of at least 2.5 (based upon a

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4.0 scale), and satisfactory aptitude and music scores on the Graduate Record Examination. All applicants for the degree shall take placement examinations in music theory, music history and literature, and pass a piano proficiency examination before or during the first quarter of study. Completion of two years undergraduate study in piano may be accepted in lieu of the piano proficiency examination.

Applicants for the degree Master of Music in the field of applied music must pass an entrance audition performed before the appropriate applied music faculty plus one or more representatives from the Graduate Committee. The audition, in the form of a half-hour recital, should be performed prior to enrolling for graduate study or, if that is impossible, early in the first quarter of graduate study.

Applicants for the degree Master of Music in the field of woodwind or brass specialization must present a baccalaureate degree with a major in music education (instrumental) or applied music (woodwind or brass instrument), show outstanding ability on the major instrument and unmistakable adaptability to other woodwind or brass instruments, and pass an entrance audition on the major instrument and one minor instrument, prior to and during the first quarter of study. Qualified applicants who fail to meet preliminary requirements may be admitted provisionally and shall be eligible to be accepted for the degree program when these requirements have been fulfilled.

Degree Requirements

Candidates for the Master of Music degree must earn 48 credits acceptable for graduate study and must complete all requirements outlined in their respective courses of study, including participation in choral or instrumental ensembles and such collateral courses as may be deemed desirable by the Graduate Committee. (See Chart)

Candidates must meet whatever undergraduate foreign language requirements are appropriate to their major area of music study. Applied voice majors are expected to have completed one year each of French, German and Italian. Musicology majors are expected to have a reading knowledge of at least one foreign language, preferably French or German.

In music education, students may select Plan A (with thesis) or Plan B (without thesis). In applied music, public recital will be

REQUIREMENTS FOR COURSES OF STUDY FOR THE MASTER OF MUSIC DEGREE

	Applied Music	Woodwind or Brass Specialization	Sacred Music	Music Education Plan A Thesis	B No Thesis	Theory & Composition	Musicology
Applied Music (c)	9	15	9	6	6	6	6
Major		(9)					
Minor		(6)					
Music Theory	6	6	6	6	6	9 or 12(a)	6
Music Literature	6	6	6	6	6	6	12
Recital (b)	6	6	–	–	–	–	–
Chamber Music	3	–	–	–	–	–	–
Ensemble	3	3	3	3	3	3	3
Electives	15(d)	12(g)	9(g)	6(g)	6(g)	6(e)	15(f)
Advanced Choral Conducting	–	–	3	3	3	–	–
Seminar in Sacred Music	–	–	3	–	–	–	–
Church Music Administration	–	–	3	–	–	–	–
Foundations of Music Education	–	–	–	3	3	–	–
Administration & Supervision in Music Education	–	–	–	3	3	–	–
Seminar—Music Education	–	–	–	3	3	–	–
Thesis	–	–	–	6	–	6	6
Research Methods & Materials—Music Education	–	–	–	3	3	–	–
Psychology of Music	–	–	–	–	3	–	–
Music & the Humanities	–	–	–	–	3	–	–
Composition	–	–	–	–	–	9 or 12(a)	–
Total Quarter Hours	48	48	48	48	48	48	48

(a) Hours in theory and composition must total 21.

(b) In lieu of thesis requirement.

(c) For all degrees except woodwind or brass specialization the requirement in applied music may be met in the student's major and/or minor applied area upon the recommendation of the advisor.

(d) 9 hours of electives to be selected from ensemble, pedagogy and literature courses for the principal instrument or voice.

(e) Theory electives must be selected from the theory area.

(f) Musicology electives must be selected from the music history and literature area.

(g) Electives may include cognate fields related to the student's research.

presented in lieu of a thesis. In composition, an original composition satisfies the thesis requirement. A thesis will be required of students whose major is theory or musicology, and sacred music.

Academic Standards

To receive the degree Master of Music it will be necessary to achieve a cumulative average of at least a B or 3.0 grade point average on a 4.0 basis. The thesis, research, and recital requirements must each meet at least the B standard of achievement. Grades received in courses taken for collateral credit or in ensemble courses are not used in determining the academic average of the student. A student who fails to meet the standards set by the School may, on recommendation of the Graduate Committee, be required to withdraw at the end of the quarter.

Applied Music

Graduate students are expected to advance their competence in performance by continued study in their major applied area. (In some cases a minor applied area may be substituted for the major area.) Students other than those majoring in applied music are required to undergo a jury examination at the conclusion of the period of study, or at the end of the third quarter of study. Jury examinations and other performance responsibilities for applied majors are established by the appropriate applied music faculty.

Final Certifying Examination

The final certifying examination may not be taken prior to the quarter in which all required course work, including the thesis, if such is required, will be completed. The examination may be written and/or oral. The examining committee shall be composed of members of the music faculty representative of music education (when the major is music education), applied music, theory/composition, and music history and literature. No attempt will be made to have represented on the examining committee only those instructors who taught the classes in which the candidate was enrolled; however, the professor representing his major field will be one of the examiners. The membership of the examining com-

mittee will be recommended by the student's academic advisor and approved by the Graduate Committee. The student will be examined on his thesis, his graduate studies, and general music subjects. In case of failure the examination may be repeated once after a suitable interval in which the student will have been expected to strengthen the deficiencies noted. The examination will be rescheduled at the discretion of the Graduate Committee. (The student is expected to be acquainted with the works covered by the bulletin entitled "Recommended Reading for Master's Candidates in Music" issued by the Dana School of Music.)

MASTER OF SCIENCE

CHEMISTRY

Leon Rand

Chairman of the Department
324 Ward Beecher Science Hall

Admission Requirements

For admission to the Department of Chemistry for graduate studies leading to the Master of Science degree, the applicant must present an undergraduate major in chemistry or its equivalent. The prior work must be essentially equivalent to that required by the Department of Chemistry for a Bachelor of Science, professional degree, as delineated in the *Bulletin* of the College of Arts and Sciences, Youngstown State University.

In those cases where undergraduate preparation is deficient or inadequate, the applicant may be admitted to the University, with provisional status, with the approval of the Dean of the Graduate School and the Chairman of the Department of Chemistry. Courses in which the applicant is deficient must be resolved without graduate credit.

A written examination covering analytical, inorganic, organic and physical chemistry is required of all applicants, and will be given during the week preceding registration. The purpose of this examination is to assist the student and his advisor to formulate a program of studies, and does not become a part of his official University record.

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Degree Requirements

The candidate for the M.S. degree in chemistry will be expected to complete satisfactorily the following core courses: Chemistry 911, 931, 932, 941, 942, 951, 952, and two hours of 998, plus 13 hours of electives. The electives may include six hours of 800–level chemistry courses and up to nine hours outside the chemistry department, in both cases with the consent of the student's advisor. Biochemistry majors may choose Chemistry 842 and 843 in lieu of 931 and 932 in the core course requirements. A grade point average of at least 2.7 must be achieved in the core courses.

By the time the basic graduate courses listed above are completed, each candidate will have selected a thesis advisor. A total of nine hours of Chemistry 990 (Thesis), culminating in the completion of an acceptable thesis, is required.

MATHEMATICS

Bernard J. Yozwiak

Chairman of the Department
234 Engineering Science Building

Admission Requirements

To be admitted without undergraduate deficiency, an applicant must have a cumulative grade point average of at least 2.7 in all undergraduate mathematics courses, and an undergraduate mathematics major approximating that required of undergraduate mathematics majors at Youngstown State University. This involves a minimum of 28 quarter hours of courses on the 700– and 800–level including at least a one-quarter course in advanced calculus and a one-quarter course in abstract algebra. Additional course work in these areas is strongly recommended as preparation for the graduate courses.

Degree Requirements

A minimum of 45 quarter hours of credit with a cumulative quality point average of 3.0 is required for the M.S. degree. At least 23 of these hours must be taken from 900–level courses. Certain courses from the 700 or 800 level may be included in the student's program if prior approval is given by the student's adviser. Nor-

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mally, these would be courses not included in the student's undergraduate preparation that would be most helpful in pursuing his graduate program.

Course requirements for the degree are: (1) Math 970 and (2) an approved 10-hour sequence at the 900-level. The combined undergraduate-graduate program of the candidate must include at least the equivalent of (a) two quarters each of abstract algebra and advanced calculus and (b) one quarter each of complex analysis and topology (Y.S.U. courses 727, 728, 871, 872, 875, 880).

In addition to the course work, the passing of a comprehensive examination is required. This may be written and/or oral, at the discretion of the department.

A thesis for the M.S. degree is optional. A student who elects this option and has the approval of a faculty supervisor will register for Mathematics 999 and will receive credit up to 9 quarter hours upon successful completion of the thesis. These hours may be counted as part of the 45 quarter hours required for the degree. The student will be expected to make a successful oral defense of the thesis.

MASTER OF SCIENCE IN EDUCATION

The programs leading to the degree Master of Science in Education, and the faculty member in charge of each program, are:

Master Teacher—Elementary	Marvin W. Chrisp, *Chairman of*
Principalship—Elementary	*the Department of Elementary Education*
Master Teacher—Secondary	William A. Shipman, *Chairman*
Principalship—Secondary	*of the Department of Secondary Education*
School Guidance and Counseling	William O. Swan, *Chairman of the Department of Foundations of Education*
Special Education	Ruth B. Clayton, *Chairman of*
(Slow Learning Children)	*the Department of Special Education*

Admission Requirements

To be admitted to the Master of Science in Education degree program, the applicant must have earned a bachelor's degree from an accredited college or university, and must hold a qualifying

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teaching certificate (Ohio provisional or otherwise). Admission also requires an undergraduate cumulative grade point average of 2.5 or above and satisfactory preparation for the graduate program in which the student wishes to enroll, as specified by the department of the major. For all students with less than a 3.0 grade average in undergraduate work, a satisfactory score on the Aptitude Test of the Graduate Record Examination is required.

Programs of Study

In general, the programs provide for 1) a core of foundation courses, 2) elective courses in the program being undertaken, and 3) additional work outside the School of Education. A minimum of 48 quarter hours are required for the degree in each program.

A comprehensive examination at the close of the Foundations portion of the work will be required as a basis for becoming a degree candidate.

Foundations of Education

Students in all programs are required to take 12 quarter hours in Foundations of Education:

Ed. 900	Education in Western Culture	3 q.h.
Ed. 901	Philosophical Foundations of Educational Theory and Practice	3 q.h.
Ed. 902	Sociological Aspects of Contemporary Education	3 q.h.
Ed. 904	Educational Research	3 q.h.

The Master Teacher Program

1. Six credit hours required of students in both elementary and secondary programs:

Psych. 903		Psychology of Learning	3 q.h.
Ed.	909	The Supervision of Practice Teachers— Elementary, or	3 q.h.
Ed.	910	The Supervision of Practice Teachers— Secondary	3 q.h.

2. Elementary Teachers:

   1) 12 to 18 quarter hours selected from the following education courses:

Ed. 856	Diagnosis of Reading Problems	3 q.h.
Ed. 857	Development of Remedial Reading Techniques	3 q.h.

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Ed. 917   Elementary School Reading Programs   3 q.h.
Ed. 918   Elementary School Mathematics Programs 3 q.h.
Ed. 919   Social Studies in the Elementary School 3 q.h.
Ed. 920   Elementary School Science Programs   3 q.h.
Ed. 921   Issues, Problems and Developments in   3 q.h.
        Elementary Education

   2)   12 to 18 quarter hours of electives from humanities, sciences, and other disciplines.

3. Secondary Teachers:

   1)   24 quarter hours in courses in appropriate teaching areas
   2)   Six quarter hours of electives in education or teaching areas

Students in the Master Teacher Program (Secondary Education) will have, in addition to an education advisor, an advisor appointed from the teaching area to consult on the choice of courses in that area.

The Principalship Program

1. 27 quarter hours in school administration courses:

Ed. 946   The Supervision of Instruction   3 q.h.
Ed. 947   Basic Principles of Elementary School   3 q.h.
        Administration, or
Ed. 948   Basic Principles of Secondary School   3 q.h.
        Administration
Ed. 949   School Law   3 q.h.
Ed. 950   School Business Management   3 q.h.
Ed. 951   The School Principal's Communication   3 q.h.
        Relationships
Ed. 916   The Elementary School Curriculum, or   3 q.h.
Ed. 931   The Secondary School Curriculum   3 q.h.
Ed. 961   Foundations of Guidance   3 q.h.
Ed. 953   Practicum in Administration for School   3 q.h.
        Principals

2. Nine quarter hours of:

   1)   Electives in special education   3 q.h.
   2)   Interdisciplinary electives   6 q.h.

Guidance and Counseling Program

1. 27 quarter hours in guidance and related psychology courses:

Psych. 903   The Psychology of Learning   3 q.h.
Psych. 906   Human Growth and Development   3 q.h.
Psych. 907   Psychology of Adjustment   3 q.h.

Ed.	961	Foundations of Guidance	3 q.h.
Ed.	962	Counseling: Principles, Theory, Practice	3 q.h.
Ed.	963	Occupational and Educational Information in Guidance	3 q.h.
Ed.	964	Measurement and Evaluative Techniques	3 q.h.
Ed.	968	Counseling Practicum	6 q.h.

2. Nine quarter hours of:
   1) Elective in special education   3 q.h.
   2) Interdisciplinary electives   6 q.h.

Program in Special Education for Slow Learning Children

1. 24 quarter hours of special education and related courses:

Psych.	903	The Psychology of Learning	3 q.h
Psych.	906	Human Growth and Development	3 q.h.
Ed.	976	Problems and Issues in Mental Retardation	3 q.h.
Ed.	977	Research and Problems in the Education of the Mentally Retarded	3 q.h.
Ed.	978	Administration and Supervision of Special Education	3 q.h.
Ed.	979	The Mentally Retarded in Society	3 q.h.
Psych.	980	Psychological Aspects of Mentally Retarded Children	3 q.h.
Psych. (Sp. Ed.)	981	Advanced Seminar in Mental Retardation	3 q.h.

2. Twelve quarter hours of electives in the general areas of supervision, administration, diagnosis of reading problems, psychology, and counseling. (For teachers already provisionally certified in elementary or secondary education but not in special education, the qualifying courses for special certification [courses numbered 851 through 855] will tentatively be permitted to satisfy this 12–hour requirement.)

MASTER OF SCIENCE IN ENGINEERING

Programs in civil, electrical, mechanical and metallurgical engineering lead to the degree Master of Science in Engineering.

Admission Requirements

In addition to the requirements for admission to the Graduate School, applicants must show a grade point average in under-

graduate study of at least 2.75 (on a 4.0 scale) in the courses in the field of specialized study, and meet essentially all of the undergraduate prerequisites for their proposed field of graduate study. Applicants with lesser qualifications may be admitted on the basis of evaluation of their undergraduate record by the engineering department in which they wish to enroll. Applicants may be required to take certain courses, to be determined by their advisors, to make up deficiencies. The student will not be given credit for such courses toward his graduate degree.

Degree Requirements

All engineering departments require at least 45 quarter hours for the master's degree. These hours will be divided in the following manner:

1. Mathematics: 9 quarter hours, usually Mathematics 910, 911: Advanced Engineering Mathematics I and II (5, 4 q.h.)

2. Interdepartmental Courses: 12 quarter hours from:
   M.E. 982: Engineering Analysis (4 q.h.)
   Met. Engr. 901, 902: Fundamentals of Material Science I and II (4, 4 q.h.)
   I.E. 901: Optimization Techniques (4 q.h.)
   I.E. 902: Digital Simulation (4 q.h.)
   E.E. 951: Network Analysis (4 q.h.)
   C.E. 910: Advanced Strength of Materials (4 q.h.)
   C.E. 941: Structural Mechanics (4 q.h.)

3. Departmental Courses: 24 quarter hours

CIVIL ENGINEERING

John N. Cernica

Chairman of the Department
266 Engineering Science Building

This program offers opportunities for advanced studies in two general areas of specialization: fluid mechanics and sanitary engineering; and structural mechanics.

A minimum of 18 credit hours of departmental courses in the primary area, plus a thesis, is required of all students. The thesis requirement may be waived by the department head upon recommendation of the departmental advisory committee. In that case the student will be required to take at least six hours of course work beyond the 45 required for the degree.

Before the thesis is approved by the advisor and department head, the student must have the approval of the departmental advisory committee via an oral defense of the thesis. In cases where the thesis requirement is waived, the student must, upon completing 40 hours of course work, pass an oral examination related to the course work; the exam will be administered by the department advisory committee.

After completing 12 hours of course work, the student must formulate, with his advisor, his remaining program of study.

ELECTRICAL ENGINEERING

Matthew Siman

Acting Chairman of the Department of Electrical Engineering
289 Engineering Science Building

The Department of Electrical Engineering provides the opportunity for specialized study in control systems, electronics and electromagnetic fields.

After the completion of 12 credit hours, the student is assigned a program committee with which he will jointly develop his remaining program of study. The program must include E.E. 951 (Network Analysis).

Ordinarily, the student's program of study will include an eight credit hour thesis requirement. This requirement may be waived by the department head, upon the recommendation of the student's program committee, and replaced with eight credit hours of course work selected by the committee. A student attempting a thesis must orally present and successfully defend his thesis findings. A non-thesis student must pass a written and/or oral comprehenive examination relative to his major field of study.

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MECHANICAL ENGINEERING

Frank J. Tarantine

In Charge of Graduate Studies in Mechanical Engineering
207 Engineering Science Building

Two general areas of specialization are offered: mechanics of rigid and deformable solids; and heat and fluid flow.

After completing 13 credit hours, including Mathematics 910 (Advanced Engineering Mathematics I) and M.E. 982 (Engineering Analysis I), the student will be assigned to a graduate committee of three faculty members who will plan his remaining course work and decide if he is to undertake a thesis or research project, which may be for a minimum of four or a maximum of eight hours credit. The student will omit departmental courses for thesis credit. If a thesis is undertaken, the student will be required to defend it in an oral examination. Other students may be required to take a comprehensive examination as a degree requirement.

M.E. 982 and 983 (Engineering Analysis I and II) are required of all mechanical engineering students. No more than 12 quarter hours credit of approved 800-level courses will be allowed towards the completion of the degree requirements.

METALLURGICAL ENGINEERING

Shaffiq Ahmed

Chairman of the Department
231 Engineering Science Building

For admission to the program in metallurgical engineering the candidate must have a bachelor's degree in engineering or in natural sciences (physics, chemistry or mathematics). Any candidate holding an undergraduate degree only in natural sciences will be required to take certain courses, to be determined by his advisor, to make up deficiencies. The student will not be given credit for such courses toward his graduate degree except with the permission of the departmental advisory committee.

The minimum quarter hours required for the degree is 46 hours, 21 quarter hours of which are applied towards the general advanced courses in other engineering disciplines. The remaining quarter hours are devoted to the specialized courses in metallurgical engineering and material science. All students are required to take the following courses:

Met. Engr. 920 Advanced Physical Metallurgy I
Met. Engr. 922 Advanced Mechanical Metallurgy I
Met. Engr. 960 Research Seminar

Having established his option, the student chooses electives from the courses listed in his chosen option.

OPTION A Metallurgical Engineering

Research

Met. Engr. 921 Advanced Physical Metallurgy II
Met. Engr. 923 Mechanical Properties of Materials II
Met. Engr. 951 Introduction to Electron Microscope and Field Ion Microscope
Met. Engr. 952 Dislocation and Plastic Flow
Met. Engr. 953 Thermodynamics of solids

Industrial

Met. Engr. 910 Extractive and Process Metallurgy
Met. Engr. 921 Advanced Physical Metallurgy II
Met. Engr. 931 Engineering Alloys
Met. Engr. 932 Industrial Metallurgy
Met. Engr. 933 Chemical Metallurgy

OPTION B Material Science

Research

All courses listed under *research* option in Met. Engr. *plus* the following courses:

Met. Engr. 954 Advanced Polymer Science
Met. Engr. 955 Advanced Refractory Materials
Met. Engr. 956 Advanced Nuclear Materials

Industrial

Met. Engr.	851	Introduction to Polymer Science
Met. Engr.	852	Advanced Engineering (Non-metallic) Materials I
Met. Engr.	853	Advanced Engineering (Non-metallic) Materials II
Met. Engr.	854	Advanced Engineering (Non-metallic) Materials III
Met. Engr.	954	Advanced Polymer Science
Met. Engr.	955	Advanced Refractory Material
Met. Engr.	956	Advanced Nuclear Material

In all options, the student undertakes a program of independent research. This program is jointly arranged by the candidate for the degree, the professor-in-charge and the departmental advisory committee. The thesis requirement may be waived by the department head. In the non-thesis program, the student will be required to take six additional hours of course work beyond the 46 hours required for the program.

The administration of the program will be governed by the regulations of the Graduate School and of the department. The student must secure a copy of graduate student folder from the department office.
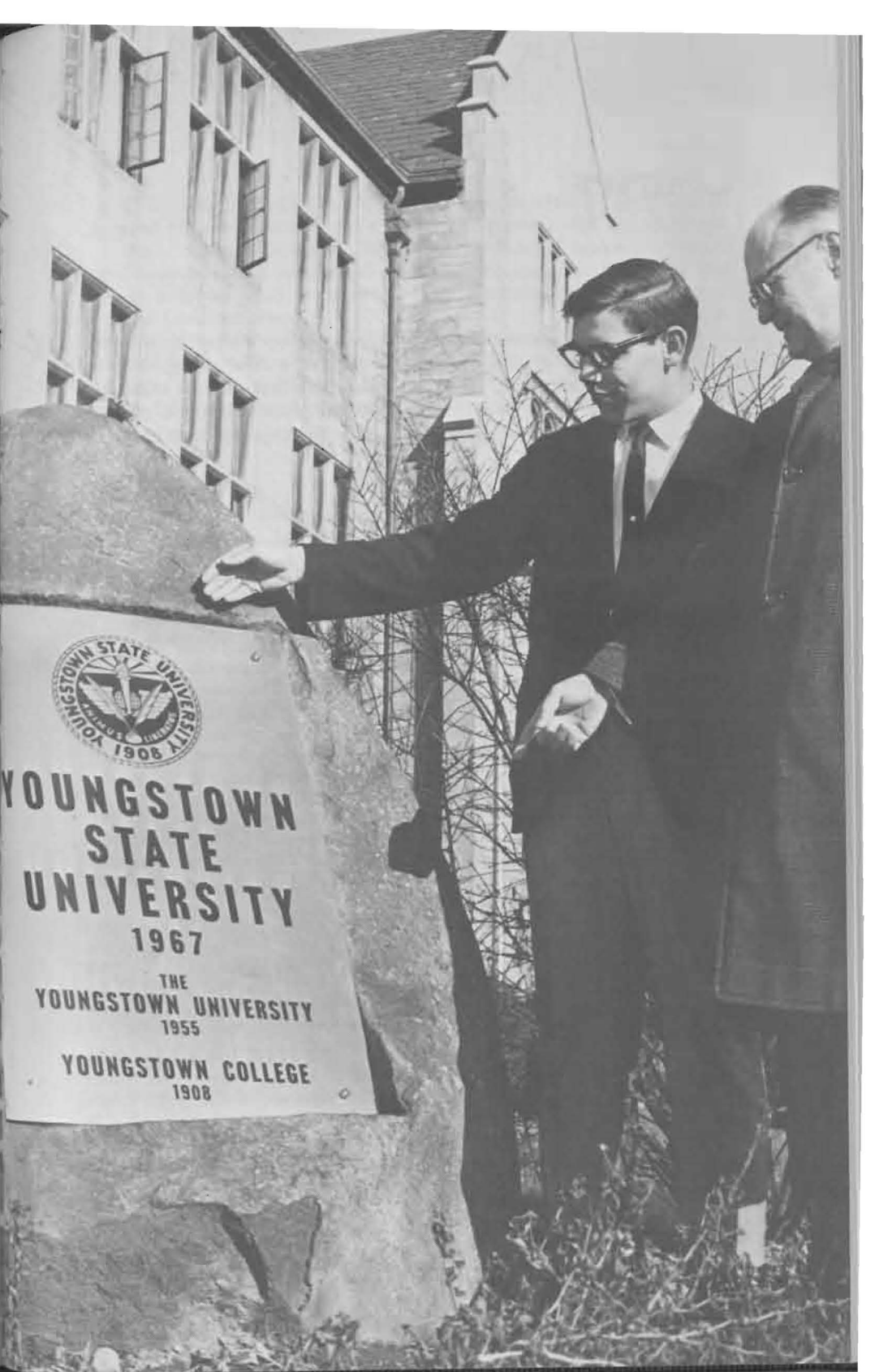
Courses

Included in this section, in addition to the 900–series courses that are open to graduate students only, are the upper division undergraduate courses (700– and 800–series) that may be taken for graduate credit but only with the approval of the student's advisor. For course descriptions and prerequisites for these courses, see the University Bulletin.

ART

Jon M. Naberezny, *Chairman of the Department*
10 Clingan-Waddell Hall

701. Seminar. (1 q.h.)
801. Seminar. (1 q.h.)
803, 804, 805. Advanced Painting. (3 + 3 + 3 q.h.)
806. Indian Art. (3 q.h.)
807. Chinese/Japanese Art. (3 q.h.)
810, 811. Advanced Ceramics. (3 q.h.)
812. Advanced Sculpture. (3–5 q.h.)
814. 20th-Century Art to 1925. (3 q.h.)
815. 20th-Century Art from 1925. (3 q.h.)
822. Arts and Crafts II. (3 q.h.)
920. *Seminar in Art Education.* Problems and projects that pertain to the teaching of art at various levels of learning within our schools. The graduate program includes both studio work and pedagogical studies. 920 may be repeated for a maximum credit of 10 hours. Prereq.: Graduate standing and permission of faculty. 5 q.h.
925. *Research in Art Education.* An individual and inventive approach to solving existing problems in art education based upon the philosophy, psychology, principles, practices, and perceptions of past and contemporary trends in art education. 925 may be repeated for a maximum credit of 10 hours. Prereq.: 920 and permission of instructor. 5 q.h.
950. *Studio Problems in Painting.* Individual research of two-dimensional form through various media including oil, acrylic, water color, collage, etc. May be repeated for a maximum credit of 10 hours. Prereq.: Graduate standing. 5 q.h.
951. *Studio Problems in Painting.* Continuation of 950. May be repeated for a maximum credit of 10 hours. Prereq.: 950. 5 q.h.

952. *Studio Problems in Painting.* Continuation of 951. May be repeated for a maximum credit of 10 hours. Prereq.: 951.   2–5 q.h.

960. *Studio Problems in Sculpture.* Individual research of plastic form through various media including plastics, wood, stone, metals, and related materials. May be repeated for a maximum credit of 10 hours. Prereq.: Graduate standing.   5 q.h.

961. *Studio Problems in Sculpture.* Continuation of 960. May be repeated for a maximum credit of 10 hours. Prereq.: 960.   5 q.h.

962. *Studio Problems in Sculpture.* Continuation of 961. May be repeated for a maximum credit of 10 hours. Prereq.: 961.   2–5 q.h.

BIOLOGY

George W. Kelley, *Chairman of the Department*
409 Ward Beecher Science Hall

802. Ecology. (5 q.h.)
803. Aquatic Biology. (5 q.h.)
821. Plant Anatomy. (5 q.h.)
822. Plant Physiology. (5 q.h.)
823. Advanced Genetics. (4 q.h.)
824. Bacterial Physiology. (3 q.h.)
831. Biological Seminar. (2 q.h.)
832. Cytology. (5 q.h.)
833. Introduction to Vertebrate Physiology. (5 q.h.)
840. Biological Techniques. (2 q.h.)
850. Problems in Biology. (4 q.h.)
851. Immunobiology. (5 q.h.)
853. Biometry. (4 q.h.)
863. Growth and Differentiation. (5 q.h.)
872. Protozoology. (4 q.h.)
874. Helminthology. (4 q.h.)

950. *Comparative Animal Physiology I.* Evolutionary development of respiratory, circulatory, nervous and muscle systems in animal kingdom. Prereq.: Biology 833.   5 q.h.

951. *Comparative Animal Physiology II.* Continuation of Biology 950 to cover osmo-ionic regulation mechanisms, nitrogen excretion, temperature regulation and endocrine system. Prereq.: Biology 950. 5 q.h.

952. *Experimental Design.* Controlling variables, experimental design, and treatment of data from biological experiments. Prereq.: 853.   5 q.h.

953. *Evolution.* Genetic and ecological forces of evolutionary process. Prereq.: Biology 721.   4 q.h.

954. *Advanced Ecology.* Interrelationships of species within the community and their influence upon the ecosystem. Prereq.: Biology 802.
3 to 5 q.h.

955. *Ecosystem Analysis.* Analytical study of structure and change of the ecosystem. Prereq.: College calculus and Biology 802 or 954.
4 q.h.

956. *Physiological Ecology.* Physiological relationships of animals to their ecological roles. Prereq.: Biology 833 and 802.
4 q.h.

957. *Advanced Molecular Biology.* Structure and role of nucleic acids in protein synthesis. Prereq.: Biol. 680.
3 q.h.

958. *Marine Biology.* Animals and Plants of the sea, their distribution, abundance, ecology and economic importance. Prereq.: Biol. 701.
2 to 6 q.h.

960. *Plant Growth and Development.* Motivating forces of plant development. Prereq.: Biol. 680.
4 q.h.

961. *Pathogenic Bacteria.* Biology, epidemiology and pathology of medically important bacteria. Prereq.: Biol. 702.
4 q.h.

962. *Medical Mycology.* Morphology, physiology and epidemiology of medically important fungi. Prereq.: Biol. 702.
4 q.h.

963. *Virology.* Study of plant and animal viruses. Prereq.: Biol. 702.
4 q.h.

970. *Experimental Parasitology.* Laboratory demonstration of bionomics of helminth parasites. Prereq.: Biol. 701.
5 q.h.

971. *Acarology.* Taxonomy, morphology, bionomics and economic importance of mites and ticks. Prereq.: Biol. 771.
4 q.h.

972. *Systematic Zoology.* Principles, significance and procedure of zoological taxonomy. Prereq.: Biol. 701.
3 q.h.

990. *Master's Thesis Research.* Research selected and supervised by departmental advisor and approved by graduate faculty of biology department and Dean of Graduate School. Prereq.: acceptance by departmental committee.
1 to 10 q.h.

991. *Botany Topics.* Arranged course in botany. Prereq.: permission of instructor.
2 to 4 q.h.

992. *Invertebrate Zoology Topics.* Arranged courses on subjects of invertebrate zoology. Prereq.: permission of instructor.
2 to 4 q.h.

993. *Vertebrate Zoology Topics.* Arranged courses on aspects of vertebrate zoology. Prereq.: permission of instructor.
2 to 4 q.h.

994. *Genetics and Evolution Topics.* Arranged course in principles of genetics and forces of evolution. Prereq.: permission of instructor.
2 to 4 q.h.

995. *Parasitology Topics.* Arranged courses in field of parasitology. Prereq.: permission of instructor.
2 to 4 q.h.

996. *Environmental Biological Topics.* Arranged courses in terrestrial and aquatic ecology. Prereq.: permission of instructor. 2 to 4 q.h.

997. *Molecular Biology Topics.* Arranged courses in subjects at molecular level of life. Prereq.: permission of instructor. 2 to 4 q.h.

CHEMISTRY

Leon Rand, *Chairman of the Department*
324 Ward Beecher Science Hall

719, 720, 721. Organic Chemistry. (4 + 4 + 4 q.h.)
722. Organic Chemistry. (3 q.h.)
729. Inorganic Chemistry I. (3 q.h.)
739, 740, 741. Physical Chemistry. (4 + 4 + 4 q.h.)

Note: The above 700-level courses may not be counted toward a M.S. in Chemistry, but may be taken for graduate credit by students in other departments.

803, 804. Chemical Instrumentation. (4 + 4 q.h.)
805. Applied Spectroscopy. (3 q.h.)
813. Thermodynamics. (4 q.h.)
821. Intermediate Organic Chemistry. (3 q.h.)
829, 830. Inorganic Chemistry II, III. (3 + 3 q.h.)
831. Inorganic Chemistry Laboratory. (2 q.h.)
836. Chemical Bonding and Structure. (3 q.h.)
841, 842, 843. Principles of Biochemistry. (3 + 3 + 3 q.h.)
845, 846. Biochemical Techniques. (2 + 2 q.h.)
911. *Advanced Analytical Chemistry.* The theoretical foundations of analysis with emphasis on recent analytical developments and the current literature. Prereq.: Chemistry 741. 3 q.h.

931, 932. *Advanced Inorganic Chemistry I, II.* I) Current theories and types of bonding. Modern interpretations of the descriptive chemistry of the more representative elements and their compounds. II) Modern interpretations of the descriptive chemistry of transition and inner-transition elements and their compounds. Introduction to coordination chemistry. Prereq.: Chemistry 829 or 830. 3 + 3 q.h.

935, 936. *Nuclear Chemistry I, II.* The principles and experimental procedures used in the study of nuclear transformations, natural and artificial disintegration. Prereq.: Chemistry 741. 3 + 2 q.h.

941, 942. *Advanced Organic Chemistry I, II.* Reaction mechanisms and physical organic chemistry. Prereq.: Chemistry 722 and 741. 3 + 3 q.h.

945. 946. *Polymer Chemistry I, II.* A study of the polymerization process and the relationship between structure and properties of polymers. Prereq.: Chemistry 721 and 741. 3 + 3 q.h.

951, 952. *Advanced Physical Chemistry I, II.* Essentials of quantum mechanics and applications of quantum mechanics to molecular structure, spectroscopy, and diffraction phenomena. Prereq.: Chemistry 741. 3 + 3 q.h.

955. *Statistical Mechanics.* Principles and methods of statistical mechanics, classical and quantum statistics with applications to gases, liquid, and solids. Prereq.: Chemistry 951. 4 q.h.

969. *Laboratory Problems.* Organized for high school teachers. A laboratory course which stresses individual effort in solving chemical problems. May be repeated up to 6 q.h. Prereq.: Work in chemistry involving laboratory. 3 q.h.

990. *Thesis.* Hours arranged.

991, 992, 993, 994, 995. *Special Topics.* Topics selected by the staff from fields of current research interest or fields of special emphasis. 991 Analytical; 992 Biochemistry; 993 Inorganic; 994 Organic; 995 Physical. Each may be repeated for credit. 2 or 3 q.h. as scheduled.

998. *Seminar.* 1 q.h.

CIVIL ENGINEERING

John N. Cernica, *Chairman of the Department*
266 Engineering Science Building

845. Civil Engineering Analysis. (3 q.h.)
846. Advanced Structural Analysis. (3 q.h.)
847. Structural Dynamics. (3 q.h.)
850. Soil Mechanics. (3 q.h.)
850L. Soil Mechanics Laboratory. (1 q.h.)
851. Foundation Engineering. (3 q.h.)
852. Advanced Soil Mechanics. (3 q.h.)

910. *Advanced Strength of Materials.* The basic methods of structural mechanics, such as conditions of equilibrium and compatibility, stress-strain relations. General treatment of energy principles including virtual work, minimum potential energy; applications to statically determinate and indeterminate systems such as rings, curved beams, plates, and other elastic systems. 4 q.h.

917. *Open Channel Hydraulics.* Analysis and design of open channels for uniform and nonuniform flow; hydraulic jump analysis; boundary layer and roughness effects; flow over spillways; flow in channels of nonlinear alignment and nonprismatic section. 4 q.h.

941. *Structural Mechanics.* Study of beams under lateral load; beams with combined lateral load and thrust; buckling beams on elastic foundations; applications of Fourier series and virtual work principles to beam-type structures; stress and strain in three dimensions; applications to flexure of beams and plates and to constrain torsion; elements of engineering theory of plates. 4 q.h.

943. *Rigid Frame Analysis.* Basic procedures in analysis of rigid frames having members of constant or variable moment of inertia; method of angle changes, Castigilanio's theorems, theorems, Maxwell-Mohr method, reciprocal deflections and influence lines, slope deflection, moment distribution, elastic center and column analogy. 4 q.h.

945. *Civil Engineering Analysis.* Applications of mathematical and numerical methods to the systematic analysis and development of problems in the field of civil engineering, including equilibrium, propagation problems in lumped-parameter and continuous systems. 4 q.h.

946. *Matrix Analysis of Structures.* Introduction to matrix algebra; use of matrix methods in the analysis of statically and kinematically indeterminate structures; flexibility and stiffness methods. 4 q.h.

951. *Dynamics of Soils.* The influence of time-dependent loads on the significant physical properties of cohesive and cohensionless soils. Methods of analysis and design for foundations and soil structures subjected to vibratory, blast, and shock loads. 4 q.h.

952. *Advanced Foundation Engineering.* Principles of mechanics of materials applied to foundation problems; stresses and deformations in soils, consolidation theory; shallow and deep foundations. 4 q.h.

953. *Flow Through Porous Media.* Analysis of seepage volume and stresses due to flow of water through soils in connection with dams, slopes, excavations, subsurface drainage and wells. 4 q.h.

957. *Structural Stability.* A study of the elastic stability of engineering structures, beam columns, static bucking of elastic beams, frames, plates, and shells; dynamic stability of beams and plates. 4 q.h.

959. *Advanced Metal Design.* Advanced topics in the structural design of girders, frames and trusses. Light gage metal structures. Use of modern alloys and hybrid systems. 4 q.h.

961. *Advanced Concrete Design.* Consideration of advanced design techniques for reinforced concrete members and structures such as composite and prestressed concrete beams and box girders, lift slabs, folded plates and shells. 4 q.h.

965. *Seminar in Civil Engineering.* The application of special topics in theoretical mechanics to problems in civil engineering. Subjects covered include elasticity, viscoelasticity, plasticity and wave motion. 4 q.h.

967. *Theory and Design of Sewerage Systems and Sewage Treatment Plants.* Theory of the various procedures and techniques utilized in the treatment of sewage. Design of sewage treatment facilities. 4 q.h.

969. *Sanitary Engineering Laboratory.* Theory and methods for chemical analysis of water, sewage, and industrial wastes.   4 q.h.

973. *Intermediate Fluid Mechanics.* Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow. Basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Unsteady flow.   4 q.h.

975. *Theory and Design of Water Distribution and Water Treatment Plants.* Theory of the various procedures and techniques utilized in the treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities.   4 q.h.

990. 991. *Thesis.*   3 + 3 q.h.

ECONOMICS

Emily P. Mackall, *Chariman of the Department*
217 Arts and Sciences Office Building

701. Money and Banking. (3 q.h.)
702. Public Finance. (3 q.h.)
703. Monetary and Fiscal Policy. (3 q.h.)
707. Economics of American Industry. (3 q.h.) (For M.S. in Education students only)
710, 711. Intermediate Micro-economics Theory I, II.
      (3 + 3 q.h.)
712, 713. Intermediate Macro-economics I, II.   (3 + 3 q.h.)
802. Comparative Economics Systems. (3 q.h.)
803. Business and Government. (3 q.h.)
805. Business Cycles and Economic Growth. (3 q.h.)
810. Business Economics. (3 q.h.)
811, 812, 813. Theory of International Trade and Development I, II, III. (3 + 3 + 3 q.h.)
820. Regional Economic Analysis. (4 q.h.)
821. Location Theory. (4 q.h.)
822. Seminar in Regional and Urban Economics. (4 q.h.)
831. Labor Markets. (4 q.h.)
833. Collective Bargaining and Arbitration. (4 q.h.)
835. Labor Legislation. (4 q.h.)
930, 931, 932. *Economics for Teachers.* An examination of the major economic issues and problems of our society and the use of appli-

cable economic theory for their solution. Meetings with representatives of various institutions of our society are included in order to relate the issues and theory to present day society. (Intended for elementary education students). 3, 3, 3 q.h.

ELECTRICAL ENGINEERING

Matthew Siman, *Acting Chairman of the Department*
290 Engineering Science Building

901. *Control Systems I.* Analysis of linear systems, characteristics of linear systems, analogous systems, development and application of Laplace and other transform methods. Systems with feedback, systems with distributed parameters. 4 q.h.

902. *Control Systems II.* Linear feedback systems theory. Stability criterion. Synthesis in complex and time domain. Multivariable systems (multiple input-output) and multiple loop systems with emphasis on state variable and matrix techniques. Analysis and design of carrier systems. 4 q.h.

911, 912. *Electromagnetic Fields I and II.* Solution of boundary value problems in general form. Laplace, Poisson and diffusion and wave equations in orthogonal coordinate systems. 4 + 4 q.h.

921. *Quantum Electronic Devices I.* Electronic energy levels in quantum electron devices; application of energy transitions to semiconductors, masers and lasers. Analysis of energy of atomic gasses as applied to gas lasers. Crystal structure of solid-state maser and laser materials. 4 q.h.

931. *Digital Systems Engineering I.* Boolean algebra, logical mapping; combination and sequential synthesis; analog and digital conversion; coding structures; hybrid numerical circuitry. Structures of combinatorial and sequential circuit synthesis; logical circuit methods of Quine, Huffman, Mealy, Moore; Boolean Matrices; Bilateral and Cascade networks. 4 q.h.

941. *Linear Electronic Circuits I.* Design of linear active circuits; amplifier analysis and synthesis; feedback amplifiers; stability; integrated circuits; transfer functions; synthesis methods; noise determination and reduction. 4 q.h.

951. *Network Analysis.* The analysis of time and frequency domain response of networks using transform and state variable techniques. Matrix methods, modeling, topological properties and signal-flow analysis techniques. 4 q.h.

954. *Network Synthesis.* A study of realization procedures for driving point and transfer function synthesis of networks. Concepts of

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positive real functions, methods such as Foster, Caver, Brune and Darlington. Approximation methods of Butterworth, Tchebyscheff. 4 q.h.

960. *Electrical Engineering Seminar.* 4 q.h.

990, 991. *Thesis.* 4 + 4 q.h.

ELEMENTARY EDUCATION

Marvin W. Chrisp, *Chairman of the Department*
206 School of Education

909. *Supervision of Practice Teachers—Elementary.* Basic counseling and supervisory techniques associated with the acceptance of responsibility for inducting the teaching neophyte into his first truly professional experiences. Actual work with student teachers. 3 q.h.

916. *The Elementary School Curriculum.* Developing an understanding of the meaning of curriculum at the elementary level, evidence of need for curricular changes, influences of society on curriculums, exploration of current status and trends; the role of teacher and administrator in curriculum appraisal and development. 3 q.h.

917. *Elementary School Reading Programs.* A critical appraisal and discussion of current research and traditional programs in the elementary school; goals, content, and problems faced by elementary administrators and teachers in the reading field. 3 q.h.

918. *Elementary School Mathematics Programs.* An analysis of past and present programs of elementary school mathematics; evaluation of programs including a consideration of adequacy of content, recognition of mathematics as a system, provision of number experiences for the learner. 3 q.h.

919. *Social Studies Programs in the Elementary School.* Objectives of elementary school social studies programs in terms of current needs; adaptation of materials of instruction in terms of the social science skills; evaluation of student progress; critical analysis of methods of improving instruction in social studies. 3 q.h.

920. *Elementary School Science Programs.* Focus on the objectives for science education in the elementary school; the elementary school science curriculum; process and inquiry in the elementary school science program; teacher education, educational media, and the evaluation of science teaching. 3 q.h.

921. *Issues, Problems, and Developments in Elementary Education.* A study of recent trends in elementary school organization and instruction (nongraded units, team teaching, middle schools, etc.). 3 q.h.

946. *The Supervision of Instruction.* (Sec. Ed. 946) Deals with the supervision of instruction and organization of a school designed for those aspiring to be principals or supervisors. Decision-making, super-

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vision, observation of supervisory experiences, direction in educational technology, the various subjects, staff relationships, school organization, pupil personnel, and extracurricular activities are among the areas considered, with emphasis upon elementary or secondary situations as appropriate. 3 q.h.

947. *Basic Principles of Elementary School Administration.* Investigation and study of the general problems of administration in the elementary school. 3 q.h.

951. *The School Principal's Communication Relationships.* (Sec. Ed. 951.) Techniques of public relations; needs and methods for effective internal communication; administration of staff and pupil personnel. 3 q.h.

ENGLISH

Margaret I. Pfau, *Chairman of the Department*
306 Arts and Sciences Office Building

900. *Introduction to Literary Study and Research.* Basic concepts in literary criticism, analysis, and research. Required of all candidates for the M.A. 3 q.h.

902. *Studies in Literary Criticism and Literary Forms.* (May be repeated once.) 3 q.h.

910. *Old English Language and Literature.* 4 q.h.

912. *Studies in Medieval Literature.* (May be repeated once.) 3 q.h.

920. *Studies in Shakespeare.* (May be repeated once.) 3 q.h.

922. *Studies in English Renaissance Literature.* (May be repeated once.) 3 q.h.

932. *Studies in Restoration and 18th-Century Literature.* (May be repeated once.) 3 q.h.

942. *Studies in Romantic and Victorian Literature.* (May be repeated once.) 3 q.h.

952. *Studies in American Literature before the Civil War.* (May be repeated once.) 3 q.h.

962. *Studies in American Literature from the Civil War to World War I.* (May be repeated once.) 3 q.h.

972. *Studies in Recent British and American Literature.* (May be repeated once.) 3 q.h.

982. *Studies in Linguistics.* (May be repeated once.) 3 q.h.
Seminars: (Topics in seminars will vary and will be announced each time the seminar is offered. Each seminar may be repeated twice.)

1001. *English Literature to 1660.* 4 q.h.

1002.	*English Literature since 1660.*	4 q.h.
1003.	*American Literature.*	4 q.h.
1004.	*Linguistics.*	4 q.h.

FOREIGN LANGUAGES AND LITERATURES

Robert E. Ward, *Chairman of the Department*
312 Jones Hall

German

800. Early German Literature. (3 q.h.)
811, 812. 18th Century German Literature. (3, 3 q.h.)
820. Goethe's *Faust.* (5 q.h.)
821, 822, 823. 19th Century German Literature. (3, 3, 3 q.h.)
831, 832, 833. Recent German Literature. (3, 3, 3 q.h.)
866. History of the German Language. (3 q.h.)
867–868. Germanic Linguistics. (3 + 3 q.h.)
870, 871, 872. Special Reading and Research.
$\qquad$ (1–5, 1–5, 1–5 q.h.)
873, 874, 875. Seminar in German Language or Literature.
$\qquad$ (3, 3, 3 q.h.)

French

801. Rabelais, Montaigne, Baroque Period of 17th-Century Literature. (3 q.h.)
802. Corneille, Age of Louis XIV, I. (3 q.h.)
803. Age of Louis XIV, II. (3 q.h.)
811. Montesquieu and Other Writers of First Half of Century Excluding Voltaire and Rousseau. (3 q.h.)
812. Voltaire and Rousseau. (3 q.h.)
813. Diderot and other Writers of Second Half of Century.
$\qquad$ (3 q.h.)
821. Precursors of Romanticism and Romanticism. (3 q.h.)
822. Realism: Post-Romantic Poets Through Baudelaire. (3 q.h.)
823. Naturalism: Parnasse: Symbolism. (3 q.h.)
831. France: Proust: 20th-Century Poetry. (3 q.h.)
832. 20th-Century Novels After Proust. (3 q.h.)
833. 20th-Century Theatre. (3 q.h.)
862. History of the French Language. (3 q.h.)
865–866. Comparative Romance Linguistics. (3 + 3 q.h.)
870, 871, 872. Special Reading and Research.
$\qquad$ (1–5, 1–5, 1–5, q.h.)
873, 874, 875. Seminar in French Language or Literature.
$\qquad$ (3, 3, 3 q.h.)

Spanish

801, 802, 803. Classical Spanish Literature. (3, 3, 3 q.h.)
811, 812, 813. 19th Century Spanish Literatura. (3, 3, 3 q.h.)
821, 822, 823. 20th Century Spanish Literature. (3, 3, 3 q.h.)
831, 832, 833. Modern Spanish-American Literature.
(3, 3, 3 q.h.)
841, 842. Medieval Spanish Literature. (3, 3 q.h.)
843. Pre-Lope De Vega Drama. (3 q.h.)
864. History of the Spanish Language. (3 q.h.)
865–866. Comparative Romance Linguistics. (3 + 3 q.h.)
870, 871, 872. Special Reading and Research.
(1–5, 1–5, 1–5 q.h.)
873, 874, 875. Seminar in Spanish Language or Literature.
(3, 3, 3 q.h.)

Italian

801. Italian Literature of the 14th Century. (3 q.h.)
802. Italian Renaissance. (3 q.h.)
803. Italian Neoclassicism. (3 q.h.)
811. Italian Romanticism. (3 q.h.)
812. The Italian Novel of the 19th Century. (3 q.h.)
813. Literature of New Italy. (3 q.h.)
821. Italian Literature of the First 40 Years of the 20th Century.
(3 q.h.)
822. Regional Italian Literature. (3 q.h.)
823. Recent Italian Literature. (3 q.h.)
864. History of the Italian Language. (3 q.h.)
865–866. Comparative Romance Linguistics. (3 + 3 q.h.)
870, 871, 872. Special Reading and Research.
(1–5, 1–5, 1–5 q.h.)
873, 874, 875. Seminar in Italian Language or Literature.
(3, 3, 3 q.h.)

FOUNDATIONS OF EDUCATION

William Swan, *Chairman of the Department*
206 School of Education

870. Problems of the Classroom Teacher. (3 q.h.)
871. Pupil Problems. (3 q.h.)
900. *Education in Western Culture.* A basic history of educational thought, practice, and purpose in Western culture with emphasis

on those factors influencing the emerging pattern of American education. 3 q.h.

901. *Philosophical Foundations of Educational Theory and Practice.* An examination of the basic philosophical premises upon which functional educational systems have been based. 3 q.h.

902. *Sociological Aspects of Contemporary Education.* A study of the implications for education of recent sociological developments with emphasis on inner-city problems, culturally disadvantaged students, and trends in family organization. 3 q.h.

904. *Educational Research.* An introduction to the techniques of educational research and elementary statistical concepts. Preparation of a written prospectus for a research problem will be required. Stress will be placed on the use of the library in the collection of data. Experience in interpreting research data will be provided in order to enable the student to adequately interpret the findings of educational research. 3 q.h.

961. *Foundations of Guidance.* Introduction to purposes and practices of pupil-personnel work in elementary schools, secondary schools, and higher education. Lecture and discussion are used to explore the philosophy and scope of guidance; history of guidance and important current developments; planning, organizing, administering, and evaluating guidance programs; and the contributions of psychology, sociology, economics, and other disciplines related to guidance. 3 q.h.

962. *Counseling: Principles, Theory, Practice.* Basic principles of counseling in an educational context. Development of procedural bases for counseling and educationally-oriented counseling theory. Ethics and limitations involved in counseling practices. 3 q.h.

963. *Occupational and Educational Information In Guidance.* Principles of career development and use of educational and occupational information resources in the guidance program. Lecture and discussion are used to explore occupational structure of the United States; sources of educational and occupational information including community resources; and the collecting, classifying, filing, and organization of educational and occupational information for use in the guidance program. 3 q.h.

964. *Measurement and Evaluative Techniques.* Study of the tools and techniques of measurement and evaluation and their application in the guidance process. 3 q.h.

968. *Counseling Practicum.* Counseling practice under supervision; the final required course in the preparation of the school counselor, open to advanced students who are completing their work for the school counselor certificate. Supervised practical counseling experience on campus and in neighboring elementary and secondary schools emphasized. Actual counseling of elementary and high school students;

test administration, scoring, and interpretation for students being counseled; group counseling practice; and role playing as related to the counseling procedure.   6 q.h.

GEOGRAPHY

Michael Klasovsky, *Chairman of the Department*
206 School of Education

806. European Area Study. (9 q.h.)
801. Resource Appraisal and Utilization. (5 q.h.)
802. Historical Geography of Anglo-America. (3 q.h.)
803. Urban Geography. (3 q.h.)
804. Political Geography. (3 q.h.)

HEALTH AND PHYSICAL EDUCATION

William B. Carson, *Chairman of the Department*
314 Jones Hall

709M. Intramural Sports: Organization and Administration
(3 q.h.)
803M. Health and Physical Education: Organization and Administration. (5 q.h.)
804C. Playgrounds: Organization and Administration. (5 q.h.)
805C. Recreational Activities: Organization and Administration.
(5 q.h.)
817C. Kinesiology and Applied Anatomy. (3 q.h.)
818M & 818W. Remedial and Corrective Physical Education.
(3 q.h.)
821C. Physiology of Exercise. (4 q.h.)
822C. Tests and Measurements. (5 q.h.)
825C. Seminar in Physical Education. (3 q.h.)

HISTORY

Hugh G. Earnhart, *Acting Chairman of the Department*
212 Arts and Sciences Office Building

701. Colonial America. (3 q.h.)
702. The Revolution and the Constitution. (3 q.h.)
704. The Federal Period of American History. (3 q.h.)
706. The Middle Period of American History. (3 q.h.)

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708. The Civil War and Reconstruction. (3 q.h.)
710. The Emergence of Modern America. (3 q.h.)
712. Recent America. (3 q.h.)
714, 715, 716. Economic History of the United States I, II, III.
(3 + 3 + 3 q.h.)
717, 718, 719. Constitutional History of the United States I, II, III. (3 + 3 + 3 q.h.)
720, 721, 722. Social and Cultural History of the United States I, II, III. (3 + 3 + 3 q.h.)
723, 724. The History of Ideas in America I, II. (3 + 3 q.h.)
730, 731. The Negro in American History. (3 + 3 q.h.)
732, 733. The West in American History I, II. (3 + 3 q.h.)
735. Urban History. (3 q.h.)
736. Urban History of the United States. (3 q.h.)
738, 739. The South in American History I, II. (3 + 3 q.h.)
741, 742. Diplomatic History of the United States, I, II.
(3 + 3 q.h.)
744. The History of American Business. (3 q.h.)
745. Readings in American History to 1865. (3 q.h.)
746. Readings in American History from 1865 to the Present.
(3 q.h.)
747. History of the United States and Pennsylvania. (3 q.h.)
751. Byzantine History. (3 q.h.)
752. History of Ancient Greece. (3 q.h.)
753. History of Rome. (3 q.h.)
754. Early Middle Ages. (3 q.h.)
755. Late Middle Ages. (3 q.h.)
758. Renaissance Europe. (3 q.h.)
759. The Reformation Era. (3 q.h.)
760. From Westphalia (1648) to the French Revolution (1789).
(3 q.h.)
761. French Revolution and Napoleon. (3 q.h.)
765. Europe from the Congress of Vienna to the Franco-Prussian War. (3 q.h.)
766. Europe from the Franco-Prussian War to World War I.
(3 q.h.)
767. Europe from World War I to the Present. (3 q.h.)
771. History of China to 1912. (3 q.h.)
773. History of Japan & Korea to 1895. (3 q.h.)
774. History of the Far East in Modern Times. (3 q.h.)
775. History of the South and Southeast Asia in the 19th & 20th Century. (3 q.h.)
777, 778. History of Russia I, II. (3 + 3 q.h.)
779. History of the Soviet Union. (3 q.h.)
780, 781. History of Eastern Europe I, II. (3 + 3 q.h.)

782.   History of the Balkans.   (3 q.h.)
783, 784, 785.   Economic History of Europe I, II, III.
(3 + 3 + 3 q.h.)
786.   Expansion of Europe to 1815.   (3 q.h.)
787, 788.   History of Population Movements I, II.   (3 + 3 q.h.)
789, 790, 791.   English History I, II, III.   (3 + 3 + 3 q.h.)
792, 793.   British Empire and Commonwealth I, II.
(3 + 3 q.h.)
795.   Historical Origins of Spanish Culture.   (3 q.h.)
900.   *Historiography: Techniques of Historical Research and Writing.*   An introduction to the professional study of history, including an examination of the sources and nature of historical knowledge, historical criticism and synthesis. Required of all candidates for advanced degrees in history.   3 q.h.
901.   *Historical Literature: American.*   Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in specific areas of American history.   3 q.h.
902.   *Seminar in American Colonial History.*   Selected problems of early American history.   3 q.h.
903.   *Seminar in 19th-Century America.*   Selected problems of American history, 1800–1865.   3 q.h.
904.   *Seminar in 19th-Century America.*   Selected problems of American history, 1865–1900.   3 q.h.
905.   *Seminar in 20th-Century America.*   Selected problems of American history in the 20th Century.   3 q.h.
906.   *Historical Literature: European.*   Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in European history.
3 q.h.
912.   *Seminar in Greek and Roman History.*   The sources and problems of Greek and Roman history.   3 q.h.
913.   *Seminar in Medieval Culture and Society.*   The main intellectual and social currents of the Middle Ages.   3 q.h.
914.   *Seminar in Renaissance and Reformation.*   Trends and aspects of the Renaissance and Reformation.   3 q.h.
915.   *Seminar in 17th-Century Europe.*   The rise of France and England to dominant force in world politics.   3 q.h.
916.   *Seminar in 18th-Century Europe.*   Selected areas of the Enlightenment, Old Regime, and the French Revolution.   3 q.h.
917.   *Seminar in 19th-Century Europe.*   The Napoleonic and post-Napoleonic era and the rise of nationalism in Europe.   3 q.h.
918.   *Seminar in 20th-Century Europe.*   Investigation of the causes of the great world wars, the rise of totalitarianism and the cold war.
3 q.h.

919. *Seminar in Russian History.* Selected problems of Russian history. 3 q.h.
920. *Historical Literature: Asian.* Readings in the standard works and monographic studies to meet the requirements of qualified graduate students who wish intensive concentration in Asian history. 3 q.h.
930. *The Teaching of History in Institutions of Higher Learning.* Investigation and discussion of professional teaching of history at the college level; course construction, presentation of subject matter, testing, instructional aids, evaluation of instruction. Required of all graduate assistants. 1 q.h.
931. *Research* 1–9 q.h.

INDUSTRIAL ENGINEERING

Robert Sorokach, *Chairman of the Department*
238 Engineering Science Building

901. *Optimization Techniques.* A study of the analytical techniques used in operations research and industrial engineering with special emphasis on their application to problems in all engineering disciplines. Background in areas such as probability and statistical techniques, least square methods, correlation and regression analysis, interpolation, and iterative methods will be presented. Algorithms for linear programming, integer programming, parametric programming and dynamic programming models will be developed. 4 q.h.
902. *Digital Simulation.* An introduction to methods of simulation using the digital computer. The generation of random numbers, Monte Carlo techniques, queueing models, and error analysis will be presented. The student will be provided the opportunity to simulate moderately complex physical systems on the digital computer. Primary emphasis will be on models of industrial operations. Prereq.: I. E. 901 and digital programming experience. 4 q.h.

MATHEMATICS

Bernard J. Yozwiak, *Chairman of the Department*
234 Engineering Science Building

701. Introduction to Set Theory. (4 q.h.)
709. Ordinary Differential Equations. (3 q.h.)
710, 711. Higher Mathematics for Engineers and Physicists I, II. (3, 3 q.h.)

725. Matrix Theory and Linear Algebra. (4 q.h.)
726. Theory of Equations. (4 q.h.)
727, 728. Abstract Algebra I, II. (4, 5 q.h.)
730. Foundations of Geometry. (4 q.h.)
732. Projective Geometry. (4 q.h.)
740, 741, 742. Mathematical Statistics I, II, III. (3, 3, 3 q.h.)
750. History of Mathematics. (4 q.h.)
760. Numerical Analysis. (4 q.h.)
842. Statistical Inference. (4 q.h.)
845. Operations Research. (4 q.h.)
846, 847, 848. Theory of Probability I, II, III. (3, 3, 3 q.h.)
860. Mathematical Logic. (4 q.h.)
871, 872. Advanced Calculus I, II. (5 + 5 q.h.)
875. Introduction to Complex Variables. (4 q.h.)
880. Introduction to Topology. (4 q.h.)
890. Mathematics Seminar. (2 q.h.)

901. *Topics in Analysis.* A course in analysis aimed at providing secondary school teachers with a broad understanding of the subject. Prereq.: Departmental permission. 5 q.h.

902. *Topics in Modern Alegbra.* A course in modern algebra aimed at providing secondary school teachers with a broad understanding of the subject. Prereq.: Departmental permission. 5 q.h.

910, 911. *Advanced Engineering Mathematics I, II.* A presentation of current methods in applied mathematics. Linear spaces and operators, matrices and determinants, multivariable calculus, functions of a complex variable, special functions of mathematical physics, operational calculus, partial differential equations. Prereq.: Math. 710 or consent of instructor. 5, 4 q.h.

920, 921. *Modern Algebra I, II.* A study of algebraic theories. Finite groups, field extensions and Galois theory, rings, modules and multilinear algebra. Prereq.: Math. 728. 5, 5 q.h.

930. *Differential Geometry.* The classical differential geometry of curves and surfaces, with tensors. Prereq.: Math. 709, 872. 4 q.h.

946, 947. *Stochastic Processes I, II.* A study of Markov chains, Poisson processes, Wiener processes, and renewal processes with applications to queuing and traffic, system reliability, epidemics, and inventory. Prereq.: Mathematics 848 and 875. 5 + 5 q.h.

948. *Analysis of Variance.* A study of linear statistical models of the relationship between analysis of variance and regression and of the assumptions underlying the analysis of variance. Prereq.: Mathematics 725 and 742. 5 q.h.

950. *Infinite Series.* An extensive treatment of convergent and divergent series including a strong emphasis on summability methods of divergent series. Prereq.: Mathematics 871. 5 q.h.

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960.   *Advanced Mathematical Logic.*   A study of the elements of recursive function theory and topics such as Godel's incompleteness theorem and decision problems for theories. Prereq.: Math. 860 or consent of instructor.   5 q.h.

970.   *Lebesgue Measure and Integration.*   Lebesgue measure and the Lebesgue integral on the real line. Construction of Lebesgue measure, definition and properties of the Lebesgue integral, differentiation of monotone functions, functions of bounded variation, absolute continuity, L^p-spaces on [O, 1]. Prereq.: Math. 872, 880.   5 q.h.

971, 972.   *Real Analysis I, II.*   Introduction to general measure theory and functional analysis. The radon-Nikodym theorem, the Fubini theorem, the Hahn-Banach theorem, the closed graph and open mapping theorems, weak topology. Prereq.: Math. 970.   5, 5 q.h.

975, 976.   *Complex Analysis I, II.*   A course in classical complex analysis. The Cauchy theorem, the Weierstrass, Mittag-Leffler, Picard, and Riemann theorems, Riemann surfaces, harmonic functions. Prereq.: Math. 872, 875, 880.   5, 5 q.h.

980, 981.   *Topology I, II.*   A further study of topological spaces. Separation, metrization, compactification. Additional topics will be selected from the following: point-set topology, algebraic topology, combinatorial topology, topological algebra. Prereq.: Math. 880.

5, 5 q.h.

990.   *Independent Study.*   Study under the supervision of a staff member. May be repeated. Prereq.: Permission of the department chairman.   1–5 q.h.

999.   *Research and Thesis.*   3–9 q.h.

MECHANICAL ENGINEERING

Frank A. D'Isa, *Chairman of the Department*
201 Engineering Science Building

821.   Heat Transfer II.   (4 q.h.)
830.   Fluid Mechanics II.   (4 q.h.)
851.   Strength of Materials IV.   (4 q.h.)
870.   Mechanical Vibrations I.   (4 q.h.)
892.   Control Theory.   (Not for Electrical Engineering majors.)
(4 q.h.)

904.   *Advanced Thermodynamics.*   Laws of equilibrium thermodynamics; relations between properties and aspects of the Second-Law. Macroscopic and microscopic considerations for the prediction of properties. Microscopic description based on classical and quantum statistics.

General stability criteria, statistical equilibrium and trend toward equilibrium fluctuations. 4 q.h.

922. *Advanced Heat Transfer.* Selected topics in steady-state and transient conduction heat transfer emphasizing techniques used in the solution of practical engineering problems. The solutions of Bessel and Legendre equations. Convection and evaluation of boundary conditions. Prereq.: M.E. 982. 4 q.h.

931. *Gasdynamics.* The application of fluid mechanic and thermodynamic principles to compressible flows: wave motion, the hodograph method, the method of characteristics, the shock tube, and airfoil theory. High velocity flow in ducts and impellers. Laboratory experiments.
4 q.h.

932. *Heat and Momentum Transport.* The flow of viscous fluids with and without heat transfer. Navier-Stokes equations, hydrodynamics and thermal boundary layers in laminar and turbulent flow, free convection, and Reynold's analogy. 4 q.h.

943. *Advanced Dynamics I.* Three-dimensional vector statics; kinematics and kinetics of particles and rigid bodies; energy, momentum, stability; application of LaGrange's equations to machinery, vehicles, ballistics; gyroscope. 4 q.h.

944. *Advanced Dynamics II.* LaGrange's equations of motion for particles and rigid bodies; impulse; small oscillations; non-holomic and dissipative systems. Hamiltonian systems; applications to intricate engineering problems. Prereq.: M.E. 943; M.E. 982. 4 q.h.

952. *Applied Elasticity.* Equations of equilibrium, compatibility and boundary conditions; their applications to plane stress and plane strain problems. Stress functions, strain energy methods, stress distribution in axially symmetrical bodies; special problems in structures involving torsion and bending of prismatical bars. 4 q.h.

962. *Mechanical Design Analysis.* The study of analytical aspects and the application of engineering science topics to machine elements and machinery. Some case studies in mechanical design. 4 q.h.

963. *Experimental Stress Analysis.* Theory and engineering applications of the most recent techniques of experimental stress analysis; brittle coatings, photoelasticity, strain gages, photostress. 4 q.h.

982. *Engineering Analysis I.* An integration of the fundamental laws and principles of basic science to obtain practical solutions of engineering problems. Formulation of mathematical models for complex physical situations and the organization of computational programs for their solutions. Examples chosen from mechanics, thermodynamics, heat transfer, and electrical circuit theory. 4 q.h.

983. *Engineering Analysis II.* Extension of M. E. 982 to engineering problems involving distributed systems, especially in the fields of thermal conduction and mechanical vibrations. Application to Sturm-Liouville problems. The formulation and solution of engineering prob-

lems using partial differential equations and numerical techniques.
Prereq.: Mathematics 910, M. E. 982.   4 q.h.
    990, 991.   *Thesis.*   4 + 4 q.h.

METALLURGICAL ENGINEERING

Shaffiq Ahmed, *Chairman of the Department*
231 Engineering Science Building

    815, 816.   Particle Interaction I, II.   (3 + 3 q.h.)
    817.   Management of Nuclear By-Products.   (1 q.h.)
    830, 831, 835.   Introduction to Nuclear Materials I, II, III.
                                       (3 + 3 + 3 q.h.)
    840.   Modern Research Techniques.   (3 q.h.)
    851.   Introduction to Polymer Science.   (3 q.h.)
    852, 853, 854.   Advanced Engineering Materials (Non-metallic)
                      I, II, III.   (3 + 3 + 3 q.h.)
    860.   Mechanical Behavior of Materials.   (3 q.h.)
    861, 862.   Applied X-Rays I, II.   (3 + 3 q.h.)
    863, 864.   Thermodynamics of Materials I, II.   (3 + 3 q.h.)
    865.   Advanced Science of Materials.   (3 q.h.)
    866.   Special Topics.   (3 q.h.)
    871.   Physical Metallurgy IV.   (3 q.h.)
    872.   Refractory Metals and Alloys.   (3 q.h.)
    890.   Metallurgy and Materials Colloquium.   (1 q.h.)

    901, 902.   *Fundamentals of Material Science I, II.*   (Designed for
students who are entering the graduate school without a degree in
Metallurgical Engineering.) Discussion of physics of solids, mechanical
properties, phase diagrams, phase transformations and alloys. (Generally, in addition, to the general requirements of the program.)
Prereq.: Consent of Advisor.   4 + 4 q.h.

    910.   *Extractive and Process Metallurgy.*   An advanced treatment
of the physicochemical principles of extractive and process metallurgy.
Prereq.: Met. Engr. 793 and 863 or consent of instructor.   4 q.h.

    920, 921.   *Advanced Physical Metallurgy I and II.*   Theoretical
treatment of various aspects of physical metallurgy. Prereq.: Met. Engr.
793 and Met. Engr. 863 or consent of instructor.   4 + 4 q.h.

    922, 923.   *Advanced Mechanical Properties of Materials I and II.*
Discussion of the mechanical properties from theoretical viewpoints;
theory of elasticity, theory of plasticity and other theories. Applications
of theories to practical problems. Prereq.: Met. Engr. 860 or consent
of instructor.   4 q.h.

931. *Engineering Alloys.* Alloy steels, refractory alloys, special nonferrous alloys; their properties, heat treatment, and behavior under special conditions. Prereq.: Met. Engr. 732 and 793 or consent of instructor. 4 q.h.

932. *Industrial Metallurgy.* The application of physical metallurgy principles to the solution of problems concerning the causes of failure. Prereq.: Met. Engr. 793 or consent of advisor. 2 q.h.

933. *Chemical Metallurgy.* An advanced course on the application of electrochemical principles to metallurgical problems. Prereq.: Met. Engr. 793 and 863 or consent of advisor. 2 q.h.

951. *Introduction to Electron Microscopy and Field Ion Microscopy.* This course is designed to teach students how to use the microscopes to prepare specimens, to take photographs, and to analyze data. Laboratory work of about six hours a week. Prereq.: Met. Engr. 861. 2 q.h.

952. *Dislocations and Plastic Flow.* Properties of dislocations and their role in plastic flow of metals and alloys. Prereq.: Met. Engr. 860 or consent of instructor. 4 q.h.

953. *Thermodynamics of Solids.* Solutions and applications of statistical thermodynamics to the study of alloys. Prereq.: Met. Engr. 863 and 865 or consent of instructor. 4 q.h.

954. *Advanced Polymer Science.* Advanced discussion of the Polymer Science with particular emphasis on the engineering and fundamental aspects. Prereq.: Met. Engr. 851 or consent of instructor. 4 q.h.

955. *Advanced Refractory Material.* Discussion of refractory materials. Prereq.: Met. Engr. 852 or consent of instructor. 4 q.h.

956. *Advanced Nuclear Materials.* Advanced discussion of the nuclear material with particular emphasis on reaction kinetics and reaction technology. Prereq.: Met. Engr. 830 or consent of instructor. 4 q.h.

960. *Research Seminar.* Prereq.: Consent of instructor. 1 q.h.

990. *Thesis I and II.* 3 + 3 q.h.

MUSIC

Donald W. Byo, *Acting Dean*
103 Dana School of Music

719. Advanced Choral Conducting. (3 q.h.)
720. Advanced Instrumental Conducting. (3 q.h.)
740. Piano Literature. (3 q.h.)
753. Counterpoint I. (3 q.h.)
754. Counterpoint II. (2 q.h.)
761. Hymnology. (3 q.h.)

762. Gregorian Chant. (3 q.h.)
763. Junior and Senior Choir Methods. (3 q.h.)
807. Orchestration. (3 q.h.)
808. Band Arranging. (3 q.h.)
827-828. Symphonic Literature. (3 + 3 q.h.)
861. History of Sacred Music. (3 q.h.)
863. Choral Literature. (3 q.h.)
869. Organ Literature and Service Playing. (3 q.h.)
871. Baroque Music. (3 q.h.)
872. 18th Century and the Viennese Classical School. (3 q.h.)
873. Beethoven and His Influence in the Musical World. (3 q.h.)
874. 19th Century Romantic Period. (3 q.h.)
875. Contemporary Music. (3 q.h.)
879. Vocal Literature. (3 q.h.)

Applied Music

Baritone Horn

Major Course

A907-A908-A909. Studies by Kahila, Lafosse, Schlossberg, and Blazevich. Solos by Fosch, Giffels, Beasley, Bach, and Bozza

3 + 3 + 3 q.h.

Major Course for Music Education

A904-A905-A906. See Baritone Horn A907-A908-A909.

2 + 2 + 2 q.h.

Minor Course

A901-A902-A903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Harpsichord

G901-G902-G903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Piano

Major Course

K907-K908-K909. Bach, *Chromatic Fantasy and Fugue;* Beethoven, late works; Schumann and Brahms, larger works; Prokofiev, *Sonatas;* advanced technical studies and etudes. Preparation of recital.

(3 + 3 + 3 q h.)

Major Course for Music Education

K904–K905–K906. *See*, Piano K907–K908–K909.

<div align="right">2 + 2 + 2 q.h.</div>

Minor Course

K901–K902–K903. Materials adapted to pupil's needs.

<div align="right">1 + 1 + 1 q.h.</div>

Organ

Major Courses

I907–I908–I909. Bach, *Trio Sonata No. 5, Toccata and Fugue in F*; Mozart, *Fantasies;* Reubke, *Sonata on the 94th Psalm*; Dupre, *Variations on a Noel*; Hindemith, *Sonatas*. Preparation of recital.

<div align="right">(3 + 3 + 3 q.h.)</div>

Major Course for Music Education

I904–I905–I906. *See*, Organ I907–I908–I909.

<div align="right">2 + 2 + 2 q.h.</div>

Minor Course

I901–I902–I903. Materials adapted to pupil's needs.

<div align="right">1 + 1 + 1 q.h.</div>

Voice

Major Course

R907–R908–R909. Advanced vocal technique and literature; development of interpretation and characterization. Repertoire for each quarter centered around the ability to sing nine new songs accurately, two chosen from the modern French repertoire and two from British and American art songs, with six of these memorized. The graduate voice major should have extensive experience in songs in Italian, German, French and English; oratorio and opera arias, solo cantatas and contemporary solos. Preparation of recital.   3 + 3 + 3 q.h.

Major Course for Music Education

R904–R905–R906. *See*, Voice R907–R908–R909.

<div align="right">2 + 2 + 2 q.h.</div>

Minor Course

R901–R902–R903. Materials adapted to pupil's needs.

<div align="right">1 + 1 + 1 q.h.</div>

Violin

Major Course

Q907-Q908-Q909. Advanced concert etudes by Paganini, Bach, *Partitas* and *Sonatas*. Modern repertoire from Bartok, Hindemith, and Prokofiev. Concertos by Brahms and Tchaikovsky. Preparation of recital.

3 + 3 + 3 q.h.

Major Course for Music Education

Q904-Q905-Q906. *See*, Violin Q907-Q908-Q909.

2 + 2 + 2 q.h.

Minor Course

Q901-Q902-Q903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Viola

Major Course

P907-P908-P909. Studies by Garnies and Dolesje; sonatas by Hindemith, Bach, and Beethoven; concerto by Haydn; solos such as Bloch, *Rapsodie*; scales, arpeggios, and double-stops for the complete range of the instrument based on Flesch and Sevcik. Preparation of recital.

3 + 3 + 3 q.h.

Major Course for Music Education

P904-P905-P906. *See*, Viola P907-P908-P909.

2 + 2 + 2 q.h.

Minor Course

P901-P902-P903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Cello

Major Course

C907-C908-C909. Scales and arpeggios in four octaves with varied bowings, and in thirds and sixths; Popper, *Etudes*, Op. 73; Duport, *21 Etudes*; Schubert, *Arpeggione Sonata*; Debussy, *Sonata*; Prokofiev, *Sonata*, Op. 119; concertos by Schumann or Shostakovich. Preparation of recital.

3 + 3 + 3 q.h.

Major Course for Music Education

C904-C905-C906. *See*, Violoncello C907-C908-C909.

2 + 2 + 2 q.h.

Major Course

C901–C902–C903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

String Bass

Major Course

L907–L908–L909.   Simandl, *30 Etudes;* Hrabe, *Studies;* Zimmerman, *Orchestral Studies;* sonatas by Marcello, Eccles, or Vivaldi; concertos by Dittersdorf or Bottesini. Preparation of recital.

$$(3 + 3 + 3 \text{ q.h.})$$

Major Course for Music Education

L904–L905–L906.   *See,* String Bass L907–L908–L909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

L901–L902–L903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Flute

Major Course

E907–E908–E909.   Studies such as Andersen, Op. 60; Bitsch, *12 Etudes;* Bozza, *14 Etudes arabesques;* sonatas by Duquis, Felt, Casterede, Houdy, Prokofiev; solos such as Jolivet, *Chant de Linos* and Messiaen, *Le Merle nuir.* Preparation of recital. $3 + 3 + 3$ q.h.

Major Course for Music Education

E904–E905–E906.   *See,* Flute E907–E908–E909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

E901–E902–E903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Oboe

Major Course

H907–H908–H909.   Studies such as Ferling, *48 Studies;* Andraud, *Vade-Mecum;* sonatas by Dutilleux and Schuller; concerti by Mozart, Vaughan Williams, and Milhaud. Preparation of recital. $3 + 3 + 3$ q.h.

Major Course for Music Education

H904–H905–H906.   *See,* Oboe H907–H908–H909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

H901–H902–H903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Clarinet

Major Course

D907–D908–D909.   Studies such as Bozza, 15 *Difficult Etudes;* Polatschek, 28 *Advanced Studies;* Paganini, 15 *Etudes;* concerti by Bozza, Nielsen, Poulenc, and Copland; Berg, *Four Pieces for Clarinet;* orchestral studies and Paris Conservatory solos. Preparation of recital.

$$3 + 3 + 3 \text{ q.h.}$$

Major Course for Music Education

D904–D905–D906.   *See,* Clarinet D907–D908–D909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

D901–D902–D903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Bassoon

Major Course

B907–B908–B909.   Studies such as Milde, Op. 26, Vol. 2; Gambaro, 18 *Studies;* Bozza, *Concertino,* Op. 46; concerti by Jacob, Weber, and Bruns; Pierne, *Theme and Variations.* Preparation of recital.

$$3 + 3 + 3 \text{ q.h.}$$

Major Course for Music Education

B904–B905–B906.   *See,* Bassoon B907–B908–B909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

B901–B902–B903.   Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Trumpet

Major Course

N907–N908–N909.   Orchestral studies. Extensive development in the study of transposition; advanced studies by Charlier, Bozza, Brandt, Bodet, Broiles, Perrin, and Tomasi; solos by Bozza, Bitsch, Giannini, Beversdorf, Hummel, and Purcell. Preparation of rectial. $3 + 3 + 3$ q.h.

Major Course for Music Education

N904–N905–N906. *See,* Trumpet N907–N908–N909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

N901–N902–N903. Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

French Horn

Major Course

F907–F908–F909. Advanced studies by Bitsch, Chaynes, Ceccarossi, Reynolds, Alphonse, and Schuller; demanding orchestral and ensemble passages; classical, romantic, and contemporary sonatas and concerti. Preparation of recital. $3 + 3 + 3$ q.h.

Major Course for Music Education

F904–F905–F906. *See,* French horn F907–F908–F909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

F901–F902–F903. Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Trombone

Major Course

M907–M908–M909. Studies by Lafosse, Kahila, Ostrander, and Delguidice; solos by Creston, Bloch; transcriptions of Bach *Cello Suites* and C.P.E. Bach; orchsetral excerpts by Stoneberg and Brown. Preparation of recital. $3 + 3 + 3$ q.h.

Major Course for Music Education

M904–M905–M906. *See,* Trombone M907–M908–M909.

$$2 + 2 + 2 \text{ q.h.}$$

Minor Course

M901–M902–M903. Materials adapted to pupil's needs.

$$1 + 1 + 1 \text{ q.h.}$$

Tuba

Major Course

O907–O908–O909. Studies by Sear, Bernard, Vasilieu and others; solos by Beversdorf, Vaughan Williams, Hindemith, and Persichetti; *Horn Concerti* of Strauss and Mozart; orchestral studies by Sear. Preparation of recital. $3 + 3 + 3$ q.h.

Major Course for Music Education

O904–O905–O906. *See,* Tuba O907–O908–O909.

2 + 2 + 2 q.h.

Minor Course

O901–O902–O903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Percussion

Major Course

J907–J908–J909. Snare drum: studies such as Albright, *Contemporary Studies for Snare Drum;* Delecluse, *Douze Etudes pour Gaisse Claire;* Wisler, *Polyrhythmic Independence for Hands and Feet;* excerpts from contemporary symphonic literature. Mallet and keyboard percussion: Land, Bach *Inventions;* Voxman, *Selected Studies.* Tympani: Remsen, *Contemporary Tympani Studies;* First, *Solo Tympanist;* solos for percussion instruments by Desportes, Petit, Baudo, Bigot, and others. Preparation of recital.

3 + 3 + 3 q.h.

Major Course for Music Education

J904–J905–J906. *See,* Percussion J907–J908–J909.

2 + 2 + 2 q.h.

Minor Course

J901–J902–J903. Materials adapted to pupil's needs.

1 + 1 + 1 q.h.

Theory and Composition

910, 911, 912. *Music Styles.* The study and application of 18th, 19th, and 20th century compositional techniques.   3 + 3 + 3 q.h.

913. *Pedagogy of Theory.* The study and critical analysis of methods for teaching harmony, sightsinging, and ear-training.   3 q.h.

916. *Fugue.* Analysis of the fugal style used in 17th century trio sonatas, and in both volumes of *The Well-Tempered Clavier* by J. S. Bach. Writing 3–4 voice fugues employing imitative and invertible counterpoint. Prereq.: Music 753 (Counterpoint I) or 754 (Counterpoint II).

3 q.h.

920, 921, 922. *Seminar in Materials of Music.* The study of techniques used in musical composition with emphasis on analyzing and writing. Course requirements will be determined by student's field of interest. Can be repeated for credit. Admission to course by permission of instructor.

3 + 3 + 3 q.h.

923, 924, 925. *Advanced Composition.* By permission of instructor only. Working in the larger forms, for chorus, orchestra, or chamber ensembles. 3 + 3 + 3 q.h.

Music History and Literature

940. *Music in the Middle Ages.* The development of polyphonic music from early organum to about 1450, with emphasis on techniques, styles, and forms. Seminar, with readings, reports, and musical illustrations. Prereq.: Music 782. 3 q.h.

941. *Music in the Renaissance.* Musical developments from about 1450–1600 dealing with the vocal music of this period, both sacred and secular, and the formulation of independent instrumental styles. Seminar, with readings, reports, and musical illustrations. 3 q.h.

942. *Introduction to Musicology.* Fundamental concepts and problems of musicology; sources, reference materials, methodology.
3 q.h.

944, 945. *Direction of Master's Thesis.* Open to candidates for the Master of Music degree upon petition to the Dana School of Music. Approval given after student's thesis topic has been approved and his advisor assigned. 3 + 3 q.h.

Sacred Music

960, 961, 962. *Seminar in Sacred Music.* An examination of corporate worship practices and music in area churches. 1 + 1 + 1 q.h.

963. *Church Music Administration.* Problems in personnel, scheduling, budget, and equipment as encountered in the local church. 3 q.h.

Music Education

970. *Foundations of Music Education.* An examination of basic principles and techniques of music instruction; contemporary trends viewed from historical perspective. 3 q.h.

971. *Administration and Supervision in Music Educaton.* The functions and techniques of music supervision and administration; improvement of instruction; problems of music consultants; organization of in-service programs; public and staff relations. 3 q.h.

972. *Seminar in Music Education.* Individual projects and discussion of fundamental issues in music education. 3 q.h.

973. *Research Methods and Materials in Music Education.* A study of research tools and techniques and their application to problems in music education; critique of research studies; research report required in non-thesis Music Education program. 3 q.h.

974. *Psychology of Music.* Factors in the development of musical skills; a survey of the experimental literature in the field. 3 q.h.

975. *Music and the Humanities.* Designed to aid in the development of interdisciplinary courses involving music and the humanities in the secondary school. 3 q.h.

976. *Directed Study in Conducting.* Study of significant works, vocal or instrumental; special problems in conducting. May be repeated for credit. 3 q.h.

977. *Comparative Music Education.* The study of music education practices in world cultures, including the contributions of Orff, Kodaly, and Suzuki. 3 q.h.

980. *Independent Projects in Music.* Independent projects in music of a library, laboratory or field work nature designed to meet the needs of the student. Approval by major advisor with concurrence of the dean. 1-9 q.h.

PHILOSOPHY

Martin A. Greenman, *Chairman of the Department*
100 Arts and Sciences Office Building

800. Theories of Knowledge. (4 q.h.)
801. Metaphysics. (4 q.h.)
802. Theories of Value. (4 q.h.)
803. Symbolic Logic. (5 q.h.)
810. Philosophical Classics. (4 q.h.)
811. Philosophy in America. (4 q.h.)
812. Contemporary Philosophy. (4 q.h.)
814. Analytic Philosophy. (4 q.h.)
815. Existentialism and Phenomenology. (4 q.h.)
820. Seminar: Contemporary Philosophical Problems. (1-3 q.h.)
821. Seminar: Areas of Philosophy. (1-3 q.h.)

PHYSICS

Frank M. Ellis, *Chairman of the Department*
101B Ward Beecher Science Hall

901, 902. *Classical Mechanics.* Variational principles and Lagrangian equations. The two-body central force problem. Kinematics and dynamics of rigid bodies. Hamiltonian equation of motion; Hamilton-Jacobi theory. Prereq.: Physics 702 and Mathematics 710. 3 + 3 q.h.

910, 911. *Introduction to Quantum Mechanics.* Quantum phenomena in relation to classical physics. Schrodinger and Heisenberg picture; angular momentum and scattering theory. Hamiltonian theory of a

particle in an electromagnetic field. Pauli principle; identical particles. Prereq.: Physics 702, 822, 705, and Mathematics 711.   3 + 3 q.h.

915, 916. *Space Science.* Geophysics; physics of the Earth's atmosphere and other planets. Physics of the sun and the solar system. Advances in the International Geophysical year, 1957–58; problems of man in space. Prereq.: Physics 510, 601, and Mathematics 710, 711.
                                    3 + 3 q.h.

920, 921. *Electromagnetic Theory.* Electromagnetic fields in a vacuum; microscopic and macroscopic fields. Methods for calculation of potential problems. Maxwell's equations in the presence of metallic boundaries. Radiation from an accelerated charge. Lienard-Wiechert potentials. Prereq.: Physics 822 and Mathematics 711.   3 +3 q.h.

930, 931. *Solid State Physics.* The physics of solid state phenomena including crystal structure, diffraction, crystal binding, lattace vibrations and thermal properties of solids, theory of metals and semiconductors, superconductivity, dielectric properties of solids, magnetism and imperfections in solids. Prereq.: Physics 810 or equivalent background. Physics 930 is prereq. to 931.

POLITICAL SCIENCE

Ivis Boyer, *Chairman of the Department*
109 Arts and Sciences Office Building

800. Select Problems, American Government. (3 q.h.)
801. Select Problems, Public Administration. (3 q.h.)
840. Select Problems, Comparative Government. (3 q.h.)
860. Select Problems, International Relations. (3 q.h.)
880. Select Problems, Political Theory. (3 q.h.)

PSYCHOLOGY

Sanford Hotchkiss, *Chairman of the Department*
23A Ford Hall

903. *The Psychology of Learning.* Examination of experimentally-determined facts concerning the learning process and their implication for use in school.   3 q.h.

906. *Human Growth and Development.* Expanded aspects of child and adolescent psychology.   3 q.h.

907. *Psychology of Adjustment.* Basic problems dealing with mental health, individual differences, motivation and minor deviant behavior.   3 q.h.

980. *Psychological Aspects of Mentally Retarded Children.* An intensive study of psychology and educational psychology in mental retardation; exploration and discussion of paradigm in child psychology, developmental psychology and personality. 3 q.h.

981. *Advanced Seminar in Mental Retardation.* (Sp. Ed. 981) Exploration of general research and other theoretical studies concerning the mentally retarded, with particular emphasis on psychological variables in learning. 3 q.h.

SECONDARY EDUCATION

William A. Shipman, *Chairman of the Department*
206 School of Education

850. Reading Problems in the Secondary School. (3 q.h.)

910. *Supervision of Practice Teachers—Secondary.* Basic counseling and supervisory techniques associated with the acceptance of responsibility for inducting the teaching neophyte into his first truly professional experiences. Actual work with student teachers. 3 q.h.

931. *The Secondary School Curriculum.* Historical development of the American secondary school curriculum, present nature, and recent developments. Study of reports, experiments, and typical programs. The roles of supervisors, administrators, teachers, pupils, and public in the development of curriculums. 3 q.h.

946. *The Supervision of Instruction.* (El. Ed. 946) A course dealing with the supervision of instruction and organization of a school designed for those aspiring to be principals or supervisors. Decision making, supervision, observation of supervisory experiences, direction in educational technology, the various subjects, staff relationships, school organization, pupil personnel, and extra-curricular activities are among the areas considered with emphasis upon elementary or secondary situations as appropriate. 3 q.h.

948. *Basic Principles of Secondary School Administration.* The role of the secondary school principal in general administrative techniques. 3 q.h.

949. *School Law.* Principles of constitutional, statutory, case, and common law affecting Ohio schools as they apply to the political subdivision of the school district and the administrative, line, and staff personnel; legal provisions and principles relating to education at all levels. 3 q.h.

950. *School Business Management.* The principal's responsibility for management problems such as purchasing, budgeting, building maintenance, insurance, food services, pupil transportation, etc. 3 q.h.

951. *The School Principal's Communication Relationships.* (El. Ed. 951) Techniques of public relations; needs and methods for effective internal communication; administration of staff and pupil personnel.
3 q.h.
953. *Practicum in Administration for School Principals.* 3 q.h.

SOCIOLOGY

James W. Kiriazis, *Acting Chairman of the Department*
328 Arts and Sciences Office Building

859, 860. History of Social Philosophy and Social Theory
(4 + 4 q.h.)
810, 814. Advanced General Anthropology: Cultural and Physical.
(4 + 4 q.h.)
851. Research Methods: Sociological and Anthropological. (5 q.h.)
807. Urban Society. (4 q.h.)
900. *Special Sociological Problems.* Advanced seminars focusing on independent study at the graduate level: Social Organization in a Changing World; Social Disorganization (or Deviance) and Social Controls; Social and Cultural Factors in Personality Development; Minority Relationships; Sociology of Law; Social Change; Comparative Institutions. each 4 q.h.
910. *Special Anthropological Problems.* Advanced seminars focusing on independent study at the graduate level: Archaeology, Its Methods and Functions; Human Origins and Differentiation; Anthropology of Religion; Cultural Change and Its Impact. each 4 q.h.

SPECIAL EDUCATION

Ruth B. Clayton, *Chairman of the Department*
206 School of Education

851. Principles and Practices in Curriculum Planning and Development for Slow Learners: Social Studies. (3 q.h.)
852. Principles and Practices in Curriculum Planning and Development for Slow Learners: Language Arts. (3 q.h.)
853. Principles and Practices in Curriculum Planning and Development for Slow Learners: Arithmetic. (3 q.h.)
854. Preparation, Selection and Adaptation of Instructional Materials for Slow Learners. (3 q.h.)
855. Occupational Orientation and Job Training. (3 q.h.)

856. Diagnosis of Reading Difficulties. (3 q.h.)

857. Development of Remedial Reading Techniques. (3 q.h.)

976. *Problems and Issues in Mental Retardation.* A forum for presenting positions relative to the recurring philosophical, sociological and political issues in mental retardation. 3 q.h.

977. *Research and Problems in the Education of the Mentally Retarded.* Consideration of problems concerning practices in the education of the mentally retarded and the examination of pertinent psychological, educational, medical, and other relevant research in the determination of trends and practices regarding the mentally retarded. 3 q.h.

978. *Administration and Supervision of Special Education.* Consideration of the establishment and function of educational programs for the mentally retarded and the programs' relationship to the total educative process for teachers and supervisors in special education. 3 q.h.

979. *The Mentally Retarded in Society.* Especially organized to inform students of the services provided across the nation, within the states and locally. Guest speakers from agencies, private and public, serving the Retarded Act as informants and catalysts regarding unmet needs. Examination of federal, state, and community planning and research affecting the mentally retarded. 3 q.h.

981. *Advanced Seminar in Mental Retardation.* (Psych. 981) Exploration of general research and other theoretical studies concerning the mentally retarded, with particular emphasis on psychological variables in learning. 3 q.h.

SPEECH AND DRAMA

R. Donald Elser, *Chairman of the Department*
305 Arts and Sciences Office Building

811–812. Debate and Discussion. (3 + 3 q.h.)
813. Classical Rhetoric. (4 q.h.)
814. Medieval and Renaissance Rhetoric. (4 q.h.)
816. American Rhetoric. (4 q.h.)
817. British and American Oratory. (4 q.h.)
818. Contemporary Public Address. (4 q.h.)
821–822–823. Theatre Directing. (3 + 3 + 3 q.h.)

Graduate Faculty

Administrative Members

Albert L. Pugsley, Sc.D., LL.D. — President
William H. Coffield, Ph.D. — Vice President for Academic Affairs

Charles H. Aurand, Mus.M. — Dean of the Dana School of Music
M. Jean Charignon, Ph.D. — Dean of the William Rayen School of Engineering

Karl W. Dykema, A.M. — Dean of the College of Arts and Sciences
Earl E. Edgar, Ph.D. — Dean of the Graduate School
Robert L. Miller, M.B.A. — Dean of the School of Business Administration

Nicholas Paraska, Ph.D. — Dean of the Technical and Community College

Joseph F. Swartz, Ph.D. — Dean of the School of Education

Senior Members

Domenico B. Aliberti, Associate Professor of Foreign Languages: Maturita Classica (Bachelor), Liceo "L. Valli", Barcellone PG (Italy), 1950; D.Ltr., University of Messina, Italy, 1959.

J. Leonard Azneer, Associate Professor of Education; B.A., Yeshiva University, 1941; M.H.L., Jewish Theological Seminary, 1949; Ph.D., University of Pittsburgh, 1959.

Lorrayne Y. Baird, Assistant Professor of English: A.B., Catawba College, 1951; M.A., Appalachian State University, 1959; Ph.D., University of Kentucky, 1969.

Subramanian Balakrishnan, Assistant Professor of Mathematics: B.A., Annamalai University (India), 1947; B.Sc., Andhra University (India), 1950; M.Sc., Andhra University, 1951; Ph.D., Lehigh University, 1968.

Howard Banilower, Associate Professor of Mathematics: B.A., Brooklyn College, 1956; M.S., Purdue University, 1957; Ph.D., Purdue University, 1961.

David M. Behen, Professor of History: Ph.B., University of Chicago, 1932; Ph.D., University of Chicago, 1953.

Paul X. Bellini, Assistant Professor of Civil Engineering: B.S., University of Massachusetts, 1962; M.S., University of Massachusetts, 1964; Ph.D., University of Massachusetts, 1968.

Frederick J. Blue, Associate Professor of History: B.A., Yale University, 1958; M.S., University of Wisconsin, 1962; Ph.D., University of Wisconsin, 1966.

Irwin Cohen, Professor of Chemistry: A.B., Case Western Reserve University, 1944; M.S., Case Western Reserve University, 1948; Ph.D., Case Western Reserve University, 1950.

Patricia J. Connor, Associate Professor of Music: B.M., Oklahoma University, 1940; M.Mus., North Texas State University, 1941; D.M.A., Boston University, 1964.

Sister Mary James Conroy, Assistant Professor of English: B.S. in Ed., Youngstown State University, 1956; M.A., Marquette University, 1963; Ph.D., University of Notre Dame, 1968.

Theodosius L. Demen, Associate Professor of Mathematics: University of Innsbruck, Austria, 1948–51; M.S., Marquette University, 1954; Ph.D., St. Louis University, 1958.

Thaddeus M. Dillon, Professor of Mathematics: B.S., John Carroll University, 1950; M.S., John Carroll University, 1952; Ph.D., University of Pittsburgh, 1963.

Lawrence DiRusso, Associate Professor of Education: A.B., Youngstown State University, 1954; M.A., Kent State University, 1960; Ed.D., Case Western Reserve University, 1966.

Thomas N. Dobbelstein, Assistant Professor of Chemistry: B.S., Eastern Michigan University, 1964; M.S., Iowa State University, 1966; Ph.D., Iowa State University, 1967.

G. A. Dobbert, Associate Professor of Sociology: M.A., University of Chicago, 1957; Ph.D., University of Chicago, 1965.

Leslie S. Domonkos, Associate Professor of History: A.B., Youngstown State University, 1959; M.A., University of Notre Dame, 1960; M.S.M., University of Notre Dame, 1963; D.S.M., University of Notre Dame, 1966.

Dale W. Fishbeck, Assistant Professor of Biology: B.A., Yankton College, 1957; M.A., University of South Dakota, 1959; Ph.D., University of Minnesota, 1968.

Elmer Foldvary, Associate Professor of Chemistry: B.S., Youngstown State University, 1958; M.S., Texas A. and M. University, 1961; Ph.D., Texas A. and M. University, 1964.

Randolph N. Foster, Jr., Director of Institutional Research: B.M., University of Texas, 1942; M.M., University of Texas, 1947; Ed.D., George Peabody College for Teachers, 1959.

Henry N. Fukui, Assistant Professor of Chemistry: B.S., Bates College, 1949; M.S., Rutgers University, 1952; Ph.D., University of Missouri, 1954.

Charles G. Gebelein, Assistant Professor of Chemistry: B.A., Temple University, 1955; M.A., Temple University, 1959; Ph.D., Temple University, 1967.

Mehdi Ghaffarzadeh, Assistant Professor of Civil Engineering: B.S., Abadan Institute of Technology, 1962; M.S., University of Oklahoma, 1965; Ph.D., University of Oklahoma, 1968.

Martin A. Greenman, Professor of Philosophy: B.A., University of Chicago, 1942; Ph.D., University of Chicago, 1950.

Philip J. Hahn, Professor of Economics: B.S., Juniata College, 1938; M.B.A., Harvard Graduate School of Business Administration, 1940; Ph.D., Case Western Reserve University, 1965.

Clyde T. Hankey, Professor of English: B.A., University of Pittsburgh, 1949; M.A., University of Pittsburgh, 1950, University of Michigan, 1954; Ph.D., University of Michigan, 1960.

Mary V. Hare, Associate Professor of English: A.B., Mount Holyoke College, 1940; M.A., University of Virginia, 1951; Ph.D., University of Virginia, 1960.

Robert R. Hare, Associate Professor of English: B.A., Ohio State University, 1936; M.A., University of Delaware, 1957; Ph.D., University of Maryland, 1967.

Martin Helling, Assistant Professor of Mathematics: B.Sc., Ohio State University, 1956; M.Sc., University of Chicago, 1958; Ph.D., University of California at Berkeley, 1966.

Russell Charles Hibbeler, Assistant Professor of Civil Engineering: B.S., University of Illinois, 1965; M.S., University of Illinois, 1966; Ph.D., Northwestern University, 1968.

Robert E. Hopkins, Associate Professor of Music: B.Mus., Eastman School of Music of the University of Rochester, 1953; M.Mus., Eastman School of Music, 1954; D.M.A., Eastman School of Music, 1959.

Sanford N. Hotchkiss, Professor of Psychology: B.A., University of Minnesota, 1949; M.A., University of Minnesota, 1950; Ph.D., University of Minnesota, 1959.

Michael K. Householder, Assistant Professor of Civil Engineering: B.S., Valparaiso University, 1963; M.S., Purdue University, 1965; Ph.D., Purdue University, 1968.

David H. Hunt, Assistant Professor of Health and Physical Education: B.S., University of New Mexico, 1965; M.S., University of New Mexico, 1966; Ph.D., University of New Mexico, 1968.

Raymond W. Hurd, Associate Professor of Mathematics: B.S.Ed., Ohio University, 1951; M.Ed., Ohio University, 1957; Ph.D., Ohio State University, 1967.

Ronald W. Jonas, Associate Professor of Mathematics, Director of the Computer Center: B.A., The University of Texas, 1958; Ph.D., The University of Texas, 1968.

George H. G. Jones, Assistant Professor and Librarian: A.B., Oberlin College, 1931; M.L.S., Kent State University, 1957; Ph.D., Harvard University, 1966.

Richard W. Jones, Assistant Professor of Metallurgical Engineering: B.S., University of Missouri at Rolla, 1959; M.S., Rensselaer Polytechnic Institute, 1963; Ph.D., Northwestern University, 1968.

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Anthony L. Julius, Jr., Professor of Physics: A.B., Ohio Wesleyan, University, 1948; B.S., Massachusetts Institute of Technology, 1950; M.S., Ohio State University, 1952; Ph.D., St. Louis University, 1959.

George W. Kelley, Jr., Professor of Biology: B.S., University of Nebraska, 1947; M.S., University of Kentucky, 1950; Ph.D., University of Nebraska, 1953.

Taghi T. Kermani, Professor of Economics: LL.B., University of Tehran, 1949; M.A., University of Nebraska, 1953; Ph.D., University of Nebraska, 1959.

James W. Kiriazis, Assistant Professor of Sociology: A.B., Youngstown State University, 1951; M.S.W., Louisiana State University, 1953; Ph.D., University of Pittsburgh, 1967.

Charles M. Lovas, Assistant Professor of Mechanical Engineering: B.S.M.E., University of Akron, 1961; M.S.M.E., University of Notre Dame, 1963; Ph.D., University of Notre Dame, 1968.

Marvin Lukin, Assistant Professor of Chemistry: B.S., Ohio University, 1949; M.S., Case Western Reserve University, 1954; Ph.D., Case Western Reserve University, 1956.

David B. MacLean, Assistant Professor of Biology: B.S., Heidelberg College, 1963; M.S., Purdue University, 1965; Ph.D., Purdue University, 1968.

Inally Mahadeviah, Associate Professor of Chemistry: B.Sc. (Hons), University of Mysore, 1950; M.Sc., University of Mysore, 1954; Ph.D., University of Cincinnati, 1963.

Donald E. McLennan, Professor of Physics: B.A., University of Western Ontario, 1941; M.A., University of Toronto, 1948; Ph.D., University of Toronto, 1950.

Howard D. Mettee, Assistant Professor of Chemistry: B.A., Middlebury College, 1961; Ph.D., University of Calgary, 1964.

Thelma S. Miner, Professor of English: B.A., Dickinson College, 1935; M.A., University of Pennsylvania, 1942; Ph.D., University of Pennsylvania, 1945.

Ward L. Miner, Professor of English: B.A., University of Colorado, 1938; M.A., University of Chicago, 1940; Ph.D., University of Pennsylvania, 1951.

Jon M. Naberezny, Professor of Art: B.S. in Ed., Youngstown State University, 1949; M.A., State University of Iowa, 1952.

George R. Overby, Associate Professor of Education: B.A., Florida State University, 1951; M.Ed., University of Florida, 1959; Ph.D., Florida State University, 1966.

Edwin R. Pejack, Associate Professor of Mechanical Engineering: B.M.E., Rensselaer Polytechnic Institute, 1961; M.S., Rensselaer Polytechnic Institute, 1962; Ph.D., Ohio State University, 1967.

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Paul C. Peterson, Assistant Professor of Biology: B.S., Gustavus Adolphus College, 1962; Ph.D., University of Nebraska, 1968.
Kansas, 1954; Ph.D., University of Colorado, 1959.

Richard C. Phillips, Assistant Professor of Chemistry: B.A., Oklahoma State University, 1959; M.S., Florida State Uinversity, 1962; Ph.D., University of Texas, 1966.

James A. Reeder, Instructor in Chemistry: B.S., University of 1954; Ph.D., University of Colorado, 1959.

Charles Lloyd Reid, Associate Professor of Philosophy: B.A., Bethel College, 1951; M.A., Duke Uinversity, 1954; Ph.D., Duke University, 1960.

Victor A. Richley, Associate Professor of Electrical Engineering: B.E., Youngstown State University, 1956; M.S.E.E., University of Akron, 1961; Ph.D., University of Pittsburgh, 1967; P.E.

Bruce T. Riley, Associate Professor of Philosophy: A.B., Cornell College (Iowa), 1929; S.T.B., Boston University School of Theology, 1932; Ph.D., Boston University, 1940.

Lewis B. Ringer, Associate Professor of Health and Physical Education: B.S., Springfield College, 1956; M.S., West Virginia University, 1962; D.P.E., Springfield College, 1966.

Sidney I. Roberts, Professor of History: B.S.Ed., The City College of New York, 1952; M.A., Columbia University, 1953; Ph.D., Northwestern University, 1960.

Lewis S. Rosenthal, Assistant Professor of English: B.A., Colgate University, 1949; M.A., Auburn University, 1954; Ph.D., Louisiana State University, 1968.

Duane Sample, Associate Professor of Music: B.F.A., Carnegie-Mellon University, 1950; M.Ed., University of Pittsburgh, 1953; Ed.D., Columbia University, 1964.

Eugene S. Santos, Associate Professor of Mathematics: B.S.M.E., Mapua Institute of Technology, 1961; M.Sc., University of the Philippines, 1963; Ph.D., The Ohio State University, 1965.

George H. Schoenhard, Associate Professor of Education: A.B., Youngstown State University, 1936; Litt.M., University of Pittsburgh, 1939; Ed.D., University of Pittsburgh, 1957.

Lauren Schroeder, Assistant Professor of Biology: B.S., St. Cloud State College, 1960; M.A., University of South Dakota, 1964; Ph.D., University of South Dakota, 1968.

Robert H. Secrist, Associate Professor of English and Linguistics: A.B., Harvard University, 1957; M.A., New York University, 1959; Ph.D., New York University, 1965.

Alvin W. Skardon, Jr., Associate Professor of History: A.B., College of Charleston, 1933; M.A., University of Chicago, 1947; Ph.D., University of Chicago, 1960.

Morris Slavin, Associate Professor of History: B.S. in Ed., Ohio State University, 1938; M.A., University of Pittsburgh, 1952; Ph.D., Case Western Reserve University, 1961.

Charles L. Smith, Associate Professor of Education: B.S., University of Louisville, 1947; M.A., Ohio State University, 1950; Ed.D., Case Western Reserve University, 1968.

Francis W. Smith, Assistant Professor of Chemistry: B.Sc., University of Capetown, 1952; B.Sc., Honours, University of Capetown, 1954; Ph.D., University of Capetown, 1967.

Robert K. Smith, Associate Professor of Chemistry: B.S., University of Massachusetts, 1950; M.S., University of Massachusetts, 1950; Ph.D., University of Wyoming, 1966.

Anthony E. Sobota, Associate Professor of Biology: B.S.Ed., Indiana University of Pa., 1960; M.S., University of Pittsburgh, 1963; Ph.D., University of Pittsburgh, 1966.

Marilyn Solak, Associate Professor of Education: A.B., Mount Union College, 1947; M.Ed., Kent State University, 1950; Ed.D., Case Western Reserve University, 1963.

Joseph Solimine, Jr., Associate Professor of English: A.B., Brown University, 1956; M.A., University of Rhode Island, 1959; Ph.D., University of Pennsylvania, 1964.

Leonard B. Spiegel, Associate Professor of Chemistry: B.A., New York University, 1950; M.S., Florida State University, 1954; Ph.D., Florida State University, 1963.

Arthur G. Spiro, Associate Professor of Music: B.A., University of Minnesota, 1951; M.A., University of Minnesota, 1953; Ph.D., Boston University, 1961.

Gerhard M. Stein, Associate Professor of Electrical Engineering: Dipl.Ing., Technische Hochschule, Breslau, 1925; Dr.Ing., Technische Hochschule, Breslau, 1927; P.E.

Elizabeth Sterenberg, Associate Professor of Political Science: A.B., Knox College, 1929; A.M., Radcliffe College, 1932; Ph.D., University of Chicago, 1963.

William O. Swan, Associate Professor of Education: B.S. in Ed., Youngstown State University, 1950; M.S. in Ed., Westminster College, 1952; Ph.D., University of Pittsburgh, 1965.

Christopher J. Sweeney, Associate Professor of Psychology: A.B., Boston College, 1964; M.Ed., Northeastern University, 1966; Ph.D., University of Oklahoma, 1968.

Frank J. Tarantine, Associate Professor of Mechanical Engineering: B.E., Youngstown State University, 1957; M.S., University of Akron, 1961; Ph.D., Carnegie-Mellon University, 1965; P.E.

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Dumitru Teodorescu, Associate Professor of Business Administration: B.S., National College, 1928; M.L., Bucharest State University, 1931; Ph.D., Bucharest State University, 1940; M.L.S., Case Western Reserve University, 1957.

James R. Toepfer, Assistant Professor of Biology: B.A., Kent State University, 1963; M.A., Kent State University, 1965; Ph.D., Kent State University, 1968.

Clyde V. Vanaman, Associate Professor of Education: B.S., Mt. Union College, 1942; M.Ed., Kent State University, 1950; B.A., Youngstown State University, 1953; D.Ed., Case Western Reserve University, 1962.

Paul D. Van Zandt, Professor of Biology: A.B., Greenville College, 1952; M.S., University of Illinois, 1953; M.S.Ph., University of North Carolina, 1955; Ph.D., University of North Carolina, 1960.

Donald E. Vogel, Associate Professor of Music: B.M., Indiana University, 1953; M.Mus., Indiana University, 1956; Ed.D., Columbia University, 1966.

Peter W. von Ostwalden, Associate Professor of Chemistry: Doctorandum University of Graz, Austria, 1950; M.A., Columbia University, 1954; Ph.D., Columbia University, 1958.

Mark F. Walker, Professor of Music: B.M., Butler University, 1940; M.Mus., Butler University, 1949; Ph.D., Indiana University, 1955.

Robert Elmer Ward, Associate Professor of Languages: B.A., Baldwin-Wallace College, 1961; M.A., Indiana University, 1963; Ph.D., Vanderbilt University, 1967.

Gilbert R. Williamson, Associate Professor of Civil Engineering: B.S., Ohio Northern University, 1952; M.S., University of New Mexico, 1958; Ph.D., Carnegie-Mellon University, 1968.

Ralph E. Yingst, Associate Professor of Chemistry: A.B., University of Chicago, 1950; B.S., Lebanon Valley College, 1955; Ph.D., University of Pittsburgh, 1964.

By virtue of their position as the chairmen of departments which offer graduate programs, the following persons are also senior members of the Graduate Faculty:

Shaffiq Ahmed, Associate Professor of Metallurgical Engineering: I.Sc., University of Calcutta, 1950; B.E.Met.Engr., University of Calcutta, 1954; M.S.Met.Engr., University of Illinois, 1958; Ph.D., Case Western Reserve University, 1965.

Donald W. Byo, Associate Professor of Music: B.M., Youngstown State University, 1954; M.Ed., Kent State University, 1959.

John N. Cernica, Professor of Civil Engineering: B.E., Youngstown State University, 1954; M.S., Carnegie-Mellon University, 1955; Ph.D., Carnegie-Mellon University, 1957; P.E.

98

Marvin W. Chrisp, Professor of Education: B.A., University of Akron, 1950; M.A., University of Akron, 1956; Ed.D., Case Western Reserve University, 1961.

Ruth B. Clayton, Associate Professor of Education: B.A., Ohio State University, 1930; M.A., Ohio State University, 1932; Ph.D., Case Western Reserve University, 1943.

Frank A. D'Isa, Professor of Mechanical Engineering: B.S., Youngstown State University, 1943; M.S. in M.E., Carnegie-Mellon University, 1947; Ph.D., University of Pittsburgh, 1960.

Hugh G. Earnhart, Assistant Professor of History: A.B., Bowling Green State University, 1960; M.A., University of Maryland, 1963.

Margaret I. Pfau, Professor of English: A.B., Wellesley College, 1942; M.A., Case Western Reserve University, 1947; Ph.D., Radcliffe Graduate School, 1955.

Leon Rand, Professor of Chemistry: B.S., Northeastern University, 1953; M.A., University of Texas, 1956; Ph.D., University of Texas, 1958.

William A. Shipman, Professor of Education: B.S. in Ed., Kent State University, 1935; M.A., Kent State University, 1939; Ed.D., Case Western Reserve University, 1963.

Matthew Siman, Associate Professor of Electrical Engineering: B.S. in E.E., Case Western Reserve University, 1949; M.S. in E.E., Case Western Reserve University, 1956.

Bernard J. Yozwiak, Professor of Mathematics: B.A., Marietta College, 1940; M.S., University of Pittsburgh, 1951; Ph.D., University of Pittsburgh, 1961.

Associate Members

John E. Alleman, Associate Professor of Music: B.M., Michigan State University, 1951; M.M., Michigan State University, 1961.

Donald R. Arnett, Instructor in Mechanical Engineering: B.E., Youngstown State University, 1963; M.S. in M.E., University of Pittsburgh, 1967.

Joseph Babisch, Assistant Professor of Art: B.S., Buffalo State University, 1956; M.A., Kent State University, 1963; M.E., Westminster College, 1964.

Howard B. Bomberger, Metallurgical Engineering: B.S., The Pennsylvania State University, 1942; M.S., Ohio State University, 1950; Ph.D., Ohio State University, 1952.

Frank A. Ciotola, Associate Professor of Mathematics: B.A., Youngstown State University, 1952; M.A., The Pennsylvania State University, 1957.

William Conable, Assistant Professor of Music: A.B., University of Illinois, 1964; M.Mus., Boston University, 1965.

99

Paul E. Dalbec, Assistant Professor of Physics: B.S., Boston College, 1957; M.S., Notre Dame University, 1959; Ph.D., Georgetown University, 1966.

Christine Rhoades Dykema, Associate Professor of Foreign Language: Diplomes Normal et Superieur, Sorbonne, 1931; B.A., Barnard College, Columbia University, 1932; M.A., Case Western Reserve University, 1951.

Halil Erzurum, Instructor in Mechanical Engineering: B.S. in M.E., Robert's College, 1949; M.S. in M.E., Case Institute of Technology, 1952.

Ronald Lee Gould, Associate Professor of Music: B.M., North Central College, 1954; S.M.M., Union Theological Seminary, 1956.

Wilbert M. Hammack, Assistant Professor of Education: B.S. in Ed., Kent State University, 1939; M.Ed., University of Pittsburgh, 1950.

Joel E. Henkel, Assistant Professor of Physics: A.B., Princeton University, 1952; M.S., University of New Hampshire, 1958, Yale University, 1961; Ph.D., University of New Hampshire, 1965.

Lois M. Hopkins, Associate Professor of Music: B.M., Morningside College, 1948; M.M., Eastman School of Music, 1949.

Vern Leon Kagarice, Assistant Professor of Music: B.M., Bethany College, 1964; M.M., Indiana University, 1966.

Gus Mavrigian, Associate Professor of Mathematics: B.S., Carnegie-Mellon University, 1950; M.S., Carnegie-Mellon University, 1954.

Walter Mayhall, Instructor in Music.

Margarita W. Metzger, Associate Professor of Foreign Language: B.A., University of Mississippi, 1941; M.A., University of Mississippi, 1942; Licenciatura, University of San Carlos (Guatemala), 1949.

Richard C. Mitchell, Assistant Professor of Art: B.F.A., Illinois Wesleyan University, 1962; M.F.A., Ohio University, 1964.

William J. Nichols, Assistant Professor of Education: B.D. Nazarene Theological Seminary; M.S., Indiana University, 1963; Ed.D., Ball State University, 1968.

Esotto Pellegrini, Assistant Professor of Music; Mus.B., Youngstown State University, 1950; M.A., Kent State University, 1966.

John E. Petrek, Instructor in Mechanical Engineering; B.S. M.E., Oregon State University, 1945; M.S. in Engr., University of Akron, 1962.

Bhagwati P. K. Poddar, Assistant Professor of Political Science: B.A., Agra University (India), 1958; M.A., University of Oregon, 1960; Ph.D., Southern Illinois University, 1964.

Charles W. Raridon, Assistant Professor of Music: B.A. and M.A., Iowa University, 1953–57.

Fred Rosenberg, Assistant Professor of Music: B.M., Cleveland Institute of Music, 1949; M.A., Case Western Reserve University, 1952.

Charles R. Rullman, Instructor in Music: B.F.A., University of Omaha, 1956; M.A., State University of Iowa, 1958.

Lowell J. Satre, Assistant Professor of History: B.A., Augustane College, 1964; M.A., Ph.D., University of South Carolina, 1968.

Samuel J. Skarote, Assistant Professor of Electrical Engineering: B.E.E., Ohio State University, 1960; M.S.E.E., Ohio State University, 1965.

Agnes M. Smith, Assistant Professor of History: A.B., Hiram College, 1940; M.A., West Virginia University, 1945; Ph.D., Case Western Reserve University, 1966.

Virgil B. Smith, Associate Professor of Sociology: B.S., Brigham Young University, 1950; M.S., Brigham Young University, 1951; Ph.D., Utah State University, 1968.

Myron James Wisler, Assistant Professor of Music.

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