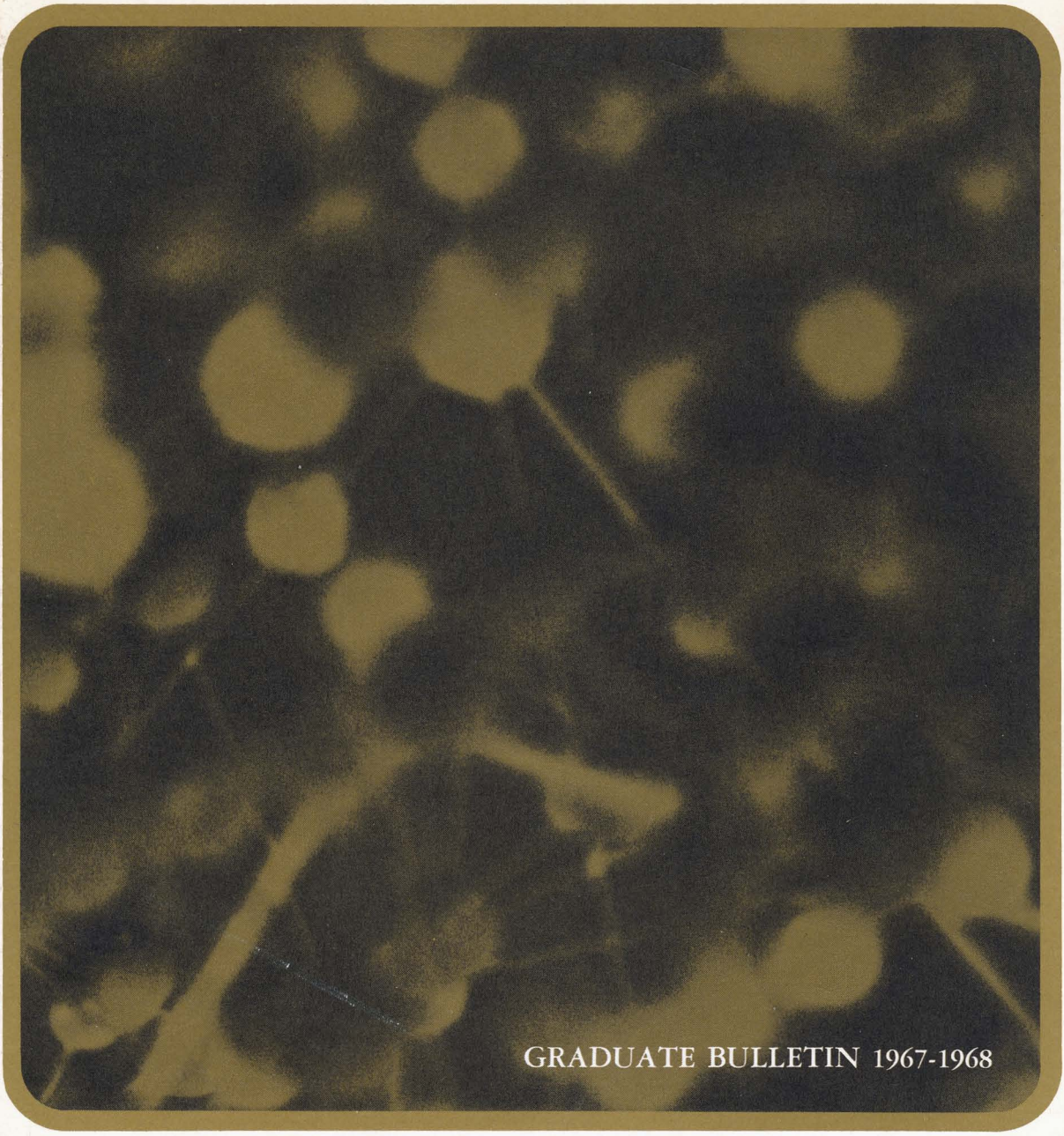
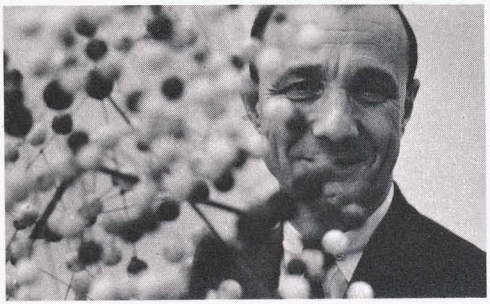


STATE UNIVERSITY OF NEW YORK
AT STONY BROOK

About the Cover

The cover illustration consists of a small section of a photograph of a model of the crystal lattice of hydroxyapatite, the inorganic material of bone. Stony Brook faculty members and graduate students pursue scholarly research in this and other areas of the biological and physical sciences, the social sciences, the humanities, and engineering.
Below is the complete photograph from which the cover section was taken. Shown with the model of his research project is Dr. Edmund D. Pellegrino, professor of medicine, chairman of the department of medicine and director of the Stony Brook Medical Center.



STATE UNIVERSITY OF NEW YORK AT STONY BROOK

THE GRADUATE BULLETIN

1967–1968

Additional Information

For general information about graduate programs and/or application, please write or phone:

The Graduate School
State University of New York
at Stony Brook
Stony Brook, N.Y. 11790
(516) 246-5945

Rendering of new residential college complex occupied in fall, 1967.

Contents

ACADEMIC CALENDAR
1967-1968

Fall Semester 1967	
Registration	September 19-20
Classes Begin	September 21
Thanksgiving Holiday	November 23-26
Classes Resume	November 27
Christmas Holiday	December 21-January 2
Classes Resume	January 3
Last Day of Classes	January 13
Semester Examinations	January 15-25

Spring Semester 1968	
Registration	February 2
Classes Begin	February 5
Spring Recess	April 10-16
Classes Resume	April 17
Last Day of Classes	May 18
Semester Examinations	May 20-30
Commencement	June 4

AN INTRODUCTION TO STONY BROOK

The State University at Stony Brook is one of four University Centers of the State University of New York. The Master Plan of the State University, revised in 1964, calls for the development at Stony Brook of graduate programs leading to the Ph.D. in all departments of the College of Arts and Sciences and the College of Engineering by 1970.

During the 1967-68 academic year, graduate programs leading to the Master's and Ph.D. degrees are offered by the Departments of *Biological Sciences, Chemistry, English, History, Mathematics, Physics,* and *Psychology* in the College of Arts and Sciences and by the Departments of *Applied Analysis, Electrical Sciences, Materials Sciences,* and *Mechanics* in the College of Engineering. Master's degree programs are offered by the Departments of *Earth and Space Sciences* and *Sociology*. Programs in other areas now being developed will be approved as the faculty and facilities necessary to assure high standards become available.

History and Location

The University was founded in 1957 at Oyster Bay, Long Island, as a center for educating secondary school teachers of mathematics and science. In 1960, however, within the context of a fast-growing State University, it was designated a University Center and given the mandate to develop undergraduate and graduate programs through the Ph.D. in the humanities, sciences, social sciences and engineering. As a comprehensive university, it was also to become a center for research.

In order to realize its larger goals, the University moved in 1962 to a new and larger campus at Stony Brook. Today, there are 32 buildings on the campus with additional buildings under construction or planned for construction during the 1967-68 period.

The academic program continues to expand at both the graduate and undergraduate levels, the aim being a balanced institution with strength in all areas of the arts and sciences and engineering. In addition, a comprehensive Medical Center is being planned for the Stony Brook campus. The Medical Center, which will include schools of Medicine, Nursing, Dentistry, and Social Work, will admit its first students in 1971. However, graduate students will benefit from this

pending development almost immediately, since members of the Medical Center Planning Group will participate in the instructional and research activities of the two existing Colleges and will direct some Ph.D. research.

Stony Brook is located in a region of woods and hills and small historic villages on the north shore of Long Island some 50 miles northeast of New York City. The University enjoys the relative seclusion of a semi-rural setting, coupled with proximity to the cultural, scientific and industrial resources of the nation's largest city. The campus is linked to Manhattan by a pattern of four- and six-lane highways and by the Long Island Railroad (see map at back of Bulletin). The proximity of the University to Brookhaven National Laboratory makes possible the participation of faculty members and their graduate students in the research program of the laboratory.

Students and Faculty

As a relatively new University, Stony Brook is experiencing dramatic growth. The 1967-68 full-time enrollment will exceed 5,000 students including about 700 graduate students and a number of post-doctoral fellows. Enrollment will reach 10,000 by the early 1970's. Eventually 40% will be graduate students.

As of September 1967, Stony Brook will have more than 400 faculty members. A complete directory of faculty members participating in current graduate programs can be found elsewhere in this bulletin.

The Stony Brook Campus

The Stony Brook campus is situated minutes away from the coves and beaches of Long Island Sound. The Atlantic shore is about 20 miles to the south. The campus consists of 850 acres of rolling, densely wooded terrain, with the central core area largely cleared for the buildings now in use.

There are seven large academic structures which provide classroom, lecture hall, laboratory and office space for the divisions, schools or departments they serve. These include the Humanities Building, the Social Sciences Center, and buildings for Chemistry, Biology, and Engineering. The Physics Building houses the Departments of Physics and Mathematics, and, temporarily, Earth and Space Sciences. The Frank Melville, Jr. Memorial Library, in addition to housing the customary books, periodicals, microfilm, music collections, and listening and reading facilities, also provides temporary quarters for the University administration.

Eighteen two- and three-story residence hall buildings afford living quarters for 4,000 students and contain numerous lounges and dining halls. The Gymnasium, with its swimming pool, basketball and squash courts, and rooms for gymnastics and ballet, serves the curricular, intramural and intercollegiate athletic

programs. It also supplies space for the Office of Physical Education and the University Theater.

Buildings and Research Facilities

The State University Construction Fund envisions an expenditure of $150 million in new facilities (not including the Medical Center) on the Stony Brook campus in the period 1962 to 1970. Prominent among the new buildings to be erected in the current $50 million "second phase" expansion program will be a Nuclear Structure Laboratory (to be completed by Summer, 1967), Graduate Engineering facilities and a Computing Center building (Fall, 1967), a Campus Center (late 1968), an Earth and Space Sciences building (early 1968), a Lecture Hall Center (early 1968), and an Instructional Resources Center (early 1968) in which new methods of visual presentation of instruction will be created. Also on the drawing boards are a Fine Arts Center with buildings for music, art and theater arts, a Marine Sciences Research Center, an Administration Building and additional dormitories.

Currently, the following fully-equipped buildings are in use:

The *Biology Building,* containing more than 86,000 sq. ft. of floor space, is well equipped for graduate study and research in experimental biology. Research laboratory space is available to graduate students working with individual staff members. The equipment in these laboratories varies with the research activities of the staff member. In addition to the laboratories, facilities directly serving graduate research include a departmental reading room for current scientific journals, a greenhouse with five individually controllable compartments and a potting room, a 250 KV X-ray machine, a well-equipped shop, electron microscope, photographic dark room, isotope counting room, herbarium, a museum, constant temperature rooms, and environmental chambers. An air-conditioned animal wing contains sea water and fresh water aquaria, animal rooms, and research laboratories.

The Department of Biological Sciences has its own boat for use in marine research, and has acquired a shore station at Flax Pond near Long Island Sound, near the campus, for instruction and research in marine biology.

A second and greatly enlarged Life Sciences building, planned for occupancy in 1971, will expand the physical facilities for graduate instruction and research.

The *Chemistry Building* is a spacious, modern structure (86,000 sq. ft. gross floor area) designed for research and instructional activities covering a broad range of specialization in chemistry. Equipment available for research includes one or more examples of virtually all spectrographic instruments such as electron spin

resonance, nuclear magnetic resonance, mass, Raman, visible, ultra-violet, infrared, and far infrared spectrometers. Also available is a wide range of instruments for nuclear and radiochemistry, an amino acid analyzer, preparative gas chromatographs, a dichrograph, and X-ray diffraction equipment. Instruments specially constructed for the Chemistry Department's research facilities include a flash-photolysis apparatus, a stop-flow apparatus, cryogenic infrared cells, and a high pressure apparatus. Services available for the support of research include well-staffed glass-blowing, machine, carpentry, and electronics shops, and a departmental library.

The Chemistry Department is currently planning an additional large building. The new building is designed primarily for graduate research, and the tentative date for occupancy is the fall of 1969.

The 92,000 sq. ft. *Physical Laboratory* provides space for graduate and faculty research and supporting facilities. A major and continuing program of investment by the State of New York is speeding the development of instruction and research in the Physics Department. Equipped or approaching completion are research laboratories in high energy physics (bubble- and spark-chamber film measurement, counter techniques); nuclear physics (neutron physics, radioactivity, Mossbauer studies, positron processes); solid-state physics (electron transport and resonance phenomena in semi-metals, magnetic resonance in solids); and atomic physics (lifetimes of atomic excited states, molecular and atomic beam resonance). Through the participation of several of the faculty in the research programs of the nearby Brookhaven National Laboratory, a number of the facilities of that Laboratory are available to graduate students. Supporting facilities in the Physical Laboratory include a departmental library, two machine shops, an electronic shop, and a photographic laboratory.

An HVEC FN "King" tandem Van de Graaff accelerator, part of the Nuclear Structure Laboratory, supports a large scale program in nuclear structure and reactions. An extension to the Physical Laboratory, greatly enlarging the space available for faculty and graduate research, is now planned for completion in 1969.

The *Engineering Building* contains 96,000 sq. ft. of gross floor area. General facilities available to graduate students include well-equipped research laboratories in all fields of specialization. Examples of the kinds of research facilities offered by the College of Engineering are, in the Department of Electrical Sciences: digital and analog computers, energy converters, microwave instruments for radiation research, solid-state equipment, complete selection of oscilloscopes and frequency standards; in the Department of Materials Sciences: X-ray diffraction equipment, electron microscopy equipment, laboratories for mechanical testing, single

crystal-growing, emission, spectroscopy, and infrared spectroscopy, a radiochemical counting facility, a subcritical reactor facility, thin film evaporator, thermal decomposition apparatus, physical adsorption apparatus, torsional relaxation equipment, and a magnetic properties laboratory. The Department of Mechanics facilities include a low-turbulence wind tunnel, infrared radiation measuring devices, and fundamental fluid mechanics instrumentation.

Among the supporting facilities in the College of Engineering are an Engineering Library, a precision machine shop, faculty and student shops, a photographic shop, and an electronics shop.

A Heavy Laboratory Building, including shock tunnels, a supersonic wind tunnel, and a materials research laboratory is under construction; the Light Laboratory Building, which will contain the general-purpose graduate laboratory facilities, will be completed before the end of 1967.

The *Humanities Building,* oldest of the campus structures, provides classroom and office space for the Departments of Art, English, Germanic and Slavic Languages, Romance Languages, and Philosophy. The building also houses the Registrar's Office, a gallery for art exhibitions, an auditorium, language laboratories, and a faculty lounge.

The new *Social Sciences Center* houses the Departments of Anthropology, Economics, Education, History, Political Science, Psychology, and Sociology. The first section of the two-structure complex will contain conference and seminar rooms and faculty offices. Adjoining this section will be the classroom-laboratory building. The two buildings will be linked by landscaped courtyards, an elevated gallery and an arcade, providing pleasant surroundings for the 123,000 square feet of working space.

Graduate students in psychology will conduct research in a 20,000 square foot psychology laboratory wing divided by floors into clinical research, human research, and animal research. The special features of this area include shielded rooms, two animal surgeries connected by a central washroom, and closed-circuit television in the clinical and social interaction laboratories.

The Institute for Colonial Studies, established in 1966, promotes research in the comparative study of the colonies of the Western Hemisphere. The Institute is collecting and preserving the manuscript sources of the British and European settlements. These documents will provide an unusual research facility for scholars and graduate students.

An oral history room equipped with recording instruments and tapes is another facility available to graduate students in the Department of History.

Libraries

The Melville Memorial Library, a three-story air-conditioned building, is

designed for 350,000 volumes and will seat 700 students for reading and study purposes. It is intended as the first part of a large structure that will house a million and a half volumes at its next stage of development. Supplemental technical and scientific collections are housed in the science buildings and in the College of Engineering, all of which are centrally administered from the main library. In all campus libraries students have free access to the open bookstacks with reading areas and bookstacks integrated throughout. The libraries are open until midnight except on Saturday.

Small study rooms and soundproof typing rooms are provided in the Melville Library. A special area houses the files of microfilm, microcards, microprint, and microfiche. Equipment is available for the purpose of making page copies of microform materials, and a photocopy machine can be used to copy pages from magazines and reference books.

The University Library is a selective government depository and receives large numbers of publications issued by the U.S. and other governments. About 3,300 periodicals are currently received covering all areas of knowledge, and the staff is processing books at the rate of 48,000 volumes per year. The total library collection now numbers 185,000 volumes and 48,000 documents.

The library furnishes students with recordings of speeches, poetry, and drama, as well as music in the Music Library, which occupies a portion of the first floor. The latest electronic equipment is installed, including a dial system incorporating the use of tapes and cartridges operated by remote control under the direction of a music librarian and an electronics technician.

A second unit of the library, which will increase its capacity by two and one half times, is now in the planning stages. It is expected to be occupied by 1970.

The Computing Center

The Computing Center, another essential central facility of the University, has many objectives. It not only introduces students to concepts of modern computing technology through course work and the integration of the computer-oriented approach in problem courses, but also makes the computing facilities freely available for such student activities as term papers, research projects, and theses.

The Center serves the faculty in both sponsored and unsponsored research activities and the administration in such areas as institutional research and administrative data processing. Short courses in programming and problem oriented languages are held periodically for faculty and administrative staff.

The present equipment consists of an IBM 7044 computer (with 32,768 words of storage) to perform the principal processing functions assisted by an IBM 360/30 computer to perform various peripheral functions necessary for the 7044. Additional equipment includes a high speed disc, 11 magnetic tape units, an automatic plotter, and associated tabulating equipment.

During the 1967-68 academic year, a new major system, remote access, with capabilities which reflect the latest state-of-the-art, will be installed. This system will permit communication to the central computer via controls located throughout the campus. The Computing Center building, to be completed this year, will be located in the Engineering Quadrangle and will house the staff and equipment.

Housing

Rooms are available for unmarried graduate students in the University residence halls. All rooms provide for double occupancy, and are furnished with a bed, mattress, bureau, study desk and chair, and closet for each occupant. Board may be purchased by resident students, and consists of 21 meals a week. Non-resident students may purchase meals in the University dining halls also.

Houses, apartments, and rooms are available within reasonable driving distance of the Stony Brook campus. However, it is somewhat difficult to obtain off-campus accommodations within walking distance.

The "University Housing Service," located on the second floor of the Library, aids students who are interested in renting rooms, apartments, or houses in the Suffolk County area.

An expanded program of faculty involvement with the students exists in the form of "residential colleges." Graduate students are invited to participate as graduate associates in this program, which is designed to expand cultural and intellectual opportunities in the residences as well as to foster student identity within the University and improve interpersonal relationships. Individual colleges will range in size from 200 to 400 students each, and each college and its students and faculty associates will have the opportunity to develop in individual program, style, and tradition.

Summer Program

Though the six-week Summer Session offers formal course work primarily for undergraduates, graduate students are encouraged to remain on campus during the summer to continue study and research under faculty guidance in more informal situations. A limited number of Summer Research Assistantships are available.

FINANCIAL INFORMATION

Tuition

The tuition rate for graduate students is $300 per semester. There is no tuition charge for graduate assistants, research assistants, and certain fellows, but they must pay other fees listed below.

Other Fees

State University Fee: $12.50 per semester.
Identification Card: $2.00.
General University Deposit: $20.00.
Telephone Deposit: $15.00 (payable by dormitory residents).
Student Health Insurance Fee: $26.50 (payable at Fall registration).
Late Registration Fee: $15.00 (paid by students registering after the close of the official registration period).
Graduation Fee: $15.00 (payable upon completion of all degree requirements and prior to the award of the degree).
Transcript Fee: $1.00 for each transcript (a student who obtains a degree may receive two transcripts without charge).

Residence Charges

Room and board charges for students living on the Stony Brook campus are approximately $825 per academic year, of which $385 represents the rent for a double occupancy room; these charges are payable on a quarterly basis. A $25 advance room deposit is required, this amount being applied to the first quarter payment. The advance room deposit is refundable if application is made in writing before July 1st. Board is $440 per year.

The above fees and charges are subject to change without notice.

Refunds

A student who withdraws after the first five days of a semester is entitled to only a partial refund of monies collected. A schedule of refunds is available in the University Business Office. After a student has registered and occupied a room, there can be no refund for the balance of that quarter, except for entry into military service.

Financial Aid

Sources of direct financial aid include the New York State Scholar Incentive Program and the Division of Vocational Rehabilitation of the New York State Education Department. Both the State of New York and the Federal Government offer low cost loan programs to help graduate students finance their education. Inquiries concerning either financial aid or loan programs should be directed to the Financial Aid Officer in the Dean of Students Office.

Graduate Assistantships and Fellowships

Teaching assistantships carry stipends of $2,575 for the academic year and tuition exemption. For advanced students the stipend is $2,700.

Research assistantships for advanced graduate students and University Fellowships are also available, with stipends of $2,575 and higher for the academic year and tuition exemption.

Teaching assistantships, research assistantships, and fellowships are awarded on a competitive basis by the Graduate School on recommendation of the department.

State University of New York at Stony Brook participates in such fellowship and traineeship programs as: NDEA Fellowships, NSF Traineeships and Fellowships, NASA Traineeships, and New York State Regents' Fellowships. The stipends of University fellowships and graduate assistantships are subject to adjustment if held in conjunction with New York State Regents Awards and other extramural awards.

Students from the member States of the Organization of American States who wish to pursue graduate studies may apply, upon seeking admission to the University, for a fellowship grant under the terms of the Program of Fellowships and Professorships of the Organization of American States. Requests for O.A.S. fellowship applications should be directed to the Technical Secretary, O.A.S. Fellowship and Professorship Program, Pan American Union, Washington, D.C. The deadline for receipt of applications for this program is January 31 for those wishing to start their studies in the fall, and July 31 for those who wish to enter the University in the spring semester.

During the 1966-67 academic year, approximately 90% of the graduate students at Stony Brook held fellowships or assistantships.

ADMISSION REQUIREMENTS

To be admitted to graduate study, an applicant must have the preparation and apparent ability which (in the judgment of the department and the Graduate School) is sufficient to enable him to progress satisfactorily in a degree program. Admission decisions are based primarily on past records and on letters of recommendation. Ordinarily, a baccalaureate degree in the chosen field of study is required, with an average grade of B in course work in the major and related areas. However, in exceptional cases in which the undergraduate preparation is inadequate, or the grade average is less than B, an applicant may be admitted provisionally, if he is considered to have a reasonable probability of making satisfactory progress in graduate studies. Detailed admission requirements are listed in each department's section of this Bulletin.

The department may set conditions which the admitted student must satisfy during the early period of his graduate work.

Admission application blanks and additional information may be obtained by writing to the appropriate department, or to: *The Office of the Graduate School, State University of New York, Stony Brook, New York 11790.* (No application fee is required.)

DEGREE REQUIREMENTS

Admission to the graduate school does not automatically qualify a student as a candidate for the Ph.D. degree. Formal recommendation of advancement to candidacy for the Ph.D. degree must be made to the Graduate School by the department after a review of the student's performance in courses, independent study, and departmental examinations. A candidate for the Ph.D. degree engages in research leading to a thesis. For the masters degree a less formal procedure is followed, and a department may substitute a comprehensive examination for the research and thesis.

While individual departments may have certain course requirements, the Graduate School does not specify a minimum number of courses to be completed for each degree. Instead, the granting of the degree is based on the completion of residence, examination, thesis, special departmental requirements, and the recommendation of the student's department. Ordinarily, however, certain courses

should be taken in preparation for comprehensive examinations and research. The student will follow an approved program of courses, seminars, and individual study, determined so as to meet his needs and to satisfy departmental requirements. A student, well prepared on admission, should normally be able to complete the course work for the Master's degree in about one calendar year of full-time study, and for the Ph.D. preliminary (candidacy) examination in about two years of full-time study.

Requirements for advanced degrees, which vary somewhat among departments, generally include the following:

The M.A. and M.S. Degrees

1. Residence: one year
2. Research and thesis, or the passing of a comprehensive examination
3. Departmental recommendation

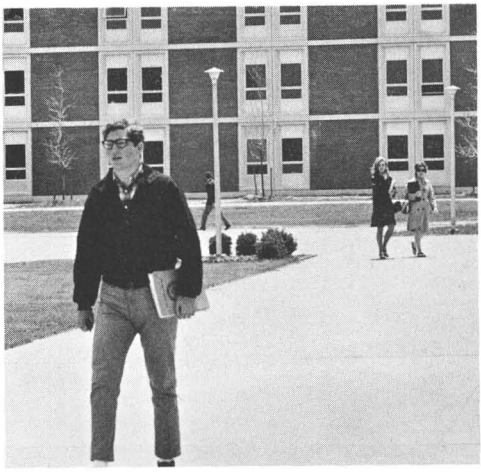
The Ph.D. Degree

1. Residence: two years
2. The passing of proficiency examinations in foreign languages
3. The passing of the departmental preliminary examination
4. Advancement to candidacy
5. Research and thesis (including oral defense of thesis)
6. Departmental recommendation

The Ph.D. thesis must demonstrate the ability of the candidate to carry on independent research of high quality and must represent a significant contribution to knowledge.

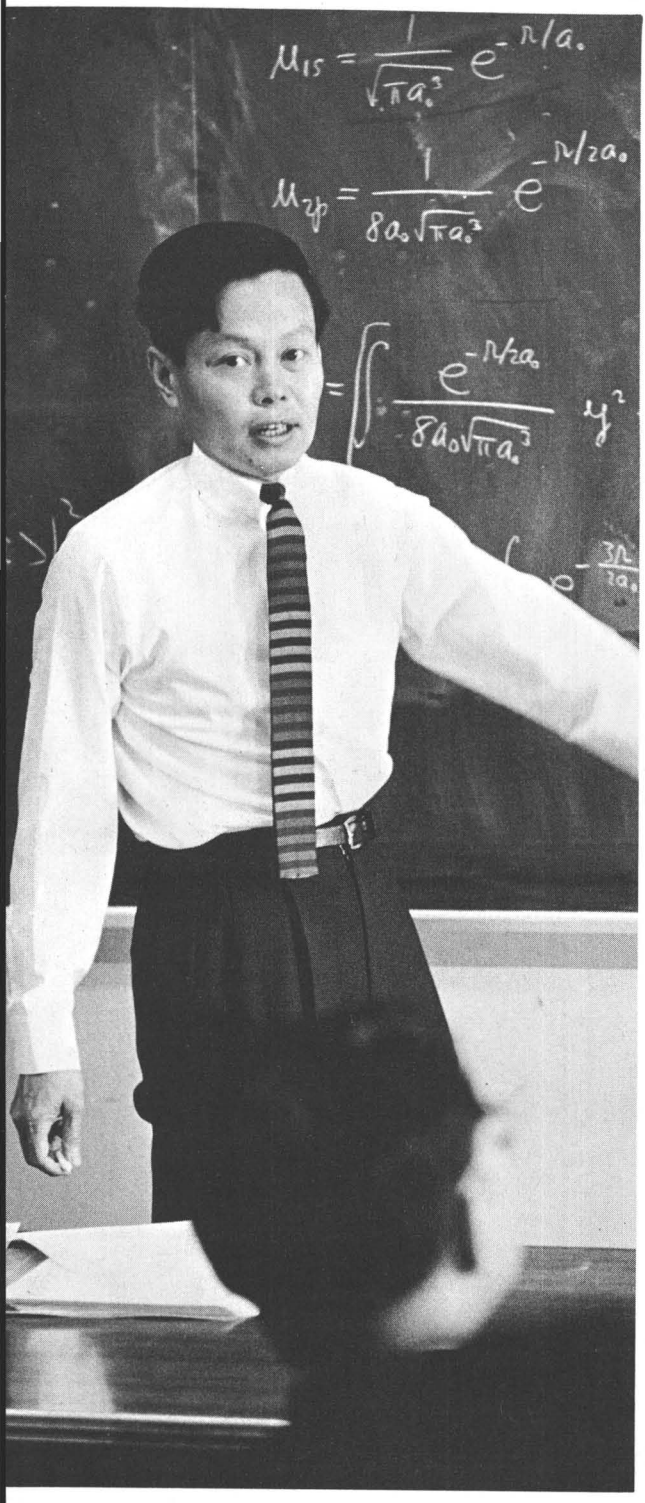
DEGREE PROGRAMS AND COURSES

Courses numbered 201 to 399 are for advanced undergraduates; detailed descriptions of these courses are given in the Undergraduate Bulletin (which may be obtained by writing to the Admissions Office, State University of New York, Stony Brook, New York 11790). Graduate courses are numbered 501 and above.



Depicted on page 17 are, at left, Nobel Laureate Chen Ning Yang conducting a graduate class in physics and, at bottom right, noted literary critic Alfred Kazin explaining a fine point to an English seminar. Photos at top right and center, respectively, are of a history seminar and a physics experiment.

On this page are shown a senior cello recital, top, the newly completed Social Sciences Center, and the expanding Computing Center scheduled to move in early 1968 to new and larger quarters.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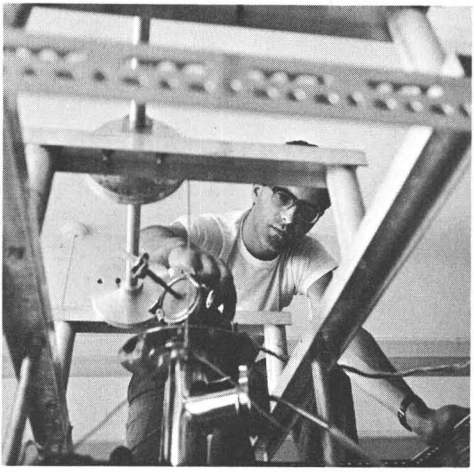

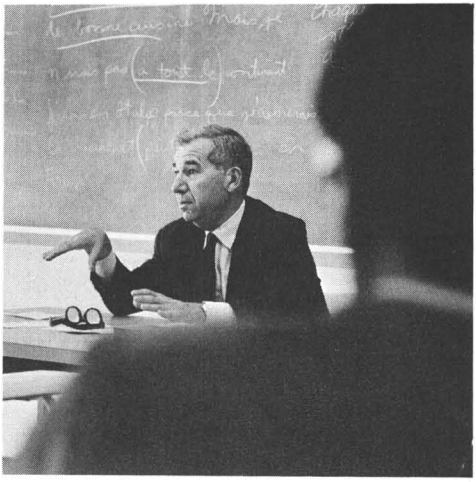

GRADUATE PROGRAMS IN ARTS AND SCIENCES

BIOLOGICAL SCIENCES

Professors: ERK (*Chairman*), GLASS, GOREAU, M. SIMPSON, WILLIAMS
Associate Professors: BATTLEY, CIRILLO, JONES, MERRIAM, MOOS, RILEY, SMOLKER, TUNIK, WALCOTT
Assistant Professors: CARLSON,[a] EDMUNDS, FOGG, FOWLER,[b] FREUNDLICH, GAUDET, HECHTEL, HOWLAND, KERNAGHAN, KRIKORIAN, ROSENBERG, WOHLMAN, WURSTER
Instructor: OBREBSKI
(*Professors of Medicine*: KNUDSON, PELLEGRINO) [c]

Admission to Graduate Study

A. A baccalaureate degree with the following minimal preparation is required: mathematics through one year of calculus, chemistry including organic chemistry, general physics, and one year of biology including laboratory.

B. A minimum grade-point average of 2.75 (B–) in all undergraduate course work, and 3.00 (B) in science and mathematics courses.

C. Letters from three previous instructors, and results of the Graduate Record Examination.

D. Acceptance by the Department of Biological Sciences and the Graduate School.

In special cases, students not meeting requirements (A) through (C) may be admitted on a provisional basis. These students must act immediately to fulfill deficiencies in basic courses before being enrolled as regular students. Credits earned in these courses do not count toward graduate degree requirements.

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a Not in Residence, Academic Year 1967-68.
b Not in Residence, Fall semester 1967.
c Medical faculty who may supervise graduate research in the Biological Sciences.

Requirements for the M.A. Degree

A. Residence: one year
B. Qualification to candidacy
C. Formal course requirements: successful completion of an approved course of study of at least 24 semester credits, including two semesters of Interarea Seminar.
D. Thesis: Independent laboratory, field, or theoretical research under the supervision of a staff member of the Department.
E. Comprehensive examination: When the thesis is completed, a comprehensive examination will be given no later than two weeks before the end of the semester in which the final work in the Master's program is done.
F. Oral defense of thesis: Upon acceptance of the thesis by a reading committee an oral examination on the thesis will be given.

Requirements for the Ph.D. Degree

In order for a student to continue in a program of study toward the Ph.D. degree, the Graduate Studies Committee must have reached consensus that the overall performance of the student during his first year has been satisfactory.

A. Formal course requirements: Successful completion of an approved course of study.

B. Preliminary examination: After completing the major portion of course work, a student may apply for the preliminary examination. Normally the examination will be both written and oral, and may be taken no later than the sixth semester after entrance.

C. Language requirement: Normally a reading knowledge of two foreign languages selected usually from German, French and Russian in consultation with the Graduate Studies Committee.

D. Advancement to candidacy: The department's recommendation with respect to candidacy for the Ph.D. degree will be based upon the satisfactory completion of the above requirements.

E. Thesis examination: An examining committee will read the thesis and give the candidate an oral examination on the thesis research and related areas.

F. Residence: Two years of full time graduate study.

Graduate Programs in Biology

Graduate studies in biology are focussed in three main programs: Molecular and Cellular Biology, Genetic and Developmental Biology, and Ecology and Behavior. Each program offers a sequence of basic courses taught by its own staff, a series of seminar courses, and early participation by graduate students in research. The programs are briefly described below:

Molecular and Cellular Biology

The Molecular and Cellular Biology program is designed to prepare the student to formulate and attack biological problems at the molecular and cellular levels. The program accommodates a broad spectrum of interests, from traditionally biochemical areas such as the chemical bases of enzyme action, the physical biochemistry of macromolecules, or the biosynthesis of proteins and nucleic acids through the molecular and cellular bases of gene expression and of learning, metabolic control mechanisms, contractile systems, and ultrastructure.

Genetic and Developmental Biology

The Genetic and Developmental Biology program encompasses study and research in genetics, genetic mechanisms (analysed at both the cellular and molecular levels), regulation of gene expression, and developmental phenomena in microorganisms, plants, and animals. Fundamental instruction is offered in genetics, the physiology of development, and the genetic control of development, using examples from a variety of biological systems. Advanced courses and seminars help prepare the student for research in a particular aspect of genetics or development.

Ecology and Behavior

The program in Ecology and Behavior reflects the increasingly convergent aspects of modern biological science dealing with phenomena occurring in populations. Neither ecology nor behavior, both of which are concerned with the adaptation of organisms to their biotic and physical milieus, can stand without reliance on the concepts and findings of the other. The program provides opportunities to specialize within ecology and behavior, as well as to obtain a background in the broader areas represented by this program, including basic preparation in systematics.

Teaching Responsibilities

All graduate students are expected to serve as a teaching assistant for the equivalent of one year (two laboratory sections each semester).

Courses

Advanced Undergraduate Courses

Certain advanced undergraduate courses (300 level) may be taken for graduate credit. Students should consult their advisors about the suitability of such courses in their program of studies.

Graduate Courses

BIO 501 Biochemistry

A survey of the structure of the major chemical constituents of the cell including carbohydrates, liquids, nucleic acids, and proteins. Emphasis will be placed on enzyme structure, enzyme kinetics, reaction mechanisms including the role of coenzymes; metabolic pathways of biosynthesis and degradation involved in cellular activity.

Fall, 3 credits

BIO 505 Microbial Regulatory Mechanisms

A series of lectures and discussions devoted to current concepts of microbial regulatory mechanisms. Some of the topics to be discussed are feedback inhibition; allosterism; the operon theory and repression; the role of sRNA in repression; control of RNA and DNA synthesis. The genetic and biochemical aspects of these subjects will be stressed.

Fall, 3 credits

BIO 509 Experimental Biochemistry I

An introduction to modern methods of biochemical analyses. Students will spend various periods of time working in close association with members of the staff engaged in biochemical research.

Fall, 2 credits

BIO 510 Experimental Biochemistry II

A continuation of BIO 509.

Spring, 2 credits

BIO 512 Cellular Biology

A course designed to present current thinking and progress in problems concerning cell structure, function, and the relationship between the two. The approach is basically analytical, striving where possible to explain cellular phenomena in terms of molecular and biochemical organization. Laboratory work will give instruction in the critical use of some tools and methods of investigation at the cellular level. Each student will undertake a limited project in which he will do independent work in the laboratory. One hour lecture, one hour discussion, and four hours of regularly scheduled laboratory.

Spring, 4 credits

BIO 521 Principles of Genetics

This course presents the basic features of the processes of replication, mutation, recombination and gene expression. Illustrative material is drawn from several appropriate biological systems, with emphasis placed on microorganisms.

Fall, 4 credits

BIO 522 Principles of Development

This course seeks to ascertain the basic principles of development common to all levels of biological organization. Factors underlying patterns of cell division, cellular aggregation, and differentiation in plants and animals are discussed. The influence of changes in internal and external environment on developmental systems is critically examined.

Spring, 4 credits

BIO 523 Genetic Control of Development

In this course the process of development is studied as a regulated transcription of a

genetic program. Emphasis is placed on the mechanisms of gene modification by environment and on gene interactions that are relevant to differentiation. Details of chromosomal organization and non-chromosomal inheritance will be discussed as reflections of genetic function. Specific genetic abnormalities of development in a variety of species will be examined in the light of available models.

Fall, 4 credits

BIO 530 Projects in Genetics and Development

Individual laboratory projects, closely supervised by staff members, to be carried out in staff research laboratories on a rotation basis.

Each semester, 2 credits

BIO 531 Plant Morphogenesis

A course concerned with the analysis in depth of certain aspects of plant development. The areas from which specific problems will be selected include photomorphogenesis, hormonal control of plant growth, and plant tissue culture. Discussion will involve an examination of the classic and contemporary literature. The laboratory will provide experience in research methods and opportunity for independent investigation. Two hours of discussion each week and laboratory by arrangements.

Fall, 4 credits

BIO 534 Experimental Embryology

Animal development is examined from various theoretical points of view. Embryological phenomena are considered at the organismal, cellular, biochemical, and genetic levels. The experimental basis of contemporary theory is emphasized. Two hours lecture and discussion with 3 hours of laboratory.

Spring, 3 credits

BIO 535 Physiology and Development of Higher Plants

A survey of selected topics in plant physiology with emphasis on developmental aspects. The relationship of cells, tissues, and organs to water and solutes; inorganic plant nutrition; plant metabolism (photosynthesis, respiration, nitrogen metabolism) ; translocation and physiology of growth; and development of vascular plants are topics considered. Particular emphasis is placed on principles and their application to higher plants.

Fall, 4 credits

BIO 536 Physiology and Development of Lower Plants

A consideration of the major problems and current research dealing with the physiology and biochemistry of growth and development in bacteria, algae, fungi, slime molds and bryophytes. The course will include a study of the life cycles of representatives of the above group of plants and a critical discussion of certain important physiological and biochemical processes, concepts, experiments, and problems relating to growth and development. Emphasis will be placed on those aspects of enzyme regulation and control of protein synthesis that relate to growth and differentiation in these organisms.

Spring, 3 credits

BIO 541 Principles of Ecology

This course examines the interactions of organisms with their biological, chemical, and physical environments. The physical nature of the primitive environment, the origin of life, the fundamentals of organismal interaction, the ecology of the intertidal zone, and the transition from an aquatic to a terrestrial environment will be considered. The development of theoretical concepts of community structure and their biological implications will be emphasized.

Fall, 4 credits

BIO 542 Principles of Behavior

This course begins with a review of the neurophysiological and endocrinological bases of behavior, which is followed by a study of multi-organ, or system, responses to specific environmental variables. It concludes with detailed examinations of specific topics in behavior as reflected in the current literature.

Spring, 4 credits

BIO 544 Population Genetics

This course examines the historical development and current concepts of population

genetics. Among the subjects covered are mutation, genetic fixation and drift, polyploidy, effects of population size, hybridization, selection, ecotype formation, and speciation. Descriptive and experimental studies of several plant and animal populations are discussed in detail.

Spring, 3 credits

BIO 545 Comparative Animal Physiology

A course which approaches the study of the physiological functions of vertebrate and invertebrate animals on a comparative basis. The student will examine physiological mechanisms controlling feeding and digestion, osmotic regulation and excretion, respiration, receptor and effector systems, and behavioral responses in widely diverse animal phyla. He will be introduced to the diversity of mechanisms which serve to ensure a unity of life processes and to the techniques and equipment required for their study. Two hours of lecture and two three-hour laboratories.

Fall, 4 credits

BIO 561 The Invertebrata I

An examination of the protozoa, acoelomates, pseudoacoelomates, echinoderms, and possible echinoderm allies, including protochordates. Emphasis is on diversity of form, functional and comparative morphology, evolution, and classification. A basic knowledge of major phyla is assumed. Course to be given in alternate years. Three hours lecture and discussion with three hours of laboratory.

Fall, 4 credits

BIO 562 The Invertebrata II

An examination of the annelids, annelid allies, arthropods (excluding detailed treatment of insect orders), annelid-arthropod allies, and mollusks. Emphasis on diversity of form, functional and comparative morphology, evolution and classification. Course to be given in alternate years. Three hours lecture and discussion with three hours of laboratory.

Spring, 4 credits

BIO 570 Population and Community Ecology

A course which uses both cultured and naturally distributed organisms to examine the control and interactions of populations. Emphasis is placed on the development of theoretical concepts and biological implications through the use of physical, stochastic, and biological models. Topics include mortality, fertility, growth of populations, competition, predator-prey interaction, and community analysis.

Spring, 4 credits

BIO 574 Plant Systematics

This course examines the basic concepts of plant taxonomy, and includes such topics as the development of classification, effect of evolutionary theory on systematics, principles used in determining relationships, delimitation of taxa, and the concept and analysis of characters. The laboratory is designed to familiarize the student with techniques of traditional, chemical, numerical, and population analyses of various plant taxa.

Spring, 4 credits

BIO 581, 582 Interarea Seminar

Two members of the staff combine their interests to develop a series of topics and review of the literature which touches on both fields of interest.

Each semester, 2 credits

BIO 583-598 Special Seminars

Topics to be arranged.

BIO 599 Research

Original investigation undertaken with the supervision of a member of the staff.

Each semester, credit to be arranged

BIO 670 Seminar in Marine Biology

Selected topics from the recent literature on the ecology, biogeography, and evolution of marine organisms. BIO 336 or its equivalent is a prerequisite for this seminar course.

Spring, 2 credits

BIO 681-698 Advanced Seminars

Topics to be arranged.

BIO 699 Research

Original investigation undertaken as part of Ph.D. program under supervision of a research committee.

Each semester, credit to be arranged

Departmental Colloquium

A weekly series of talks and discussion by members of the staff, advanced graduate students, and visiting biologists, in which current research and thinking in various areas of biology will be presented.

Each semester

Program Seminar

Each graduate program schedules regular seminars throughout the academic year.

CHEMISTRY

Professors: BONNER (*Chairman*), FRIEDMAN, KOSOWER, OKAYA, RAMIREZ, SUJISHI, WOLFSBERG[a]

Associate Professors: J. ALEXANDER, HAIM, HIROTA, LAUTERBUR, LENOBLE, WISHNIA

Assistant Professors: BOIKESS, EMERSON, GOLDFARB, KERBER, KWEI, MUROV, SCHNEIDER, SOLO, STIEFEL, WHITTEN

Director of Chemical Laboratories and Lecturer: CROFT

Admission to Graduate Study

For admission to graduate study in chemistry the following are required:

A. Baccalaureate degree in chemistry earned in a curriculum approved by the American Chemical Society, or an equivalent course of study.

B. A minimum grade-point average of 2.75 (B–) in all undergraduate course work, and 3.00 (B) in all courses in the sciences and in mathematics.

C. Acceptance by the Department of Chemistry and by the Graduate School.

In exceptional cases, a student not meeting the requirements (A) and (B) may be admitted on a provisional basis.

Qualifying Examination

Before classes begin in the fall semester a series of three qualifying examinations in the fields of physical, inorganic, and organic chemistry will be administered to all incoming graduate students. These examinations will be based upon final examinations given in the undergraduate program of the State University at Stony Brook. The examinations will also be given between the fall and spring semesters and at the end of the spring semester. Any of the three parts not passed must be repeated. The purpose of the qualifying examinations is to aid in the advising of incoming graduate students concerning their first year programs and to insure that the students are qualified for candidacy for an advanced degree.

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a Senior Chemist, Brookhaven National Laboratory, on part-time appointment at the State University of New York at Stony Brook.

Seminars

All first year graduate students will register for the chemistry seminar series CHE 531 (0 credit) and 532 (1 credit). The first semester series (CHE 531) is a pre-research seminar in which the faculty members of the Department of Chemistry will present talks on their research programs. The objective of these seminars is to provide information which will allow the student to make an intelligent selection of a research advisor. During the second semester (CHE 532) each student shall present a topic of his own selection.

In addition to the above, all graduate students are expected to attend the Department's regularly scheduled colloquia. These colloquia are presented by outstanding chemists invited from outside the University.

Research Advisor

During the second semester, no later than April 15, each first year student shall request a faculty member to become his research advisor and shall then apply to the Chairman of the Department of Chemistry for final approval. Each student shall register for one or two credits of research for the second semester with the expectation that he will initiate his research work upon selection and approval of the research advisor.

The research advisor becomes the academic advisor for the student, and his subsequent program of study must meet with the approval of the research advisor.

Faculty research programs currently in progress include synthetic and physicochemical studies of molecular inorganic hydrides; organophosphorus compounds and organic synthesis; stable free radicals and diradicals, aryldiimides, molecular biochemistry and medicine; experimental and theoretical studies of electrolyte solutions, including calorimetry and statistical mechanics of equilibrium and transport processes; isotopic reaction studies and isotope geochemistry; molecular quantum chemistry and theory of isotope effects; nuclear reactions and fission, stopping of recoil atoms; kinetics and mechanisms of inorganic reactions in aqueous systems; nuclear magnetic resonance; organic systems under high pressure; physical biochemistry; structural inorganic chemistry of transition elements; low temperature photochemical valency tautomerism, nonbenzenoid aromatics, strained bicyclics; organometallics; high resolution infrared and far infrared spectroscopy; electron paramagnetic resonance and optical studies of triplet state; ion pairs; small ring heterocycles; chemical reaction studies by molecular beam technique; nuclear quadrupole resonance and Raman spectroscopy; flash photolysis in gaseous systems; crystallography; organic photochemistry.

With the permission of the chairmen of the Departments of Chemistry and of Earth and Space Sciences, research may also be conducted in the area of Earth and Space Science.

Courses of Study

Students will be advised concerning courses of study appropriate to their backgrounds. The objective of the course of study in the first year is the development of breadth in chemistry. Six formal courses (selected as indicated below) or their equivalent are required of all graduate students. Normally a student will be advised to take the first four courses below in the fall semester and two required courses and one optional course in the spring semester. Qualification to candidacy is based on achievement in these first year courses as described under degree requirements.

Organic Chemistry[a]	(CHE 501 or 502 or 503)	3 credits each
Inorganic Chemistry I	(CHE 511)	3 credits
Quantum Chemistry I	(CHE 521)	3 credits
Chemical Thermodynamics	(CHE 523)	3 credits

—and at least two of the following:

Organic Chemistry[a]	(CHE 501, 502, or 503)	3 credits each
Inorganic Chemistry II	(CHE 512)	3 credits
Quantum Chemistry II	(CHE 522)	3 credits
Chemical Kinetics	(CHE 526)	3 credits
Statistical Mechanics	(CHE 528)	3 credits
Nuclear Chemistry	(CHE 529)	3 credits

Students entering with advanced standing and desiring placement out of any first year course must obtain the approval of the faculty member in charge of the course and of the Chairman. Such approvals must be filed in the Department Office.

Qualification to Candidacy

The qualifications of each first year graduate student will be reviewed by the faculty of the Department of Chemistry at the end of the spring semester. Students will be qualified to candidacy for a graduate degree upon successful completion of the Qualifying Examinations and the required graduate courses. Successful completion of the courses involves achievement of the grade point average indicated below.

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a Any one of the organic chemistry courses (501, 502, or 503) or their equivalent is required for all students. A student planning to specialize in organic chemistry is required to take all three of these courses during his first year.

Requirements for the M.S. Degree

A. Residence: One year minimum

B. Qualifying examinations

C. Language: Reading proficiency in German or another foreign language in which there exists a substantial body of chemical literature.

D. Formal course requirement: Successful completion (3.0 average [a] or above) of an approved course of study comprising at least twenty-four graduate credits.

E. Thesis: Upon acceptance of an M.S. thesis by a reading committee, the student is admitted to oral defense of his thesis. After satisfactory defense of the thesis before the committee, the Chairman of the Department recommends acceptance of the thesis to the Dean of the Graduate School.

Requirements for the Ph.D. Degree

A. Residence: Two years minimum

B. Qualifying examinations

C. Language: Reading proficiency in German, and in a second foreign language in which there exists a substantial body of chemical literature.

D. Formal course requirement: Successful completion (3.5 average[a]) of an approved course of study.

E. Cumulative examinations: The cumulative examination is intended to provide a means by which the student's depth of knowledge in a specialized area can be demonstrated. These examinations will be offered at eight stated dates each year in the three major areas of physical, inorganic and organic chemistry. A student must pass six examinations in a major area within the first two years after qualification to candidacy. At least two of these must be passed in the first year following qualification.

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[a] Based on the system A = 4.5, A– = 4.0, B = 3.5, B– = 3.0, C = 2.0, F = 0 for Chemistry Graduate Courses.

F. Thesis: Upon acceptance of a Ph.D. thesis by a reading committee, the student is admitted to oral defense of his thesis. After satisfactory defense of the thesis before the committee, the Chairman of the Department recommends acceptance of the thesis to the Dean of the Graduate School.

Doctoral Program in Chemical Physics

The doctoral program in chemical physics is intended to meet the needs of students whose interests lie in areas of both chemistry and physics. A graduate student who is admitted to either the chemistry or physics department may elect (with the consent of his department chairman) the chemical physics course program. A chemistry student may elect this program if he wishes to obtain more extensive training in physics than is normally required by chemistry departments. A physics student may elect the program if he wishes to obtain more extensive exposure to chemical systems than is normally obtained in physics departments. The mechanics of the program (admission, qualification, etc.) will be administered by the usual departmental procedures in either the chemistry or physics department. Thus the program is a course option for graduate students in chemistry or in physics[a]; each student must satisfy the requirements of his own department, except as modified below.

ADMISSION TO THE PROGRAM

A graduate student who has been admitted to the chemistry department may seek the consent of the chairman to enter the chemical physics program. The student should have a strong background in physics in the areas appropriate to his interest. A student who does not have such a background may be advised to take undergraduate courses (PHY 201 or 341 etc.) before entering the program.

QUALIFICATION

The usual procedure for qualification in the chemistry department will be followed (qualifying examinations and adequate performance in required courses). The course evaluation will be based on the required courses below; the student must have taken at least six of these courses at the time of evaluation.

REQUIRED COURSES

Twenty-seven hours of graduate courses including the following: (CHE 523) Chemical Thermodynamics; (PHY 343 or 503) Methods of Mathematical Physics; (PHY 501) Mechanics; (PHY 502) Electrodynamics; (CHE 521, 522 or PHY 511, 512) Quantum Mechanics; (CHE 528 or PHY 540) Statistical Mechanics.

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[a] A student who is admitted to physics should consult the physics section of this catalog.

A sample course plan for Chemistry graduate students is given below:

I	II
CHE 523 Thermodynamics	CHE 528 Statistical Mechanics
PHY 343 or 503 Mathematical Physics	PHY 502 Electrodynamics
PHY 501 Mechanics	CHE 522 Quantum Mechanics
CHE 521 Quantum Mechanics	

III
Optional Courses

RESEARCH

Selection of a research advisor will be made during the second semester of the first year as described in the chemistry program. The selection of the research advisor may be made in the physics department, subject to the approval of the department chairmen.

CUMULATIVE EXAMINATIONS

These examinations will usually be the chemistry cumulative examinations; however, a hybrid set of examinations may be recommended by an interdepartmental committee.

Courses

CHE 501 Structural Organic Chemistry

A discussion at an advanced level of the most important features in structural theory, such as steric hindrance and strain, conformation analysis, stereochemistry, aromaticity, resonance and simple Huckel theory, and the modern methods of structure determination.
Fall or Spring, 3 credits

CHE 502 Mechanistic Organic Chemistry

A consideration of the most important means of dissecting the detailed pathways of organic reactions. The use of substituent and medium effects on reactions proceeding through heteropolar, free radical and isopolar transition states is discussed; some unstable intermediates and unusual molecules are included.
Fall or Spring, 3 credits

CHE 503 Synthetic Organic Chemistry

A survey of the most important organic reactions from the viewpoint of synthetic utility, including many recent innovations in this field. The mechanisms of these reactions are discussed with the purpose of bringing out unifying features among them.
Fall or Spring, 3 credits

CHE 511 Inorganic Chemistry I

The crystal and molecular structure of inorganic compounds including complex hydrides, halides, chalconides, organo-metallic compounds and transition metal complexes will be surveyed. Chemical properties of and reactions leading to these compounds will be discussed.
Fall, 3 credits

EARTH AND SPACE SCIENCES

Professors: GOLDICH, PALMER, SCHAEFFER (*Chairman*), STROMGREN (*Adjunct*), WEYL
Associate Professors: CHIU (*Adjunct*), KALKSTEIN
Assistant Professors: DODD, HANSON, R. SMITH

Admission to Graduate Study

For admission to graduate study in the Department of Earth and Space Sciences, the following are required:

A. Baccalaureate degree in chemistry, physics, biology or one of the earth or space sciences from a department whose course requirements are equivalent to those at the State University of New York at Stony Brook.

B. A minimum grade point average of 3.00 (B) for undergraduate course work and a 3.00 (B) average in courses in the sciences and mathematics.

C. Acceptance by the Department of Earth and Space Sciences and by the Graduate School.

In exceptional cases a student not meeting requirements A. or B. may be admitted on a provisional basis.

Requirements for the M.S. Degree

A. Residence: one year

B. Language: Reading proficiency in French, German or Russian.

C. Graduate Courses: Successful completion (B average or above) of an approved course of study comprising at least 24 graduate credit hours. It is expected that at least six of these credit hours will be taken in one of the following: biology, chemistry, mathematics or physics.

D. Final Examination: A final written examination will be given. It will cover material studied in courses and information which the student is expected to obtain through supplementary reading and attendance at colloquia.

E. Thesis: A Master's thesis representing original research under the direction of a thesis advisor.

F. Oral defense of thesis: Upon acceptance of an M.S. thesis and passing of the final written examination, a committee will be appointed by the Department Chairman and the student will be admitted to an oral examination on his thesis.

G. Granting of the degree: A student who has passsed his oral examination and has met the requirements of the Graduate School may apply to the Dean of the Graduate School for the degree.

The Ph.D. Program

The Department will inaugurate a Ph.D. program in the near future. Qualified students who have the permission of the Department will then be able to transfer from the M.S. to the Ph.D. program without loss of credit for residence.

Courses

Advanced undergraduate courses carrying graduate credit

ESS 301 Optical and X-ray Mineralogy
ESS 302 Igneous Petrology
ESS 303 Sedimentary Petrology
ESS 304 Metamorphic Petrology
ESS 305 Field Geology
ESS 311 Advanced Paleontology
ESS 312 Advanced Stratigraphy
ESS 313 Systematic Paleontology
ESS 341 Astronomy and Galactic Dynamics
ESS 342 Interstellar and Galactic Astrophysics
ESS 361 Descriptive Oceanography
ESS 362 Physical Oceanography

Graduate Courses

ESS 501 Precambrian Geology

The succession of Precambrian rocks as exemplified in the Lake Superior district. Precambrian history, as interpreted with the aid of radiometric age determinations.
Spring, 3 credits

ESS 503 Advanced Field Geology

Advanced problems in field geology.
Fall and Spring, variable credit

ESS 511 Paleoecology

Methods and procedures for evaluating environments of the past using paleontologic and sedimentologic data.
Spring, 4 credits

ESS 512 Biostratrigraphy

The uses of paleontologic data in problems involving dating and correlation of rocks and interpretations of geologic history.
Spring, 3 credits

ESS 513 Micropaleontology

An introduction to the taxonomy, morphology, evolution, paleoecology and stratigraphic occurrence of foraminifera ostracods, conodonts, and other groups of microfossils. Laboratory work includes morphological study and special techniques applicable in the collection, preparation, study and photography of the various groups.
Fall 1968, 3 credits

ESS 521 Isotope Geology

Radioactive decay schemes useful for determining the age of rocks and minerals. Evaluation of the various methods and consideration of problems of interpreting data. Application of radioactive and stable isotopes to the study of geologic processes, as for example, metamorphic and magmatic activity, ore deposition, and crustal evolution.

Spring, 3 credits

ESS 522 Meteoritics

A study of the solid materials which strike the earth and their relation to earth and solar system history.

Spring, 2 credits

ESS 523 Geochemistry

The study of the distribution and chemical combinations of the earth including the atmosphere and the oceans.

Spring, 3 credits

ESS 553 Astrophysics I, Stellar Interiors

Introduction to the study of stellar interiors. Hydrostatic equilibrium. Analytical solutions (polytropics) stellar energy sources and stellar gravity sources. Main sequence stars, stellar evolution red giants, white dwarfs, pulsating stars, subnova and element synthesis.

Fall, 3 credits

ESS 554 Astrophysics II, Stellar Atmospheres

Theory of radiative transfer. Continuous spectrum of stars; the formation of lives; characteristics of absorption and emission lines; theory of line broadening; principles in the analysis of stellar spectra and determination of the abundance of the elements. Introduction to nucleosynthesis theory.

Spring, 3 credits

ESS 561 Climatic Change during the Pleistocene and Recent Time

The historical and geologic record of climatic changes during the last two million years is examined. The mechanisms responsible for climatic change are evaluated.

Spring, 3 credits

ESS 598 Seminar in Earth Sciences

A series of seminars discussing problems of current interest.

Fall, 2 credits

ESS 599 Research

Fall and Spring, Variable and repetitive credit

ENGLISH

Professors: P. ALEXANDER, ERDMAN,[a] JORDAN, KAZIN, LEVIN, LUDWIG,[b] L. SIMPSON, WEISINGER (*Chairman*)
Associate Professors: CREED, FIESS, FLEISHMAN,[b] GOLDBERG,[b] PEQUIGNEY, ROGERS, STAMPFER, THOMPSON
Assistant Professors: ABRAMS, BRETT, HALL, LORD, MILLER, SEARS, SHAW, WILSON

The Department of English offers programs leading to the degrees of Master of Arts and Doctor of Philosophy.

The program leading to the degree of Ph.D. in English combines a flexible pattern of advanced study with carefully guided training in college teaching and makes it possible for the student to complete his doctorate within four years after taking the B.A. or three years after the M.A. During his first two years of doctoral study he is expected (1) to take three 600-level seminars, (2) to prepare for the preliminary examination by reading independently and by taking 500-level courses where necessary, and (3) to teach for at least two semesters. After taking the preliminary examination, he will be free in his last year to complete his dissertation.

Fellowships and Assistantships

Applicants who will have earned only the Bachelor's degree or its equivalent prior to admission to graduate study at Stony Brook will be eligible for fellowship support and will not normally assume teaching responsibilities in the first year of graduate study. The Department participates in the University Fellowship Program and also in the NDEA Title IV Fellowship Program.

Applicants who will have either earned the degree of Master of Arts or completed equivalent work at other graduate schools prior to admission to Stony Brook will be eligible for Graduate Assistantships with a stipend of $2,575 for the academic year.

Tuition is waived for holders of fellowships and graduate assistantships.

Admission to the M.A. Program

For admission to graduate study in English the following are required:

A. A Bachelor's degree from a recognized institution.

B. An average of at least B in undergraduate literature courses.

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[a] Not in residence, Fall semester 1967.
[b] Not in residence, Academic Year 1967-68.

C. An official transcript of undergraduate record.

D. Letters of recommendation from three previous instructors.

E. Proficiency in a foreign language equivalent to two years of college work.

Any deficiencies in these requirements shall not automatically bar admission, but it is understood that inadequacies in undergraduate preparation will normally require the student to take additional work, the amount to be determined by the Graduate Committee, and not to be used to fulfill any specific M.A. degree requirements.

Requirements for the M.A. Degree

A. Formal course requirements: A student preparing for the degree of Master of Arts is required to take eight one-semester courses, normally amounting to twenty-four credit hours. These courses will include one graduate course in the literature of a *period,* one graduate course devoted to one or two authors, EGL 590 Master's Paper Direction, and five additional courses, at least four of which are to be in the English Department. Of these five additional courses, one may be a graduate or advanced undergraduate (200- or 300-level) course in a field related to English. No more than two 200- or 300-level courses will be counted toward the degree. Graduate students admitted to 200- or 300-level courses in English shall be required by the instructor to do additional reading and to submit at least two papers, one of which shall be a research paper.

Before his Master's degree is granted, the student will be required to have taken one course in Shakespeare and one course in Chaucer or Milton. Such a course on the graduate level will also fulfill the requirement of one graduate English course devoted to one or two authors as stated above.

B. Performance: An average grade of B in all course work is the minimum required, but no more than two C's will be permitted.

C. M.A. Paper: In addition to taking eight courses, the student must also write a substantial (twenty-five to thirty-five page) scholarly or critical study on an approved topic, normally as part of his work in EGL 590.

D. Departmental Examination: A student must pass the written Departmental Examination which is designed to test his mastery of analytical and scholarly techniques.

E. Foreign language proficiency: The student must demonstrate as early as possible his ability to read texts of moderate difficulty in one approved foreign language.

Satisfying these minimum requirements will not guarantee a degree. The final departmental decision as to the awarding of the degree will be made by the Graduate Program Committee.

Admission to the Ph.D. Program

Applicants who have either earned the degree of Master of Arts or completed equivalent work at other graduate schools prior to admission to Stony Brook must submit the following:

A. Official transcripts of both undergraduate and graduate work.

B. Letters of recommendation from three previous instructors, two of whom must have instructed the applicant during his graduate study.

C. A sample of recent critical or scholarly writing. This requirement can be met by the submission of the Master's thesis or a seminar paper.

Applicants who have earned the M.A. at Stony Brook will be admitted to the Ph.D. program only upon recommendation of the Graduate Program Committee of the English Department.

Every student is *provisionally* admitted to study toward the degree of Ph.D. in English until he has passed the Departmental qualifying examination.

The Department invites interested applicants to visit the campus to discuss their qualifications and plans for graduate study with the Director of Graduate Studies in English and with other members of the Department.

Requirements for the Ph.D. Degree

A. Qualifying Examination: To demonstrate his readiness for doctoral study, the student during his first semester in residence must take an oral examination administered by a committee appointed by the Graduate Committee of the Department. If he passes, his status will be changed to "admited to study toward the doctoral degree;" if he fails, he will be re-examined within two months at his request and with the approval of the examining committee. He may choose to be

examined immediately after his M.A. paper has been approved at the end of his first year of graduate study.

The examination is designed to test the student's ability to deal with what he knows and understands and to assess his response to literature or to linguistic problems; it will not cover all of English literature or a whole part of it but concentrate on a work or related works chosen by the student, with the approval of the Graduate Committee, and their historical and literary context. The student may be examined on the subject of his M.A. paper. Normally the examination will last only one hour; it will be conducted by a committee of three members, two of whom have not taught the student in a course or seminar.

B. Course requirements and program: In order to keep requirements at a minimum and make it possible to design programs to fit particular needs, the student is *required* to take and pass English 500 and only three 600-level seminars in English and American Literature and Language. He must take at least one course at either the 600- or 500-level, during each of the first three semesters of his first two years of study toward the Ph.D. degree, that is, in the two years immediately following the M.A. or its equivalent. Students who intend to work for the doctoral degree are urged to take EGL 500 (Methods of Literary Scholarship) during their first semester at Stony Brook. Students who wish to terminate their graduate study with the M.A. degree may elect EGL 500.

The student's advisor may recommend and the Graduate Committee may require that the student pursue his studies through the more formal guidance of courses taken in addition to the required seminars.

It is recommended that when the student is teaching he take no more than two courses in any combination of 600-level seminars and 500-level courses, and that when he is not teaching he take no more than four courses in any combination of 600-level seminars and 500-level courses.

Whenever there is a prerequisite to a 600-level seminar, the course which has been designated as the prerequisite may, with the permission of the instructor of the seminar, be taken concurrently with the seminar.

The average of the three grades in the three required 600-level seminars must be B or higher.

Every student must have passed (1) one course in Shakespeare,

(2) one course in either Chaucer or Milton, and (3) one course in linguistics or the history and structure of the English language. These requirements can be met by courses taken while the student was an undergraduate.

C. Residence requirements: Every student will be considered in full-time residence during any semester in which he: (1) is taking at least one 500-level course or 600-level seminar or is, in the opinion of his advisor, properly preparing himself for the Ph.D. preliminary examination; (2) is holding no position other than that required under "The Teaching Program" below; (3) is registered for EGL 699 Directed Reading for Doctoral Candidates for 3, 6, 9, or 12 hours, depending on the number of other courses he is taking and his teaching assignment, the total of all these credits and teaching hours to be no more than 12.

D. Teaching program: Every student is required to teach responsibly one course for at least two semesters and no more than four. The English Department regards training in teaching as a necessary and valuable part of work toward the Ph.D. degree. Such training may take the form of apprenticeship to a senior professor during the first and, possibly, second semester of preparation for the doctoral degree. During the second or later semesters, in some special cases possibly even during the first semester, the student may be asked to instruct in sections of large lecture courses or even to conduct his own section of the composition course, his own section of EGL 151, 161, 171, or a section of one of the introductory courses in Humanities. During his apprenticeship and his teaching, the student will receive guidance in discussions with the Director of Teaching or the professor he assists, advice from senior members of the department who visit his classes, participation in staff meetings of large courses, and informal seminars in which he and his fellow students are joined by senior members of the staff.

During those semesters in which he is teaching, the student is required to be enrolled in EGL 697 and/or EGL 698, Practica in Teaching.

The Director of Teaching Interns for the English Department will, upon application by the student, decide to what extent a student's teaching experience elsewhere will satisfy the requirements at Stony Brook.

E. Foreign language requirements: The student must complete one of two options before taking the preliminary examination.

Option I. The student must, on examination, demonstrate his ability to translate and/or comprehend writings of moderate difficulty in two foreign languages appropriate to his area of study and hence to make use of relevant literary and scholarly writings in those languages.

Option II. The student must, on examination, demonstrate (1) his ability to read, understand, and speak well one living foreign language, or his ability to read and understand well one classical language, appropriate to his area of study, and (2) his knowledge of the major literature of that language in the original language, and hence his ability to make full use of the literature of another language.

The passing of the reading and/or comprehension examination at the M.A. level shall *not* be sufficient evidence that the student has met this option.

F. Preliminary Examination: Before the end of his fourth semester in full-time residence after he has received the M.A., the student will be required to take and pass a series of examinations testing his knowledge and critical understanding of the literature of four fields in English literary history.

The student will choose his four fields from the following list:

I Beginnings to 1550
II 1550-1660
III 1660-1780
IV 1780-1890
V American Literature: Beginnings to 1870
VI British Literature: 1870-Present and American Literature: 1870-Present
VII Language and Linguistics*

One of the fields chosen must be that of the doctoral dissertation. For each of the three remaining fields the student should prepare and submit reading lists for the approval of the Graduate Program Committee of the Department before the end of the second semester of residence and *must* do so no later than the end of the third semester of residence.

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* The student who elects to be examined in the area of Language and Linguistics will ordinarily also choose to be examined in Field I, "Beginnings to 1550."

The Preliminary Examination will normally consist of a one-hour oral examination in the field of the dissertion and one three-hour written examination on each of the other three fields. The student who fails one or more of these examinations may be granted re-examination at the discretion of the Graduate Program Committee of the Department.

G. Dissertation: The dissertation may take the form of either a single long study or a series of related papers of the length of articles in learned journals. This study (or these studies) may be critical in nature as well as scholarly.

The student is advised to seek a dissertation director from among the three professorial ranks of the Department as soon as he has passed the Preliminary Examination or even earlier. The student must prepare a statement setting out the scope and method of the dissertation and submit it to his director, who will then forward the statement to the Graduate Program Committee of the Department for its approval. After the statement has been approved, the dissertation director will meet with the Graduate Program Committee to discuss the choice of a second reader of the dissertation.

Both the director and the second reader of the dissertation must recommend acceptance of the dissertation before it can be approved by the Graduate Program Committee of the Department. In cases in which the director and the second reader disagree, the Graduate Program Committee will appoint a third reader.

Matters Pertaining to Both Degrees

A. Advisory Program: Every graduate student will at the beginning of his graduate studies at Stony Brook be assigned an advisor. The advisor will help the student plan his program on the basis of his wishes and needs and in the light of his total preparation, both undergraduate and graduate. The student's advisor and no one else must sign the student's course card during registration. On occasion the advisor may recommend that the student take more or fewer courses than he wishes to. The student is advised to make the acquaintance of his advisor early.

B. Extensions of Time Limits: Extensions of time (beyond two years for the M.A. degree and three years for the Ph.D. degree) are granted at the discretion of the Graduate Program Committee of the Department and normally for one year at a time.

C. English Graduate Colloquium: The Colloquium is designed to foster a scholarly community by bringing the faculty and graduate students together informally to discuss literature and related matters. All graduate students holding the M.A. or admitted to Ph.D. study with the equivalent of the M.A. are members of the Colloquium. M.A. candidates may participate if they choose. Students will elect the officers from among themselves to plan and direct the meetings of the Colloquium. Students and members of the faculty will be invited to present papers, or lectures, or to participate in panel discussions.

Courses

Advanced undergraduate English courses, numbered from 200-399, will often be part of a beginning graduate student's program. (See restrictions under *Requirements for The M.A. Degree* above.) A list of these courses can be found in the English section of the *Undergraduate Bulletin.*

Graduate courses in the 500 series are open to all graduate students. Courses in the 600 series are open only to students admitted or provisionally admitted to study for the Ph.D. degree. All graduate courses normally carry three credits.

Each course in the 600 series to be offered in a given semester will be described by the instructor in some detail in a special Departmental announcement prepared and distributed toward the end of the semester prior to that in which it is to be offered.

None of the courses numbered 690-699 can be taken to satisfy the requirement of three seminars as stated in *Requirements for the Ph.D. Degree* above.

Courses Open to All Graduate Students

EGL 500 Introduction to Graduate Study

Introduction to the major resources, techniques, and approaches involved in literary scholarship and criticism, with illustrative practical applications.
Mr. Stampfer and Staff
Fall, 3 credits

EGL 501 Introduction to Old English Language and Literature

After a brief introduction to the language, the student will read in Old English and discuss a number of shorter Old English poems from *Caedmon's Hymn* to *The Battle of Maldon.*
Mr. Creed
Fall, 3 credits

EGL 502 Beowulf

An intensive study, largely from a literary point of view, of the Old English original of this earliest recorded English epic.
Mr. Creed
Spring, 3 credits

EGL 506 Studies in the Medieval Period

A study of major works of the Middle English period (exclusive of Chaucer) in relation to the traditions of chivalry and Christianity. Readings will include *Pearl, Sir Gawayne and the Green Knight,* Malory's *Death of Arthur,* and selected lyrics.
Messrs. Jordan, Creed
3 credits

EGL 507 Special Topics in Chaucer

A study of the principles of narrative structure in the *Canterbury Tales*. Chaucer's works will be examined in the light of modern and medieval conceptions of narrative.
Prerequisite: An undergraduate course in Chaucer or consent of instructor.
Mr. Jordan
Spring, 3 credits

EGL 512 Special Topics in Shakespeare I

The development of the Elizabethan theater; the London companies; Shakespeare's early theatrical connections; his development as a dramatist with special reference to selected plays.
Messrs. Alexander, Levin, Stampfer
Fall, 3 credits

EGL 513 Special Topics in Tudor and Stuart Drama

This course each year will focus upon some specific topic in the field of Tudor and Stuart drama exclusive of Shakespeare.
Mr. Levin
Spring, 3 credits

EGL 515 Shakespeare's Roman Tragedies

This course will focus on one area of Shakespeare's genre writing, its sources, its plots, and its sense of political legitimacy: Shakespeare's evolving sense of Rome as a civilization.
Mr. Stampfer
3 credits

EGL 517 Special Topics in Shakespeare II

This course is a continuation of EGL 512 but may be taken independently.
Messrs. Alexander, Levin, Stampfer
Spring, 3 credits

EGL 528 Andrew Marvell

Marvell's poetry will be studied, analytically and in the contexts of history and his biography, of literary traditions and critical commentaries.
Mr. Pequigney
3 credits

EGL 535 Alexander Pope

Study of Pope's major poems, translations, and miscellaneous prose, in the context of his life and times.
Mr. Rogers
3 credits

EGL 536 Studies in the Later Eighteenth Century

This course each year will focus upon some specific topic in the field. The topic for 1967-68 will be the works of Samuel Johnson and James Boswell.
Mr. Rogers
Fall, 3 credits

EGL 537 Studies in Eighteenth Century Fiction

Critical investigation of the four major mid-century novelists (Richardson, Fielding, Smollett, and Sterne) and the current state of scholarship in the field, with emphasis on relationships and distinctions among the latter three.
Mr. Goldberg
3 credits

EGL 541 Studies in Romantic Poetry

An examination of the major poems of Blake, Wordsworth, and Keats, stressing the revolutions in poetry and philosophy which marked this period.
Mr. Kazin
3 credits

EGL 542 Wordsworth and Coleridge

An intensive study of the works of Wordsworth and Coleridge centering on Wordsworth's *The Prelude*.
Mr. Abrams
3 credits

EGL 558 Matthew Arnold

An analysis of Arnold as a critic of Victorian culture, a literary critic, and poet, emphasizing his place in scientific, religious, literary and educational controversy.
Mr. Ludwig
3 credits

EGL 565 James Joyce

An intensive study of *Ulysses* with all of Joyce's other works brought into the discussion.
Mr. Ludwig
Fall, 3 credits

EGL 573 Mark Twain and the Tradition of American Humor

Some acquaintance with the work of Mark Twain, particularly *Huckleberry Finn,* will be assumed. The course will give attention to the predecessors of Twain, especially the humorists of the Old Southwest, but it will concentrate on the chronology of Twain's career.
Mr. Fiess
Fall, 3 credits

EGL 575 Selected American Writers

The seminar will be devoted to a parallel examination of the works and characters of Hawthorne and Melville with special attention to their methods and literary invention. Their relationships with other literary contemporaries will be thoroughly explored.
Messrs. Kazin, Fiess
3 credits

EGL 576 Melville

The seminar will concern itself with all of Melville's work; prior acquaintance with Melville's more familiar works like *Moby Dick* will be assumed. Textual, biographical and critical approaches will be used.
Mr. Fiess
Spring, 3 credits

EGL 578 Henry James

A study of the major novels, critical essays, and biographical and bibliographical problems of Henry James.
Mr. Thompson
Fall, 3 credits

EGL 579 Twentieth Century American Poetry

An intensive study of selected major American poets of the twentieth century.
Mr. Kazin
Fall, 3 credits

EGL 583 The Structure and History of the English Language

A study, employing the techniques of modern linguistics, of the structure of present-day American English, with some attention to selected earlier periods for comparison.
Mr. Creed
3 credits

EGL 590 Master's Paper Direction

EGL 599 Independent Studies

Work with one or more instructors designed to strengthen a weakness or intensify an area of study leading to advanced work.
Staff
Fall and Spring, 3 credits

Advanced Seminars

EGL 601 Problems in the History and Structure of the English Language

Investigations, employing the techniques of modern linguistics, in the synchronics and diachronics of the English language.
Variable and repetitive credit

EGL 602 Problems in Bibliography, Editing, and Textual Criticism

Analysis of particular problems in establishment of texts, attribution, and analytic and descriptive bibliography, with attention to methods and principles.
Variable and repetitive credit

EGL 603 Problems in Literary Theory and Criticism

Topics in the theory and history of literary criticism, considering major critical documents and the theoretical problems that arise in the formal discussion of literature.
Variable and repetitive credit

EGL 604 Problems in Literary Analysis

Discussion of various modes and techniques of practical criticism, ranging from mythic and archetypal criticism to problems in versification and prosody.
Variable and repetitive credit

EGL 605 Problems in Convention and Genre

Examination of selected topics in comedy, tragedy, epic, pastoral, and satire, as well as conventions of subject matter and technique.
Variable and repetitive credit

EGL 606 Problems in Period and Tradition

Study of the relation of individual works or writers to broader historical developments.
Variable and repetitive credit

EGL 607 Problems in Individual Authors

An investigation of various modes of dealing with a body of work by a single writer.
Variable and repetitive credit

EGL 608 Problems in the Relation of Literature to Other Disciplines

Selective investigation of the relevance of such disciplines as anthropology, communication theory, cultural history, history of ideas, linguistics, philosophy, psychology, and sociology to the study of literature.
Variable and repetitive credit

EGL 609 Problems in Comparative Literature

Study of English works or writers in their relation to other literatures.
Variable and repetitive credit

Special Advanced Courses

EGL 690 Thesis Research

Variable and repetitive credit

EGL 697 Practicum in the Teaching of English Composition

The methods and techniques of teaching English composition; supervised instruction, conferences, and group discussions.
Variable and repetitive credit

EGL 698 Practicum in the Teaching of Literature

The methods and techniques of teaching literature; supervised instruction, conferences, and group discussions.
Variable and repetitive credit

EGL 699 Directed Reading for Doctoral Candidates

Variable and repetitive credit

The Ph.D. degree requires at least one year (two semesters) of residence beyond the M.A. During each semester of residence the student will ordinarily take twelve credits per semester (nine if he is a teaching or research assistant). He must prove his proficiency in a second foreign language prior to taking qualifying examinations, and he must write a dissertation. The qualifying examinations will test the student's proficiency in his major field and two minor fields (see below, *Ph.D., Selection of Fields*).

Ph.D. programs will of necessity vary from individual to individual. The normal program, to be worked out between the student and his advisor, will ordinarily include four reading seminars, two each semester. In some instances, a directed reading course may be substituted for a reading seminar, and such other directed reading courses as may be appropriate to the student's program may also be taken. Furthermore, the student may have to take some lecture courses in order to fill gaps in his background. A student who has taken his M.A. degree at another institution may be required by the department to take one research seminar as well. Because the graduate program is designed to prepare the student for a career of teaching and scholarly research, great emphasis will be placed on extensive reading, primarily to enable the student to acquire a solid foundation of historical knowledge and to prepare him properly for his Ph.D. qualifying examinations in his major field and his two minor fields.

All Ph.D. students will be required to take a one-hour non-credit course in Teaching History at the College Level. This will usually be done in connection with section teaching in the History of Western Civilization, U.S., British, or Latin American History.

PH.D., LANGUAGE REQUIREMENTS

A reading knowledge of two foreign languages is required. One of these will ordinarily be either French or German. However, the department may permit the student to substitute any other foreign language, provided there exists a rich scholarly literature in it, or it is demonstrably necessary for the student's research. Because language proficiency is an essential prerequisite for course work, and especially for graduate seminars, the student is expected to complete his language preparation before commencing the doctoral program. Under no circumstances will a student be permitted to take the qualifying examinations until he has passed the required language examinations.

PH.D., SELECTION OF FIELDS

The student must choose for special study a major field and two minor fields of history.

A major field will consist of one of the Divisions, listed below under *Fields of*

Examination; however, a substantial part of the major field may be selected by the student in consultation with his advisor for special emphasis in the oral examination (for further details see below under *Fields of Examination*). Ordinarily, it is also from the sphere of special emphasis within the major field that the student will ultimately select his dissertation topic.

A minor field will generally consist of one of the subdivisions listed below the Divisions. Since requirements within the different fields of history vary (see *Examples,* below), the choice and exact scope of the two minor fields will likewise be determined by the advisor, in consultation with the student and one of the instructors in each of the two minor fields. In all instances, one of the two minor fields (and both in the case of U. S. History) must be clearly removed in EITHER TIME OR SPACE from the student's major field. In other words, the separation must be either along geographical or chronological lines.

Examples: a) If a student's major field is U. S. History, his two minor fields must be chosen from either Latin American, East Asian, or European History.

b) If a student's major field is Modern Europe, one of his minor fields must either be in Ancient, Medieval, or in any period of history on another continent, while his second field must be one of the Early Modern European subdivisions.

c) If a student's major field is Latin America, one of his minor fields must be a subdivision outside the Latin American field. For his second minor field, which must be that Latin American period which is NOT his major field, the student may select, in consultation with his advisor, a special area of concentration, e.g.: Mexico and Central America; Brazil; the Andean Republics; Southern Latin America, etc.

The minor fields will be passed by two written examinations, three hours each in length; the major field by a two-hour oral examination. During the oral examination in the major field, one representative from each of the student's minor fields will be present and be given an opportunity to examine the candidate on any questions that may have arisen from his written examinations in the minor fields.

Admission to Doctoral Candidacy

A student will be considered a candidate for the doctorate after he has met his language requirements and passed his qualifying examinations. After admission to candidacy, a student will register for dissertation credits in consultation with his advisor.

Fields of Examination

The Divisions (see below) constitute the major fields, whereas the minor fields will be chosen from the various subdivisions listed below the Divisions. Thus, a student's major field may be Division IV, Modern Europe (1815-Present), with

special emphasis given to certain countries, to diplomatic, economic or intellectual history, etc. Whatever the emphasis may be, the student will be held responsible for demonstrating an overall comprehension of his entire major field (Division). For the selection of minor fields, see above, *Ph.D., Selection of Fields.*

At present, the department is equipped to offer examinations in all seven Divisions, but can offer dissertation fields only in U. S., Modern European, Latin American and Medieval History. The department anticipates adding Early Modern Europe as a dissertation field as soon as additional faculty appointments in this field are made.

I. The Ancient World
II. The Medieval World, 500-1500
III. Early Modern Europe
    1. Renaissance and Reformation, 1300-1648
    2. Tudor and Stuart and Early Hanoverian England, 1485-1760
    3. The Age of Enlightenment and Revolution, 1648-1815
IV. Modern Europe (1815-Present)
    Subdivisions to be determined by consultation with advisor.
    Guidelines: Approximately 150 years and three major countries or: approximately 100 years for entire area, with emphasis on diplomatic, or intellectual, or social, or ecomonic, etc.
V. Latin America
    1. Latin America to Independence
    2. Latin America since Independence
VI. East Asia
    1. Traditional China to 1800
    2. China since 1800
VII. United States of America
    1. Colonial and Early National Period to 1824
    2. National Period since 1824

With the consent of the departmental Graduate Committee, a student may define a field or fields not included in this above list (e.g., Expansion of Europe). In a few cases, where advanced work outside the Department of History is an integral part of the student's preparation for a professional career (e.g., preparation in science for historians of science, or in economics for economic historians), the Committee will consider a request to substitute such advanced work in other departments for one of the minor fields, provided that those departments offer work on the graduate level.

Courses

Advanced undergraduate history courses, numbered from 201-399, will often be

part of a beginning graduate student's program. A list of these courses can be found in the History section of the *Undergraduate Bulletin.*

Graduate courses in the 500 series, unless otherwise indicated, are reading seminars, those in the 600 series are research seminars in the fields listed. Seminars normally carry three credits.

HIS 501 Reading Seminar in Ancient History

HIS 502 Reading Seminar in Medieval History

HIS 503 Reading Seminar in Renaissance and Reformation

HIS 504 Reading Seminar in Western Europe, 1500-1789

HIS 505 Reading Seminar in Western Europe since 1789

HIS 506 Reading Seminar in Central Europe, 1500-1789

HIS 507 Reading Seminar in Central Europe since 1789

HIS 508 Reading Seminar in Eastern Europe, 1505-1801

HIS 509 Reading Seminar in Eastern Europe since 1801

HIS 510 Reading Seminar in Intellectual European History

HIS 521 Reading Seminar in American Colonial History

HIS 522 Reading Seminar in The American Revolution, 1760-1789

HIS 523 Reading Seminar in American Constitutional Origins and Development

HIS 524 Reading Seminar in The Age of Jefferson and Jackson

HIS 525 Reading Seminar in Civil War and Reconstruction

HIS 526 Reading Seminar in United States History, 1877-1929

HIS 527 Reading Seminar in United States History 1929—Present

HIS 528 Reading Seminar in American Industrial Society to 1900

HIS 529 Reading Seminar in American Industrial Society since 1900

HIS 530 Reading Seminar in Social and Intellectual U. S. History to 1865

HIS 531 Reading Seminar in Social and Intellectual U. S. History since 1865

HIS 532 Reading Seminar in U. S. Diplomatic History

HIS 541 Reading Seminar in Latin America and the Outside World

HIS 542 Reading Seminar in Modern Mexico

HIS 543 Reading Seminar in Colonial Latin America

HIS 544 Reading Seminar in Latin America since Independence

HIS 545 Reading Seminar in Brazilian History

HIS 552 Reading Seminar in Social and Economic History of England, 1785—Present

HIS 553 Reading Seminar in Tudor and Stuart England

HIS 554 Reading Seminar in Modern British History

HIS 555 Reading Seminar in British Empire History

HIS 561 Reading Seminar in East Asian History

HIS 581 Supervised Teaching

HIS 582 Directed Reading for M.A. Candidates

Variable and repetitive credit

HIS 583 Seminar in Historiography

HIS 601 Research Seminar in Ancient History

HIS 602 Research Seminar in Medieval History

HIS 603 Research Seminar in Renaissance and Reformation

HIS 604 Research Seminar in Western Europe, 1500-1789

HIS 605 Research Seminar in Western Europe since 1789

HIS 606 Research Seminar in Central Europe, 1500-1789

HIS 607 Research Seminar in Central Europe since 1789

HIS 608 Research Seminar in Eastern Europe, 1505-1801

HIS 609 Research Seminar in Eastern Europe since 1801

HIS 610 Research Seminar in Intellectual European History

HIS 621 Research Seminar in American Colonial History

HIS 622 Research Seminar in The American Revolution, 1760-1789

HIS 623 Research Seminar in American Constitutional Origins and Development

HIS 624 Research Seminar in The Age of Jefferson and Jackson

HIS 625 Research Seminar in Civil War and Reconstruction

HIS 626 Research Seminar in United States History, 1877-1929

HIS 627 Research Seminar in United States History, 1929—Present

HIS 628 Research Seminar in American Industrial Society to 1900

HIS 629 Research Seminar in American Industrial Society since 1900

HIS 630 Research Seminar in Social and Intellectual U. S. History to 1865

HIS 631 Research Seminar in Social and Intellectual U. S. History since 1865

HIS 632 Research Seminar in United States Diplomatic History

HIS 641 Research Seminar in Latin America and the Outside World

HIS 642 Research Seminar in Modern Mexico

HIS 643 Research Seminar in Colonial Latin America

HIS 644 Research Seminar in Latin America since Independence

HIS 652 Research Seminar in Social and Economic History of England, 1785—Present

HIS 653 Research Seminar in Tudor and Stuart England

HIS 654 Research Seminar in Modern British History

HIS 655 Research Seminar in British Empire History

HIS 661 Research Seminar in East Asian History

Variable and repetitive credit

HIS 682 Directed Reading for Ph.D. Candidates

HIS 699 Research for Ph.D. Candidates

Variable and repetitive credit

MATHEMATICS

Professors: ADLER, BARCUS (*Acting Chairman*), DOSS, LISTER,[a] SZUSZ
Associate Professors: W. FOX, ISAACS (*Visiting*), WEHN, ZAUSTINSKY
Assistant Professors: BACHELIS, D'ALARCAO, HACHIGIAN, KUMPEL, OH, SCHROER, SHANTARAM, TRAMER

Admission to Graduate Study

For admission to graduate study in mathematics, the following are required:

A. A baccalaureate degree with preparation substantially equivalent to that required of mathematics majors at this institution.

B. Three letters of recommendation from members of the mathematics faculty under whom the applicant has taken courses.

The Departmental recommendation for admission will be based upon signs of exceptional ability in mathematics as indicated by these letters and the student's grades.

In certain cases a student whose background in mathematics contains gaps may be admitted on a provisional basis. Upon admission the student will be informed of the requirements which he must satisfy in order to be admitted to full standing.

Requirements for the M.A. Degree

Aside from the general requirements of the Graduate School, the single Departmental requirement is the successful completion of a comprehensive examination designed to test general proficiency in the fields of real and complex analysis, algebra, and some branch of geometry or topology. Syllabi and bibliographies indicating the nature and scope of the examination will be provided. Students will prepare for the examination in regularly organized courses and, with the occasional assistance of the staff, through independent study. Students who are admitted to full standing and are studying full-time will normally take the examination after one calendar year of preparation.

The Ph.D. Program

The Department will inaugurate a Ph.D. program in September, 1967. Information concerning admission, degree requirements, and curriculum may be obtained from the Chairman of the Department.

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[a] Not in residence, Academic Year 1967-68.

Courses

(Prerequisites may be satisfied by equivalent material taken at other universities or by independent study.)

Advanced Undergraduate Courses

MAT 301 Introduction to Complex Analysis

Holomorphic functions. The Cauchy-Riemann equations, Cauchy's theorem, Taylor series. Maximum modulus theorem. Meromorphic functions. Laurent series, the Cauchy residue theorem.
Prerequisite: Advanced Calculus.

Fall, 3 credits

MAT 302 Introduction to Real Analysis

Functions of bounded variation. Lebesgue and Lebesgue-Stieltjes measures and integrals, and the corresponding theorems of Fubini and Radon-Nikodym. Basic properties of L_2.
Prerequisite: Advanced Calculus.

Spring, 3 credits

MAT 312 Introduction to Topology

Basic topological properties; convergence, continuity, compactness, connectedness. Construction of spaces, metrics, local properties, and topics selected from homotopy, covering spaces, simplicial homology.
Prerequisite: Advanced Calculus, Algebra I (Groups, rings, and fields).

Fall, 3 credits

MAT 323 Introduction to Differential Geometry

Local theory of curves and surfaces in Euclidean space: fundamental forms, curvature, geodesics. Introduction to global differential geometry.
Prerequisite: Advanced Calculus.

Fall, 3 credits

MAT 331 Algebra II

Elementary group theory; composition series, the Sylow theorems, the fundamental theorem of Abelian groups. Field extensions; the splitting field of a polynomial, the fundamental theorem of Galois theory.
Prerequisite: Algebra I.
Spring, 3 credits

Graduate Courses

Graduate students should consult their academic advisors and instructors in regard to prerequisites.

MAT 502, 503 Algebraic Structures

Topics selected from: modules over principal ideal domains, structure theorems for groups, linear transformations, bilinear forms and multilinear algebra, factorization theory, field extensions and Galois theory, categories and functors.
4 credits each semester

MAT 512, 513 Real Analysis

The real number system and the Euclidean spaces, general topology, measure and integration theory, Banach spaces and functional analysis.
4 credits each semester

MAT 522, 523 Complex Analysis

Holomorphic, meromorphic, and harmonic functions on domains of the plane, the sphere, and Riemann surfaces; analytic continuation, universal covering spaces, and classification of the simply connected Riemann surfaces.
4 credits each semester

MAT 532, 533 Algebraic Topology

Simplicial and singular homology and cohomology; the axioms for homology and cohomology theories; homotopy groups; the Hurewicz theorem, obstruction theory, Fibre spaces; spectral sequences; cohomology operations and applications.
4 credits each semester

MAT 542, 543 Differential Geometry

Differentiable manifolds and submanifolds, tensor bundles, theorems of Stokes, Froebenius, and deRham; linear connections, Riemannian manifolds and the Riemannian connection, geodesics, elements of Morse theory for Riemannian spaces, relations between curvature and the topology of the space.
4 credits each semester

MAT 552, 553 Logic

Formal development of the lower predicate calculus through the Lowenheim-Skolem-Godel completeness theorem; examples of normalized theories; introduction to recursive functions, the Godel incompleteness theorem and the decision problem.
4 credits each semester

MAT 602, 603 Topics in Algebra

4 credits each semester

MAT 612, 613 Topics in Analysis

4 credits each semester

MAT 632, 633 Topics in Topology

4 credits each semester

PHYSICS

Professors: BALAZS,[f] COURANT,[b,g] DRESDEN,[a] EISENBUD, FEINGOLD,[f] FINOCCHIARO (*Visiting*), D. FOX, M. GOLDHABER (*Adjunct*),[g] GOOD, LAMBE,[j] B. LEE,[b] L. LEE,[c] MARTIN (*Visiting*),[b] MOSHINSKY (*Visiting*), MUETHER,[f] NE'EMAN (*Visiting*),[b] POND (*Chairman*), SCHWINGER (*Visiting*),[b] STRASSENBURG, TOLL, YANG[d]

Associate Professors: AMES, CHIU,[h] CRAIG,[g] DE ZAFRA, FURLAN (*Visiting*),[b] KAHN,[f] KAO, KIRZ, LEE-FRANZINI, MAHOUX (*Visiting*), MOULD, SILSBEE, SKOLNICK,[i] SWARTZ, THADDEUS (*Adjunct*)

Director of the Physical Laboratory: EKLUND[e]

Assistant Professors: COLE, EMMONS, FOSSAN, A. GOLDHABER,[b] GRAF, GRANNIS, GROENEVELD,[b] HWA,[b] KAYSER,[b] KRAMER, Y. LEE, PAUL, WEINBERG

Admission to Graduate Study

For admission to graduate study in physics, the following are required:

A. Baccalaureate degree in physics from an accredited institution, with departmental course requirements in physics equivalent to those at this institution (including courses at the junior and senior level in Electromagnetic Theory, Mechanics, Methods of Theoretical Physics, Quantum Mechanics and Modern Physics, Advanced Laboratory).

B. A minimum grade average of B in all undergraduate course work, and of B in physics, mathematics, and chemistry.

C. Acceptance by the Department of Physics and by the Graduate School.

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a Executive Officer, Institute for Theoretical Physics
b Member, Institute for Theoretical Physics
c Director, Nuclear Structure Laboratory
d Director, Institute for Theoretical Physics
e Associate Director, Nuclear Structure Laboratory
f Not in Residence, Academic Year 1967-68
g Physicist, Brookhaven National Laboratory, on part-time appointment at Stony Brook
h Member, NASA Goddard, on part-time appointment at Stony Brook
i Associate Director of Instructional Resources Center
j Director of Instructional Resources Center and Assistant Vice Chancellor for Instructional Resources and Informational Services of SUNY

In special cases, a student not meeting requirements A. and B. may be admitted on a provisional basis. Upon entrance, the student will be informed of the requirements he must satisfy for the termination of the provisional status.

First-Year Program

The student's program for the first year of graduate study will be determined on the basis of past records and an interview given at the beginning of the first semester.

Requirements for the M.A. Degree

A. Residence: one year.

B. Courses: The student must complete a program of courses which is approved by his faculty advisor and which includes PHY 501 (Analytical Mechanics), PHY 502 (Electrodynamics), and PHY 511 (Quantum Mechanics I).

C. Final examination: A final examination will be given, covering both material studied in the course work and information which the student is expected to attain through supplementary reading and attendance at colloquia and seminars.

The Ph.D. Program

While there are no formal course requirements for advancement to candidacy for the Ph.D., it is expected that most students will be advised to take courses in preparation for the preliminary examination. The following constitutes a sample program for a student who is admitted with no special conditions to satisfy, and who holds a teaching assistantship:

First Semester

Analytical Mechanics
Quantum Mechanics I
Methods of Mathematical Physics I

Second Semester

Methods of Mathematical Physics II
Electrodynamics
Quantum Mechanics II

Third Semester

Advanced Quantum Mechanics
At least two of the following courses:
Elementary Particles I
Nuclear Physics I
Solid State Physics I

Fourth Semester

Statistical Mechanics
Electives

Requirements for the Ph.D. Degree

A. Preliminary Examination: The preliminary examination will consist of a written and an oral part. The written part will cover the material of the courses listed in the sample program above and will also include an advanced option to be chosen by the student. It is expected that the student will supplement the knowledge gained in the course work by independent reading and attendance at colloquia. The oral part will consist of a discussion of an original proposition to be submitted by the student.

B. Language Examinations: The student is expected to have a reading knowledge of one of the following languages: German, Russian, French. Proficiency in one of these languages must be demonstrated before the preliminary examination is taken.

C. Advancement to Candidacy: The department's recommendation with respect to advancement to candidacy will be based primarily on the satisfactory completion of requirements A and B.

D. Research and Thesis: The candidate's thesis committee is appointed by the Graduate School upon recommendation of the department chairman. The chairman of the committee is the candidate's research and thesis advisor. (Although this formal arrangement begins after admission to candidacy, the student is expected to have an informal association with a research group at an earlier stage.)

E. Thesis Examination: The thesis committee will read the thesis and give the candidate an oral examination on the research topic and related areas. Upon recommendation of the committee, the department chairman recommends acceptance or rejection of the thesis to the Graduate School.

F. Teaching Requirement: Teaching experience at least equivalent to that obtained in a one-year appointment as a Graduate Teaching Assistant is required.

Doctoral Program in Chemical Physics

The program in chemical physics is intended to meet the needs of students whose interests lie in areas of both chemistry and physics. A graduate student in either the Chemistry or the Physics Department may, with the consent of his chairman, elect to enter the program. A physics student may enter the program if he wishes

to have a more extensive exposure to chemical systems than is normally obtained in physics departments. Degree requirements for a chemistry student in this program may be found in the Department of Chemistry's section of this Bulletin. The basic degree requirements for a physics student are the same as those for other students in this Department, as described above; details are included in the following sections.

ADMISSION TO THE PROGRAM

A graduate student who has been admitted to the Department of Physics may seek the consent of the Chairman to enter the chemical physics course program. The student should have a background in chemistry in the areas appropriate to his interest. The student who does not have such a background may be advised to take certain undergraduate chemistry courses (such as CHE 201,2, 255,6, 305) before entering the program.

COURSES

Since the preliminary examination for students in the program will contain an advanced option in chemical physics, the student will normally be advised to take one or more appropriate courses in chemistry, such as CHE 511, 523, 528, 529, 603, 623, 624, 625.

PRELIMINARY EXAMINATIONS

The student will take the physics examinations, as required of all physics students. The advanced option and the original proposition will be in the area of chemical physics.

RESEARCH

A research advisor will be selected after the student has been admitted to candidacy for the Ph.D. The selection of this advisor may be made in the Department of Chemistry, subject to the approval of the department chairmen.

Courses

Advanced Undergraduate Courses

PHY 341, 342 Quantum Mechanics and Modern Physics

PHY 345, 346 Senior Laboratory

Graduate Courses

PHY 501 Analytical Mechanics

Dynamics of particles and rigid bodies, variational principles, Lagrange and Hamilton equations, canonical transformations, Hamilton-Jacobi Theory, small vibrations, field equations.
3 credits

PHY 502 Electrodynamics

Maxwell's equations; special relativity and Lorentz covariance; radiation, selected studies and applications of electrodynamics (waveguides, scattering, radiation damping, plasma physics, etc.)
3 credits

PHY 503, 504 Methods of Mathematical Physics I, II

Topics will be selected from the following: linear vector spaces; tensor algebra and vector analysis; matrices; Green's functions; complex variables with application to conformal mapping and contour integration; eigenvalue problems and orthogonal functions; partial differential equations; calculus of variations; integral transforms; integral equations; special functions, generalized function theory; probability.
3 credits per semester

PHY 511, 512 Quantum Mechanics I, II

Formulation of basic laws of Quantum Mechanics, Schrodinger and matrix representations, abstract operator methods, spin and non-classical observables, stationary state and time dependent perturbation theory, collision problems, quantization of the radiation field, selected applications to problems in atomic and nuclear physics.
3 credits per semester

PHY 531 Quantum Mechanics III

Symmetries and invariance principles, many-body techniques, relativistic electron theory, introduction to field theory.
3 credits

PHY 540 Statistical Mechanics

Microcanonical, canonical, grand canonical ensembles; Boltzmann statistics, quantum statistics; microscopic approach to thermodynamics.
3 credits

PHY 551 Nuclear Physics I

Basic properties of nuclei, radioactivity, and electromagnetic properties; experimental techniques, accelerators, and nuclear detectors; the two-body problem and nuclear forces.
3 credits

PHY 553 Astrophysics I, Stellar Interiors

Introduction to the study of stellar interiors. Hydrostatic equilibrium. Analytical solutions (polytropics), stellar energy sources, and stellar gravity sources. Main sequence stars, stellar evolution red giants, white dwarfs, pulsating stars, subnova and element synthesis.
3 credits

PHY 554 Astrophysics II, Stellar Atmospheres

Theory of radiative transfer. Continuous spectrum of stars; the formation of lines; characteristics of absorption and emission lines; theory of line broadening; principles in the analysis of stellar spectra and determination of the abundance of the elements. Introduction to nucleosynthesis theory.
3 credits

PHY 555 Solid State Physics I

Crystal structure, symmetry and space groups, ionic crystals, lattice vibrations, band theory of metals and semiconductors, transport phenomena, imperfections, magnetic and dielectric phenomena, low-temperature properties of solids.
3 credits

PHY 557 Elementary Particle Physics I

Introduction to elementary particle characteristics and phenomena, symmetry and invariance principles, partial wave analysis and resonance phenomena, models for strong interaction, weak interactions, accelerator and detector development.
3 credits

PHY 562 Solid State Physics II

Transport properties of solids; electron-phonon and electron-electron interactions; optical, spectroscopic and photoelectric properties; dielectric and magnetic properties; superconductivity.
3 credits

PHY 564 Nuclear Physics II

Nuclear models and their relations to properties of nuclei, theory of nuclear reactions, nuclear beta decay.
3 credits

PHY 566 Elementary Particle Physics II

Fundamental particle systematics, weak and strong interactions, high energy phenomena.
3 credits

PHY 580 Special Research Projects

Research under the direction of a faculty member. Not open to Ph.D. candidates who have passed the preliminary examination.
Each semester, variable and repetitive credit

PHY 585 Special Study

Reading course in selected topics.
Each semester, variable and repetitive credit

PHY 610, 611 Quantum Field Theory I, II

Field quantization; interacting fields; S-matrix theory; Feynman diagrams; charge and mass renormalization; dispersion relations; general field theory.
3 credits per semester

PHY 620 Relativity

General theory of relativity; cosmology.
3 credits

PHY 630 Low Temperature Physics

Subject matter varies from semester to semester, depending on interest of students and staff. Topics covered may include quantization effects in superfluids and superconductors, superfluid hydrodynamics, tunnelling in superconductors, low temperature properties of solids.
3 credits

Seminars

Each semester, several seminars for advanced graduate students will be offered. These courses are intended primarily for students doing research in the area, although other students may enroll with the permission of the faculty seminar leader. Seminars for 1967-68 are listed below; additional ones may be offered if there is sufficient faculty and student interest. Each seminar carries 1 credit, with repetitive credit permitted.

PHY 670 Seminar in Theoretical Physics

PHY 671 Seminar in Statistical Mechanics

PHY 672 Seminar in Elementary Particle Physics

PHY 674 Seminar in Nuclear Physics

PHY 676 Seminar in Solid State Physics

Special Topics Courses

The subject matter of each special topics course varies from semester to semester, depending on the interests of students and staff. Advanced topics will be discussed, particularly those that are of current interest. Each special topics course carries 3 credits, with repetitive credit permitted.

PHY 680 Special Topics in Theoretical Physics

PHY 681 Special Topics in Statistical Mechanics

PHY 682 Special Topics in Solid State Physics

PHY 684 Special Topics in Nuclear Physics

PHY 686 Special Topics in Elementary Particle Theory

PHY 688 Special Topics in Astrophysics

PHY 690 Special Topics in Quantum Electronics

PHY 699 Thesis Research

Independent research for Ph.D. degree. Open only to candidates for the Ph.D. who have passed preliminary examination.
Each semester, variable and repetitive credit

PSYCHOLOGY

Professors: KALISH *(Chairman)*, KRASNER,[a] PETRINOVICH, A. ROSS, STAMM, WYERS
Associate Professors: BRAMEL,[b] EISENSTEIN, GREER, GOLDFRIED,[c] M. LEVINE, SINGER
Assistant Professors: DAVISON, D'ZURILLA, EMMERICH, FEHMI, F. LEVINE, O'LEARY, POMERANZ,[d] SCHVANEVELDT, M. SMITH, VALINS, YOUNG

Admission to Graduate Study

Undergraduate requirements for admission shall normally include:

A. A baccalaureate degree in psychology.

B. An average of 3.0 in all undergraduate course work.

C. Letters of recommendation from three instructors or academic advisors.

D. Results from the Graduate Record Examination.

E. Acceptance by the Department of Psychology and the Graduate School.

Students who do not meet these requirements may also apply if they feel that special circumstances should be considered.

Requirements for the Degree

The award of the Ph.D. degree in Psychology is intended to signify both a scholarly mastery of the field of psychology and the ability to conduct independent research.

Residence

Minimum residence required is two years including at least two consecutive semesters of full-time study. Full-time study is defined as twelve credits per semester, except for teaching or research assistants for whom full-time study is nine credits per semester.

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a Director of Clinical Training.
b Not in residence, Academic Year 1967-68.
c Director of Psychological Services.
d Assistant Director of Psychological Services.

Language Proficiency
Proficiency in translating one foreign language must be demonstrated before the student is admitted to the Specialty Examination. Ability to translate technical literature in either French, German, or Russian is the criterion for satisfaction of the requirement. Substitution of any other language requires special departmental permission.

First Year Evaluation
The progress of each first year graduate student is reviewed at the end of the academic year by the entire faculty. The purpose of this review is to allow the student to withdraw without an unusually heavy investment of time when, in the opinion of the Department, the student would not pass the preliminary examination at the Ph.D. level or produce a suitable dissertation. Any student whose performance is below the standard for the Ph.D. established by the Department of Psychology may be asked to withdraw. Under certain circumstances a student may be permitted to obtain a terminal Master of Arts degree after passing the Preliminary Examination at the M.A. level, satisfactorily completing the quantitative methods course and the learning course, and completing 30 semester hours of study culminating in an M.A. thesis.

Preliminary Examination
The Preliminary Examination ordinarily must be completed by the end of the third semester of graduate study and consists of two parts: (1) the General and (2) the Specialty Examination. The General Examination, covering basic knowledge in the principal areas of Psychology, is the same for all students. The Specialty Examination is constructed individually for each student depending upon the area of specialization.

Degree Candidacy
Upon successful completion of the Language Requirement and the Preliminary Examination, the student is admitted to candidacy for the Ph.D.

Courses

PSY 501 Quantitative Methods I

This course presumes a knowledge of basic statistical methods. Emphasis will be on scaling, measurement, psychophysics, and curve fitting.
Fall, 3 credits

PSY 502 Quantitative Methods II

Inferential statistics, correlation, and advanced statistical techniques which have special usefulness in psychological research including complex analysis of variance, trend analysis, and analysis by orthogonal polynomials.
Spring, 3 credits

PSY 511 Learning

A consideration of the basic principles of learning. Analysis of the leading theories of learning, as well as areas of controversy and dispute.
Fall, 3 credits

PSY 512 Learning

A continuation of Psychology 511 which stresses the application of learning theories and principles.
Spring, 3 credits

PSY 521, 522 The Development of Behavior and Behavior Deviation

A consideration of contemporary theories and research in the area of personality, deviant behavior, and the social labeling process. Techniques of psychological measurement and assessment as they relate to both theoretical formulations and to specific clinical problems involving assessment and modification of behavior. This course will be taught in conjunction with Practicum, PSY 531, 532.
Fall and Spring, 3 credits per semester

PSY 531, 532 Practicum in Testing and Behavioral Observation Techniques

Experience in testing and diagnosis will be provided through the cooperation of clinics, hospitals, and schools outside the University.
Fall and Spring, 1 credit per semester

PSY 535 Theories and Applications of Psychotherapy and Behavior Modification

Thorough delineation of the leading schools of Psychotherapy. Emphasis on therapeutic techniques derived from modern learning theory and social psychological theory. Study of the relationship of theories of psychotherapy to models of deviant behavior and to assessment procedures. PSY 545 will be accompanying Practicum.
Fall, 3 credits

PSY 536 Special Techniques in Behavior Modification

Presentation and discussion of materials on special techniques of modifying human behavior such as behavior therapy, hypnosis, family therapy, non-directive, and other special techniques. Included are films, tape recordings, and demonstrations. Material will be related to case materials available through Practicum, PSY 546.
Spring, 3 credits

PSY 545-546 Behavior Change Laboratory and Practicum

Experience and training will be provided in the area of psychotherapy conceptualized as a method for inducing change in behavior. Emphasis will be placed on practice in modes of behavior change.
Fall and Spring, 1 credit per semester

PSY 550 Social Psychology

Theories, methods, and data relevant to human behavior and cognition in interpersonal contexts. Consideration will be given to such topics as belief and attitude change, aggression and altruism, development of the self concept.
Fall, 3 credits

PSY 560 General Physiological Psychology

The physiological basis of behavior. Discussion of the neuronal basis of sensation, perception, motivation, learning, sleep and problem solving. Consideration of brain pathology and behavior impairment.
Spring, 3 credits

PSY 561, 562 Physiological Methods

Basic bio-electric principles and techniques, stereotaxic techniques, lesioning methods, pharmacological methods, and histological techniques will be presented and practiced. Basic methods for bio-electric stimulation and recording will be emphasized. This course will be taught in conjunction with PSY 563, 564.
Fall and Spring, 3 credits per semester

PSY 563, 564 Physiological Methods Laboratory

Experience in practical application of techniques for manipulating the physiological substrate in relation to behavior in an experimental setting. Emphasis will be placed on individual projects, library research, and seminar reports.
Fall and Spring, 3 credits per semester

PSY 571, 572 Comparative Behavior

Comparative methods for the observation and measurement of animal behavior. Both naturalistic and laboratory methods will be

discussed. This course will be taught in conjunction with PSY 573, 574.
Fall and Spring, 3 credits per semester

PSY 573, 574 Comparative Behavior Laboratory

The use of detection response techniques, conditioning techniques, and habitation methods in the study of adaptive behavior will be practiced using a wide variety of vertebrate and invertebrate species.
Fall and Spring, 3 credits per semester

PSY 581, 582 Comparative Physiological Colloquium

Colloquium presentations on current research problems by advanced students, staff, and visiting scientists. One hour of lecture and two of seminar each week.
Fall and Spring, 3 credits per semester

PSY 603, 604 Practicum in Clinical Procedures

Third and fourth year students will be placed in settings designed to broaden their clinical experience.
Variable and repetitive credit each semester

PSY 610, 620 Seminars in Selected Topics

Topics will be selected on the basis of the needs of the graduate program and the research interest of the staff. The seminars will consider such topics as The Physiological Bases of Higher Mental Processes, Sensory Processes, Animal Behavior, Psychopharmacology, Theories and Problems of Learning, Social Psychology, and Computer Applications in Psychology.
Variable and repetitive credit each semester

PSY 698 Research

Variable and repetitive credit each semester

PSY 699 Doctoral Research

Variable and repetitive credit each semester

SOCIOLOGY

Professors: LANG, SELVIN (*Chairman*)
Assistant Professors: COLLVER, FELDMAN,[a] GOODE, GOODMAN, HUDSON, POLSKY

Admission to Graduate Study

Students will be admitted to graduate study in sociology only if, in the judgment of the Department, they are qualified to attain and expect to work toward a Ph.D. degree. An applicant must have:

A. A minimum grade point average of 2.75 in all undergraduate course work and 3.00 in all courses in sociology and related social sciences.

B. A minimum of 15 semester hours of undergraduate credit in sociology.

C. A one-semester course in statistics.

D. Proficiency in a foreign language (preferably French or German) equivalent to two years of college work.

E. Acceptance by the Department of Sociology and by the Graduate School.

In special cases, some of the above requirements may be waived and the student admitted on a provisional basis. Such a student must make up any deficiencies in required undergraduate study during his first year, without this work carrying graduate credit. The taking of the Graduate Record Examination is recommended but not required for admission.

Requirements for the M.A. Degree

A. Residence: At least one year of full-time study (see below for definition of full-time study) in residence beyond the bachelor's degree.

B. Course requirements: Successful completion of an approved course of study of at least 24 semester-credits, including two semesters of course work (six credits) in sociological theory, one course in methods of sociological research, and one approved course in statistics beyond that required for admission.

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[a] Not in residence, Fall 1967.

C. An overall average of B or better in all course work.

D. Language requirement: The passing of a proficiency examination in one foreign language (French or German, unless written permission to substitute a different language has been granted by the Department).

E. Written examination: Passing of a written comprehensive examination on basic sociological knowledge and techniques *before* the student submits his master's thesis.

F. Submission of an acceptable master's thesis.

Course of Study

The emphasis in this program is on the areas that make up the core of graduate training prior to the development of a specialization. These core areas are:

a) sociological theory

b) methods of empirical research

c) major areas of substantive knowledge.

Theory includes the history of social theory, contemporary sociological theory, and theory construction. At least one course in each of the three types of theory is required. The history of theory requirement can be satisfied by taking Sociology 361 and the contemporary sociological theory requirement by taking Sociology 362. Both of these are senior-level courses that can also be taken for graduate credit. However, a student who lacks undergraduate courses in both areas can receive graduate credit for only one of these courses. Since most entering students will already have had a course in theory, they will usually take *either* Sociology 361 *or* Sociology 362, depending on the type of course previously taken, *and* the course in theory construction.

The methods requirement is to be satisfied by a graduate course in methods of research and by an advanced course in statistics for sociologists. Since the latter presupposes an undergraduate course in statistical applications to sociology all students without such a course should enroll in Sociology 202 during the fall semester. This course will *not* carry graduate credit.

To cover the major substantive areas each student will take at least one course in each of four areas: ecology and demography, social psychology, social organization and institutions, social change and disorganization.

As he advances a student will spend more and more of his time in research activities under the direct supervision of a faculty member. Full-time study may therefore entail varying semester course loads: 9 credits for a student on a research assistantship or on a teaching assistantship, and 12 credits for others. In accordance with the policy of the Graduate School, a student taking this many credits will *automatically* be judged to be a full-time student. Students taking fewer credits can also be considered full-time if they receive certification from the Graduate Dean. Credits ranging up to 6 per semester may be given for individual research work outside formal courses but under the supervision of a faculty member.

A student with adequate undergraduate preparation can complete this program within one year by taking four courses a semester and writing his thesis during the summer. Students may wish to take more than the minimum number of required graduate courses and to spread this work over three or four semesters. All degree requirements must be completed within two years from admission to graduate study in the Department, except where in the opinion of the Department special circumstances warrant an extension.

Courses

Advanced Undergraduate Courses

SOC 358 War and Military Institutions

SOC 361 Historical Development of Contemporary Sociology

SOC 362 Modern Sociology

Graduate Courses

SOC 501 Methods of Research

Problems in the design of research and analysis of data.
Prerequisite: One course in statistics or permission of instructor.
Fall, 3 credits

SOC 502 Advanced Statistics

A second course in statistical methods most frequently used by sociologists.
Prerequisite: One course in statistics.
Spring, 3 credits

SOC 506 Sociological Theory

Modes of conceptualization and theory construction. Problems in developing a theory.
Prerequisite: SOC 361 and SOC 362 or permission of instructor.
Spring, 3 credits

SOC 511 Population Analysis

A survey of demographic theory and research. Determinants and consequences of population size, growth rates, composition and spatial distribution, family formation, fertility, mortality, and migration.
Prerequisite: One course in statistics.
Fall, 3 credits

SOC 521 Social Interaction

The study of interaction in formal and informal settings. The reciprocal influence among group structure, norms, and interactive processes. A prior course in social psychology is assumed.
3 credits

SOC 522 Socialization and the Self

Socialization as a continuous process throughout the life-cycle. Social and cultural sources of identity. Self-other systems as a form of social control. A prior course in social psychology is assumed.
3 credits

SOC 531 Stratification

Causes and consequences of the unequal distribution of wealth, power, prestige, and other social values in different societies. Changes in the stratification system as a result of industrialization and revolution.
3 credits

SOC 532 Complex Organizations

Division of labor, communication, and decision-making in large and formally administered organizations, such as industrial concerns, governmental agencies, political parties, trade unions, schools, hospitals, and prisons.
3 credits

SOC 541 Conflict and Violence

Conflict and violence as related to social change. Examination of community controversies, social movements, uprisings, and war.
3 credits

SOC 542 Deviance

Survey of recent research literature on various kinds of deviance (crime, delinquency, and morally stigmatized behavior). Controversial issues in theory and research methods.
3 credits

SOC 590 Independent Study

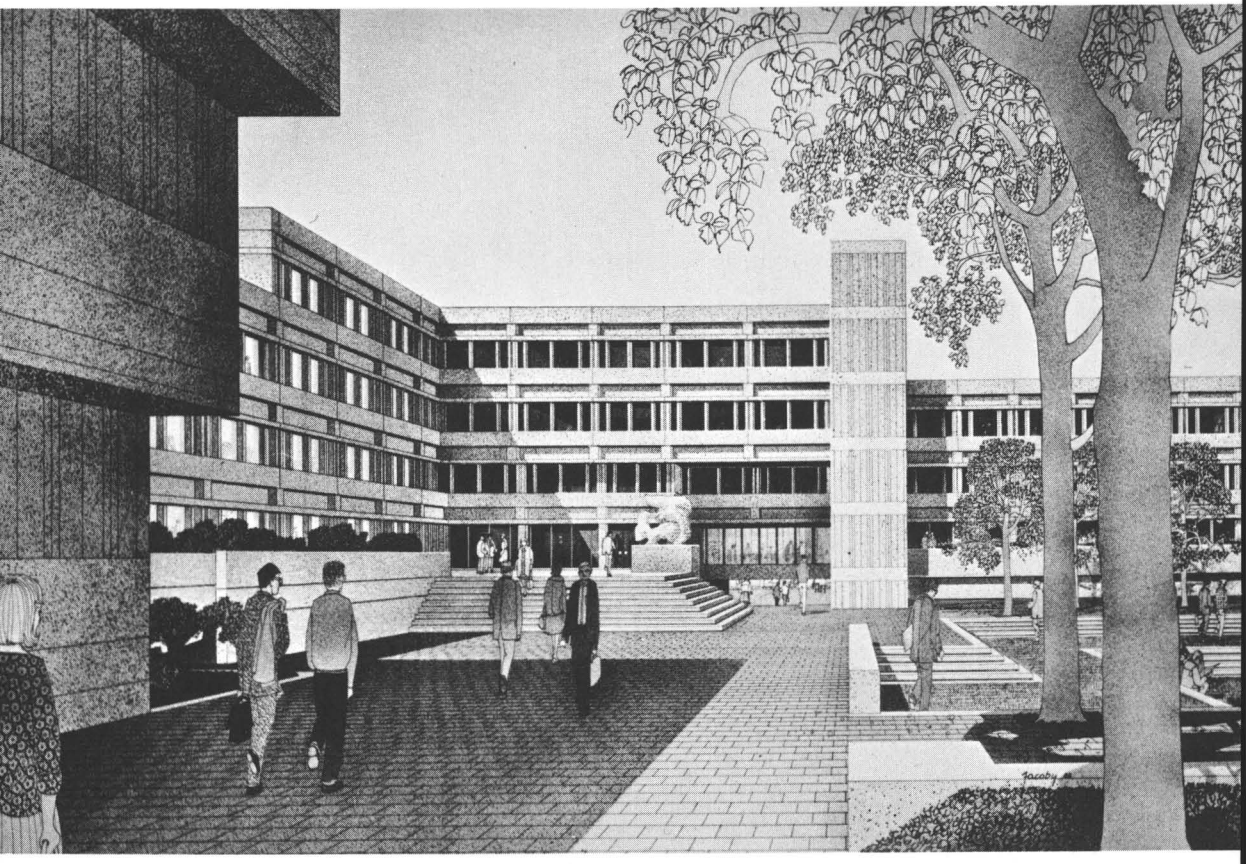
Intensive reading under supervision of one or more instructors of material not covered in the formal curriculum.
Each semester, 1 credit to be arranged

SOC 591-595 Special Seminars

Topics to be arranged. The seminar will be built around actual research activities of students and faculty.
3 credits

SOC 598 Research

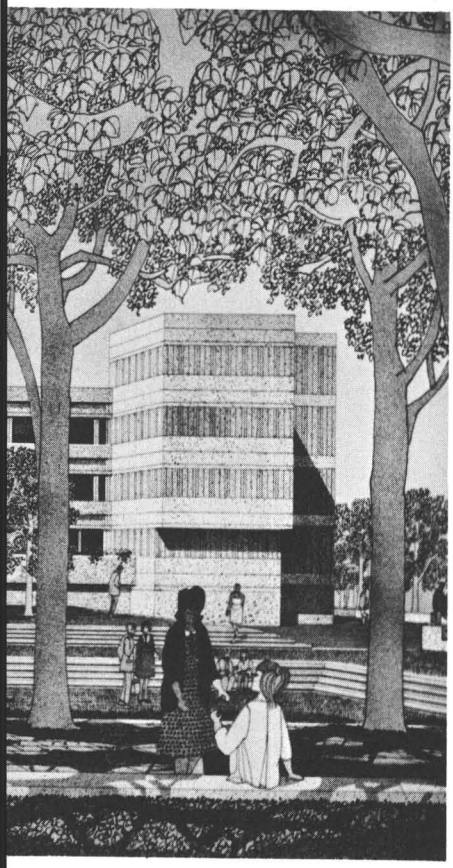
Each semester, credit to be arranged

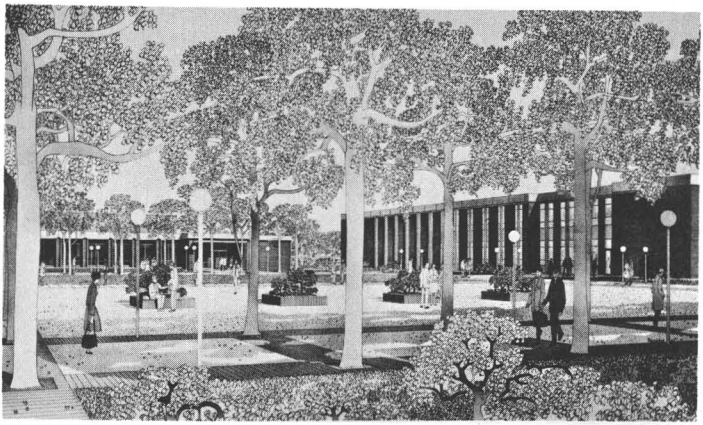


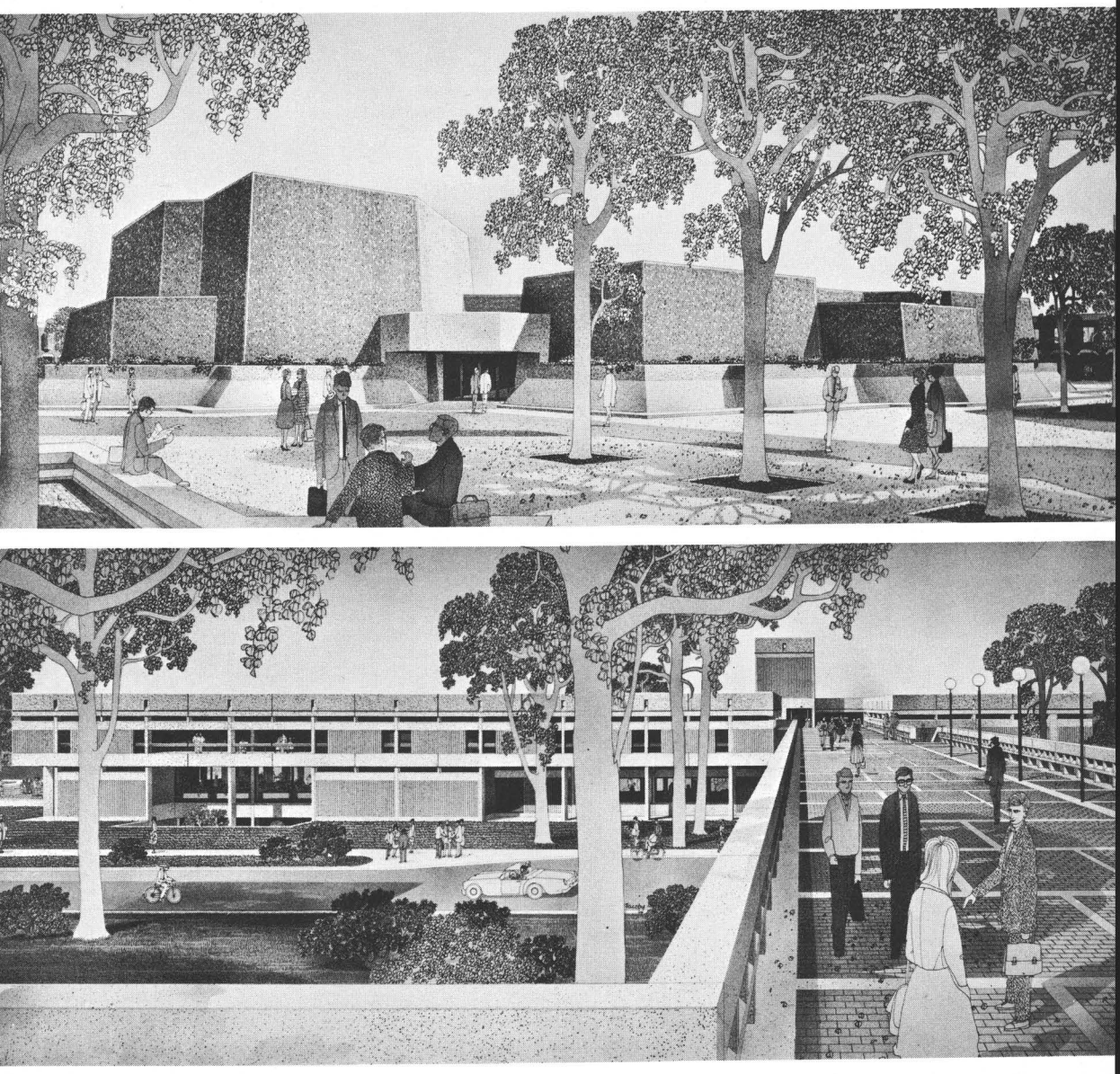
Earth and Space Science building (at left) will be completed in early 1968.

New dining halls, part of recently completed residential complex, will accommodate 500 students at one sitting (below).

Engineering quadrangle includes new graduate engineering and computing center facilities (bottom).







New Lecture Hall Center (top) will contain seven lecture halls and two classrooms.

Large Campus Center (lower) will serve as social-recreation focus of campus life beginning in late 1968.

GRADUATE PROGRAMS IN ENGINEERING

The College of Engineering offers graduate study with degrees leading to the M.S. and Ph.D. The College consists of four academic departments offering graduate programs, each under the direction of a chairman. The graduate program chairmen and the Dean of Engineering comprise the Graduate Executive Committee which reviews all student applications and approves the enrollment of the graduate student in one of the programs best suited to his background and interests.

Admission to Graduate Study

For admission to graduate study in engineering, the minimum requirements are as follows:

A. A B.S. degree in Engineering, Mathematics, Physics, Chemistry, or a closely related area from an accredited college or university.

B. A minimum grade average of at least B in all courses in engineering, mathematics and science courses.

C. Acceptance by the Graduate Executive Committee and the Graduate School.

Requirements for the M.S. Degree

A. Residence: One academic year on a full-time basis.

B. Formal course requirements: At least twenty-four credits. The faculties of individual graduate programs may impose additional course requirements. In addition, the grades in courses totaling at least eighteen credits must be B or better and the average grade for all courses taken must also be B or better. Also, the faculties of the various programs may require certain courses to be taken by the candidates.

C. Satisfactory completion of a thesis in the student's area of specialty. An Oral Examination on the thesis may be required by the faculties of any graduate program.

D. Admission to Candidacy: The status of Candidate for the Master of Science degree is conferred upon the student by the Dean of the Graduate School upon the recommendation of the faculty of the graduate program and the Dean of Engineering. The student is eligible for candidacy only after he fulfills his residency requirements. The recommendation will be based upon the records submitted at the time of admission and performance in formal course work.

E. Final recommendation: Upon the fulfillment of the above requirements the faculty of the graduate program will recommend to the Dean of the Graduate School through the Graduate Executive Committee, that the Master of Science degree be conferred or will stipulate further requirements that the student must fulfill.

Requirements for the Ph.D. Degree

A. Residence: Two academic years on a full-time basis.

B. Language requirement: A reading ability in at least one foreign language relevant to the student's field of interest is required. The student's choice of language must be approved by his research advisor.

C. Qualifying examination: Students must satisfactorily pass a qualifying examination to ascertain their ability to study for the Ph.D. degree. This examination shall precede the preliminary examination by a minimum of two semesters.

D. Plan of work: After completion of at least one year of full-time residence and prior to taking the preliminary examination, the student must select a research advisor who agrees to serve in that capacity. The student will then prepare a plan of further course work. This must receive the approval of the student's advisor and the faculty of the graduate program.

E. Preliminary examination: Upon completion of the course work and language requirements a comprehensive oral examination, which may be supplemented by a written examination, will be given to the student.

F. Admission to Candidacy: After the student has successfully passed the preliminary examination he is eligible to be recommended for admission to candidacy. This status is conferred by the Dean of the

Graduate School upon recommendation of the Chairman of the graduate program.

G. Thesis: The most important requirement of the Doctor of Philosophy degree is the completion of a thesis which must be an original scholarly investigation. The thesis shall represent a significant contribution to the scientific literature and its quality shall be compatible with the publication standards of appropriate and reputable scholarly journals.

H. The student shall defend his thesis before an examining committee. On the basis of the recommendation of this committee, the Graduate Executive Committee will recommend acceptance or rejection of the thesis to the Dean of the Graduate School. All requirements for the degree will have been satisfied upon the successful defense of the thesis.

APPLIED ANALYSIS

Professors: CHANG, DUFFIN (*Visiting*) [b], FINERMAN, GELERNTER, GERST (*Chairman*) [a], ROSEN, ZEMANIAN (*Acting Chairman 1967-68*)
Associate Professors: BELTRAMI, Y. CHEN (*Visiting*), DENHAM, DICKER, DOLLARD, LEIBOWITZ, SRIVASTAV, TEWARSON, THAMPURAN
Assistant Professor: JOSEPH

Requirements for the M.S. and Ph.D. degrees are listed on pages 75-77.

The graduate program of this department provides a course of study in modern applied mathematical techniques with a view to their utilization in the engineering or scientific disciplines. The course offerings and the research program cover both the theories and principles which are common to the applications as well as the more specialized methods which arise in specific areas. As part of this program, this department has instituted a co-operative project with the Department of Electrical Sciences for the development of specializations in the fields of automatic control theory, network theory, and statistical communication theory.

Faculty research programs currently in progress include studies in network analysis and synthesis, transformation calculus, control theory, information theory, numerical methods, distribution theory, approximation theory, diffusion methods, vibrations, random processes, signal detection, wave propagation, stochastic differential equations, programming languages and systems, boundary value problems, partial differential equations and their applications, and optimization.

Courses

Advanced Undergraduate Course

ESA 316 Special Functions of Applied Analysis
3 credits

Graduate Courses

ESA 501 Analysis of Linear Systems I
Propagation problems in discrete systems, integral transform techniques, system functions, convolution, applications of complex variables, stability.
3 credits

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[a] Not in residence, Academic Year 1967-68.
[b] In residence, Fall 1967.

ESA 502 Analysis of Linear Systems II

Propagation problems in continuous systems, solution of partial differential equations by transform techniques, asymptotic relations, iterative structures, sampled-data systems, z-transform, systems with memory.
3 credits

ESA 503 Principles of Applied Analysis I

Equilibrium and characteristic value problems in discrete engineering systems. Development and application of pertinent material from the following subjects: matrix calculus, linear vector spaces, transformation theory and spectral decomposition, extremum principles, numerical methods.
3 credits

ESA 504 Principles of Applied Analysis II

Equilibrium and characteristic value problems in continuous engineering systems. Development and application of pertinent techniques from the following subjects: Sturm-Liouville theory, orthogonal functions, special functions, variational principles, integral equations, Green's function, conformal mapping, theory of characteristics, analytical and numerical methods of solution.
3 credits

ESA 507 Stochastic Processes I

Processes with mutually independent, uncorrelated or orthogonal random variables. Markov processes. Martingales. Processes with independent or orthogonal increments. Stationary processes. Prediction. Applications to biology, quantum theory, numerical analysis, statistical physics, nuclear fission, astronomy and astrophysics, chemical reactions.
Prerequisite: ESA 320, or the equivalent.
3 credits

ESA 508 Stochastic Processes II

Problems in the filtering of noise and criteria for signal detection. Study of prediction theory and the Wiener-Hopf Equation. Prediction in state space and the use of iterative filters. Connection with least squares and maximum likelihood estimates. Introduction to information theory. The notion of entropy; proof of the Shannon theorems for a noisy channel.
Prerequisite: ESA 507, or the equivalent.
3 credits

ESA 510 Introduction to Applied Analysis

An introductory course for the purpose of developing certain concepts and techniques which are fundamental in modern approaches to the solution of applied problems. Topics germane to the applications are selected from the fields of topology, real variables, integration theory, Hilbert and Banach spaces. Students intending to take ESA 605, 623 or 628 are advised to take this course first.
3 credits

ESA 511 Complex Variable Theory with Applications

A study of those concepts and techniques in complex variable theory which are of interest for their engineering applications. Pertinent material is selected from the following topics: complex algebra, analytic functions, harmonic functions, integration in the complex plane, Taylor and Laurent expansions, singularities, calculus of residues, entire and meromorphic functions, conformal mapping. Application is made to problems in heat conduction, potential theory and fluid mechanics.
3 credits

ESA 515 Non-Linear Systems

Basic non-linear differential equation theory. Analytical, graphical and approximation techniques for studying the behavior of non-linear engineering systems. Application of phase plane and describing function techniques.
3 credits

ESA 524 Theory of Approximation

A survey of various engineering situations which present special problems in approximation theory, followed by an extensive development of methods for treating these problems. Topics covered include: smoothing of data, least squares methods, Chebyshev approximation, approximation by rational functions, orthogonal functions, Hilbert space methods, general aspects of approximation in normed linear spaces.
3 credits

ESA 526 Numerical Analysis I

Simultaneous linear equations, matrix inversion, eigenvalues, linear programming, error analysis.
3 credits

ESA 527 Numerical Analysis II

Ordinary differential equations, integral equations, partial differential equations of elliptic, parabolic and hyperbolic type.
3 credits

ESA 531 Tensor and Group Methods in Applied Analysis

This course provides an introduction to the powerful methods of tensor and group theory with applications to engineering and physics. Commencing with a review of linear vector spaces, the course then proceeds to tensor algebra, tensor calculus with applications to dynamics, elasticity, electromagnetic theory and relativity, group properties of transformations and group representation with physical applications.
Prerequisite: Elementary Matrix Algebra.
3 credits

ESA 537 Methods of Operations Research I

A study of the methods of operations research and of their application to the design of complex engineering systems. Model testing. Analysis of data. Linear and dynamic programming. Theory of games and decisions. Flow charting. The digital computer as a research tool and system component. Simulation, applied statistical techniques.
3 credits

ESA 538 Methods of Operations Research II

Non-linear programming and programming under uncertainty; introduction to statistical decision theory and game theory. Monte Carlo techniques. Applications such as inventory theory or traffic theory according to the interest of the class.
Prerequisite: ESA 537, or the equivalent.
3 credits

ESA 541 Network Theory—Analysis

Fundamental properties of electrical networks are examined, such as linearity, time-invariance, passivity, causality, and stability. Their relationship to the concept of positve-reality and its generalizations is developed. Quadratic forms, energy functions, and Lagrange's equations are discussed.

The time-domain implications of these results are next considered. The Boehner-Schwartz theorem on positive-definiteness and Bernstein's theorem on complete-monotonicity are derived and applied to obtain realizability criteria for impulse response matrices. The transfer functions corresponding to non-decreasing step functions are also analyzed.

Finally, the scattering matrix is developed and applied to an analysis of various types of degenerate networks.
3 credits

ESA 542 Network Theory—Synthesis

General properties of network functions in the complex frequency plane and at real frequencies, Hurwitz polynomials and positive-real functions. Equivalent and reciprocal networks. Synthesis of passive one-ports; two-element kind networks, RLC networks. Realizability criteria for passive two-ports. Synthesis of transfer immittances. Transfer function synthesis. Image-parameter techniques. Lattice, ladder and other unbalanced configurations. N-port realizability theory. Realization techniques using active elements.
3 credits

ESA 543 Optimum Design of Feedback Control Systems I

This course is identical with ESE 543.
3 credits

ESA 544 Optimum Design of Feedback Control Systems II

This course is identical with ESE 544.
3 credits

ESA 545 Graph Theory and its Applications

A development of the concepts and techniques applied in the study of those aspects of engineering systems which may be represented by flow-graphs. Connectivity. Capacity. Input-output relationships. Single commodity flow. Max-min theorem. Multi-commodity flow. Reciprocity connection with

linear programming. Probabilistic nets. Application to communication systems, electrical networks, transportation systems, traffic flow, fluid mechanics.
3 credits

ESA 553 Introduction to Mathematical Control Theory

State variables of dynamic systems, linearized perturbation analysis, adjoint systems, controllability and observability, stability analysis, introduction to variational calculus and dynamic programming. Intended as either a single course or as preparation for ESA 543, 544.
Prerequisite: ESA 501, or the equivalent.
3 credits

ESA 557, 558 Elasticity I and II

This course is identical with ESC 541, 542.
3 credits per semester

ESA 561 Vibrations

Principal modes and natural frequencies of discrete and continuous systems. Forced vibrations, dissipative continua. Stability analysis. Introduction to non-linear vibrations.
3 credits

ESA 563 Hydrodynamics

The mathematical theory of inviscid fluid motions. Irrotational motion, flow nets, conformal mapping, Schwarz-Christoffel transformation. Applications to subterranean flow and surface waves, aerodynamics, hydrodynamic stability.
3 credits

ESA 564 Cavity Flows

A brief review of the hydrodynamics of free-streamline flows. The Helmholtz and Riabouchinsky cavity flow models are studied and applied to physical problems. Unsteady cavity flows are solved by means of perturbation methods. Existence and uniqueness of solutions are discussed.
Prerequisites: ESA 563—ESA 605 or their equivalent.
3 credits

ESA 565 Wave Propagation I

This course is identical with ESE 520.
3 credits

ESA 566 Wave Propagation II

This course is identical with ESE 521.
Prerequisite: ESA 565.
3 credits

ESA 567 Wave Propagation in Plasma

This course is identical with ESE 522.
3 credits

ESA 580 Algorithmic Languages and Compilers

FORTRAN, PL-1, and ALGOL and the techniques used in their compilation. Study of syntax, semantics, ambiguities, procedures, replication, iteration and recursion in these languages.
3 credits

ESA 599 Research

Variable and repetitive credit

ESA 605 Probability Theory and Applications

Measure-theoretic basis of probability. Fourier transforms. Generating functions. Sums of independent random variables. Limit theorems. Martingales. Markov processes and their connection with differential and integral equations, potentials. Applications to random walk and ruin problems, information theory and coding, statistical mechanics, problems of strategy and decision-making, queueing problems, extinction of populations.
Prerequisite: ESA 320 and a knowledge of Measure Theory and Integration, or the equivalent.
3 credits

ESA 606 Statistics

Probability theory. Probability distributions and generating functions. Statistical inference. Small sample theory. Tests of hypotheses. Distribution-free methods. Applications to processing and interpretations of engineering and industrial data, design of experiments, quality control, sequential analysis, decision functions, reliability studies, curve fitting, estimation of response relationships, time series, optimization techniques, factor analysis.
Prerequisite: ESA 321 and a knowledge of Lebesgue Integration, or the equivalent.
3 credits

ESA 609 Markov Process and Their Applications

Modern definition of a Markov process. Transition functions. Operators of transition functions. Diffusion processes. Brownian motion and generalized Brownian motion. Feller processes. Wiener processes. Transformations of Markov processes. Stochastic differential and integral equations. Applications to engineering, physics, astronomy, biology.
Prerequisite: ESA 605.
3 credits

ESA 611, 612 Theory of Partial Differential Equations and Their Applications I and II

Theorem of Cauchy and Kowalewsky; classification of partial differential equations in general; characteristics; potential theory and elliptic equations; hyperbolic equations and propagation of discontinuities, parabolic equations; various methods of solving partial differential equations; applications to problems in electromagnetics, hydrodynamics, solid mechanics, plasma physics and many other problems in engineering analysis.
Prerequisite: ESA 504.
3 credits per semester

ESA 621 Advanced Operational Methods in Engineering Systems

An advanced course in the application of operator techniques to the analysis of engineering systems. Topics covered include: the general integral transform, Hilbert, Hankel and Mellin transforms, finite transforms, Wiener-Hopf technique, generating functions, asymptotics, Mikusinski operational calculus.
3 credits

ESA 623 Distribution Theory and its Applications I

Spaces of testing functions and distribution. The calculus of distributions. Distributions as derivatives of continuous functions. Direct product, convolution, and convolution algebras. The distributional Fourier and Laplace transformations. Applications to the analysis of linear systems.
3 credits

ESA 624 Distribution Theory and its Applications II

Heaviside operators defined on the system of distributions vanishing on the negative semi-axis. Systems of integro-differential equations with constant coefficients; the classical and distributional solution. Generalized Volterra's operators. Systems of integro-differential equations with variable coefficients; properties of the solutions.
3 credits

ESA 625 Advanced Boundary Value Problems in Engineering Systems

Linear operators on a Hilbert space and their spectra; applications to self-adjoint boundary value problems and Fredholm theory. The boundary behavior of Cauchy integrals in the usual and distributional sense is studied to provide a unified approach to certain problems in engineering analysis: Plemelj formulas, singular integral equations, and the Wiener-Hopf and Hilbert problems; Hilbert transforms.
3 credits

ESA 627 Theory of Integral Equations and Their Applications

Integral equations with degenerate kernels, equations of the second kind, iterative solutions, contraction mapping principle, Fredholm theory, spectral theory for symmetric kernels, Volterra equations of the first and second kind, equations with weakly singular kernels, simultaneous systems, applications.
Prerequisites: ESA 503, ESA 510 or permission of instructor.
3 credits

ESA 628 Functional Analysis I

Metric and Banach spaces and their applications to engineering problems. Completeness, contraction mappings, compactness and Arzela's theorem. Linear spaces and manifolds, norms, continuous linear functionals, dual spaces, Hahn-Banach theorem, reflexivity, weak convergence. Applications to linear engineering systems are given.
Prerequisite or Corequisite: ESA 503
3 credits

ESA 629 Functional Analysis II

Hilbert space, orthogonality, orthonormal expansions, Riesz-Fischer theorem, self-adjoint operators. Topological linear spaces, seminorms, continuous linear functionals, dual spaces, weak and strong topology. Applications to the foundations of physical system theory and generalized networks.
Prerequisite: ESA 628.
3 credits

ESA 631, 632 Approximate Methods in Engineering Boundary Value Problems I and II

A survey of boundary value problems arising in engineering for which analytical solutions either are not available or are of little practical value, followed by an intensive study of various techniques for the approximate solution of these problems. Topics covered include numerical solutions by means of finite differences; approximate analytical solutions such as Galerkin's method, collocation, Ritz method, and the method of least squares. Applications are drawn from the areas of fluid mechanics, elasticity, heat transfer, and potential theory.
3 credits per semester

ESA 641 Geometric Programming

Basic concepts and techniques of geometric programming. Relevant results from Linear and Convex programming. Duality and its refinements. Extended geometric programming. Applications to non-linear optimization problems in engineering design.
Prerequisite: Permission of instructor.
3 credits

ESA 680 Selected Topics in Computer Sciences

Selected topics in proof theory, heuristic programming, computability and recursive function theory, recent and current research in the computer sciences.
Prerequisite: Permission of instructor.
3 credits

ESA 690 Topics in Applied Analysis

Selected topics from various fields of applied mathematics which require specialized development of subjects in the fields of analysis and algebra.
3 credits

ESA 691 Seminar in Applied Analysis

Supervised reading and discussion of current journal publications in applied analysis.
3 credits

ESA 699 Research

Variable and repetitive credit

block and sequential codes, random linear codes, cyclic codes and their implementation, the fading channel, unidirectional versus feedback communication, and the tradeoffs of rate for reliability. The course concludes with some further theorems of information theory and a discussion of the information theoretic versus the communication theoretic approach to the general problem of digital communication.
Prerequisite: ESE 531.
3 credits

ESE 540 Introduction to System Theory

State variable representation of continuous and discrete systems, feedback and stability, linear system and superposition, impulse response and integral representation, autonomous systems and transfer functions. Routh, Nyquist, and Lyapunov stability.
3 credits

ESE 541 Feedback Control Systems I

Analysis and synthesis of continuous and discrete systems, Nyquist and Bode plots, root locus method, multiple loop systems, synthesis through pole-zero configurations, compensation of continuous and sampled systems.
3 credits

ESE 542 Feedback Control Systems II

Stability analysis and design of non-linear systems by describing function method. Perturbation analysis. State equation of non-linear systems. Phase plane and phase space methods. Stability theorems and Lyapunov functions.
3 credits

ESE 543, 544 Optimum Design of Feedback Control Systems I and II

System design by minimization of integral square error with constraint. Root square locus method. Analysis of random processes including power spectrum, correlation functions and Weiner's theorem. Statistical design theory of continuous and sample systems. Interpolation, extrapolation, filtering and prediction of continuous and sample data. Optimum filtering and control of nonstationary systems. Pontryagin's maximum principle and applications. Bang-Bang and Pang-Bang systems. Dynamic programming and generalized maximum principle.
3 credits per semester

ESE 550 Combinational Switching Theory

Definition and classes of combinational functions and their complexity: symmetry classes, monotone functions, and their detection. Complete algorithm for two level synthesis. Functional decomposition and multilevel synthesis with simple gates. Linearly separable functions—methods of testing and synthesis. Adaptive linear logic: comparison of set theoretic and statistical approaches, single unit adaption theorems. Non-linearly separable functions synthesis with non-linear elements, networks of linear and adaptive elements. Probabilistic logic, synthesis of reliable networks from unreliable components. Special applications: pattern recognition, property filters, etc.
3 credits

ESE 551 Sequential Networks and Automata Theory

Classification of functions into definite, regular, computable and non-computable; historical introduction through Godel, Turing and Kleene. Use of regular expressions as a model for finite automata, state graphs and flow tables. Partially specified functions, prime compatibility classes, and complete algorithm for "single level" state minimization. Decomposition of sequential machines. "Linear" sequential machines; methods of testing and synthesis, properties of output sequences. Comparison with statistical approach to very large sequential networks. Probabilistic automata.
Prerequisite: ESE 550.
3 credits

ESE 599 Research

Variable and repetitive credit

ESE 610 Seminar in Solid-State Electronics

A course designed primarily for the student who is, or expects to be, involved in solid-state research. The subject matter presented is designed in any given semester to support the research interests of the staff and the students involved.

ESE 620 Seminar in Electromagnetic Theory

Current research problems in electromagnetic wave propagation and antennas.
3 credits

ESE 630 Seminar in Communications Theory

3 credits

ESE 640 Seminar on Systems Theory

Recent and current research work in systems theory.
3 credits

ESE 650 Seminar in Computer Sciences

Current research topics in logical design, machine learning, and self-organization.
3 credits

ESE 699 Research

Variable and repetitive credit

MATERIALS SCIENCES

Professors: S. LEVINE,[a] SEIGLE (*Acting Chairman*)
Associate Professors: JACH, F. WANG
Assistant Professors: BILELLO, JAIN, SIEGEL

Requirements for the M.S. and Ph.D. degrees are listed on pages 75-77.

The Department of Materials Sciences offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. The motivating philosophy of the graduate program is to provide the student with a broad synthesis of the theoretical and experimental techniques required for work with all classes of solid materials. Emphasis is placed on courses which unify the field in terms of fundamentals treated with sufficient depth to enable the student to contribute in diverse areas of materials sciences and technology. Current research interests of the faculty include studies of point defects in metals, dislocation mechanics, radiation effects in inorganic crystals, polymer interfaces, biomedical materials, galvanomagnetic phenomena in semiconductors and semi-metals, magnetic interactions in solids, thermodynamics of solids, and mechanisms of solid-state sintering.

Courses

Advanced Undergraduate Courses

ESM 325 Diffraction Techniques and the Structure of Solids

ESM 326 Quantum Theory of Matter

ESM 327 Semiconductor Theory and Technology

ESM 328 Nuclear Technology and Materials

Graduate Courses

ESM 509 Thermodynamics of Solids

The basic laws and thermodynamic relationships are briefly reviewed, with emphasis on the computation of standard free energy changes of reactions, and application to equilibrium calculations. Current knowledge regarding the thermodynamic properties of condensed phases is discussed, including the thermodynamics of first and higher order phase transitions in solids. The thermodynamic treatment of ideal, regular, and real solutions is reviewed. Use of the foregoing in the estimation of reaction free energies and equilibria in condensed phase reactions such as diffusion, oxidation, and phase transformations is emphasized. Finally, the thermodynamic analysis of phase equilibrium diagrams is considered.
3 credits

ESM 511 Imperfections in Crystals

The course provides an introduction to point and extended imperfections in crystalline solids. The characteristics of point defects in metals, semiconductors and ionic solids are described, and the thermodynamics of point defects is developed in detail. Elementary dislocation theory is introduced. The ener-

[a] Not in residence, Academic Year 1967-68.

getics of dislocations are treated using elasticity theory, and important dislocation reactions are described. In addition, the structures of internal boundaries are presented. Finally, interactions between lattice imperfections are discussed, with emphasis on the generation and annihilation of imperfections, dislocation climb, clustering and segregation.
3 credits

ESM 512 Strength and Plasticity of Solids

This course provides a broad treatment of the strength and plasticity of solids from both the macroscopic and microscopic viewpoints. Subjects included are analysis of stresses and strains in solids, mechanical tests and properties, macroscopic criteria for yielding and fracture in homogeneous solids, modes of fracture, ductile and brittle behavior; dislocation theory and the strength of materials, generation and multiplication of dislocations, dislocation interactions and theories of yielding and fracture, influence of impurities, solutes, and dispersed phases upon dislocation movement, theories of fatigue, creep, and rupture at elevated temperatures.
3 credits

ESM 515 Reactions in Solids I

This course provides a comprehensive treatment of solid state reactions and transformations. Diffusion in solids is considered in detail, including solution of the transport equations for volume, grain boundary, and surface diffusion, Kirkendall effect and other diffusion phenomena, atomic mechanisms of diffusion, correlation effects, etc. Next, the theory of processes in which diffusion plays an important role is considered, such as ionic conduction, oxidation of metals, and the sintering of solids.
3 credits

ESM 516 Reactions in Solids II

Continuation of ESM 515. The theory of phase transformations in solids is considered. Kinetics and mechanisms of nucleation and growth and martensitic transformations. Melting and solidification, precipitation from solid solution, polymorphic transformations, eutectic and eutectoid reactions, second order transitions, recrystallization, and other transformations in solids.
Prerequisite: ESM 515.
3 credits

ESM 520 Structure of Solids

This course offers a broad treatment of the structure of solids, beginning with the principles of geometrical and mathematical crystallography, symmetry and groups, the reciprocal lattice, and Brillouin zone construction. The structures of real crystals are discussed and rationalized in terms of atom and molecular geometry and bonding. Next the structure of non-crystalline solids is considered. The atom distribution function is introduced and applied to liquids and glasses. Structural factors influencing the formation of amorphous phases are discussed. Finally the structure of heterogeneous solids is considered, including the topology of crystallite assemblies and domains in polycrystalline and multiphase systems.
3 credits

ESM 530 Physical Properties of Polymers I

This course provides an advanced study of the physical and physical chemical principles underlying the behavior of polymers. Topics include an introduction to the statistical thermodynamics of polymers, X-ray and spectroscopic techniques and their use in structural studies, thermodynamics of polymer solutions, light scattering techniques, theory of viscosimetry and osmometry. Practical applications are emphasized.
3 credits

ESM 531 Physical Properties of Polymers II

Continuation of ESM 530 to such topics as viscoelasticity, flow, and diffusion of polymers; sedimentation theory and ultraconfiguration, electrostatic free energy and the statistical mechanics of poly-electrolytes, electrophoresis theory and techniques, configuration of polymers in solution, catalysis by macromolecules.
Prerequisite: ESM 530.
3 credits

ESM 533 Radioisotopes in Materials Studies

This course is primarily a laboratory one which stresses the utilization of radioactive isotopes in the study of a variety of materials problems such as wear testing, thickness gauging, electrodeposition, chemical reactivity of solids, etc.
3 credits

ESM 540 Advanced Techniques of Materials Research I

Theory and laboratory demonstrations of modern techniques for the preparation and characterization of engineering materials such as high vacuum and high temperature techniques, cryogenic procedures, crystal growth and zone melting techniques.
3 credits

ESM 541 Advanced Techniques of Materials Research II

Continuation of ESM 540 to the theory and demonstration of spectroscopic methods, diffraction techniques, electron microscopy, and other methods for the examination of materials.
Prerequisite: ESM 540.
3 credits

ESM 550 Statistical Theory of Matter

The principles of classical and quantum statistical mechanics are introduced and the relationships between statistical mechanics and classical thermodynamics developed. Detailed applications are made to electronic and lattice specific heats, order-disorder transformations, paramagnetism, and other phenomena in solids. An introduction to the thermodynamics of irreversible processes is given, and the methods of irreversible thermodynamics aplied to thermoelectric and thermomechanical effects in solids.
Prerequisite: ESM 509.
3 credits

ESM 599 Research

Variable and repetitive credit

ESM 603 Surfaces and Interfaces I

A large part of technology depends on the properties of surfaces and interfaces. This course explores the application of physical and chemical principles to the study of surface behavior. The following topics are included: thermodynamics of surfaces, surface bonds, interfacial tension, properties of monolayers, surface potentials, surface conductance, electrokinetic phenomena, adsorption at liquid interfaces and solids, reactivity at interfaces, theory of corrosion and oxidation, structural defects and interfacial behavior.
3 credits

ESM 604 Surfaces and Interfaces II

This course is the second half of ESM 603 and includes the physics of semiconductor surfaces and thin films with applications, chemadsorption and catalysis, membrane phenomena, mass transport through surfaces, applications to adhesion, friction, lubrication, wear, wetting and detergency; stability of colloids, emulsions, foams, smog and pollution, ion exchange, chromatography.
Prerequisite: ESM 603.
3 credits

ESM 615 Electron Theory of Solids

Band theory of solids, Brillouin zones, Fermi surface in metals, alloys and semiconductors, galvanomagnetic effects, optical properties, magnetism, lattice vibrations and thermal properties of solids. Applications to magnetoresistance, Hall effect and thermoelectric devices, photoconductors and luminescent materials, metal-semiconductor contacts and the photovoltaic effect.
3 credits

ESM 618 Electric and Magnetic Polarization of Materials I

This course is designed to teach the students the origins of magnetic and dielectric properties of materials, the relationship between properties and structure, and impart an understanding of the physical principles involved in the device applications of magnetic and dielectric materials. The course covers a review of atomic structure; electric and magnetic susceptibilities; piezoelectricity, ferroelectrics and antiferroelectrics; thermodynamical theory of ferroelectricity; ferroelectricity and lattice dynamics; ferro-, ferri-, and antiferromagnetics; theories of ferromagnetic anistropy; magnetic metals and alloys; garnets

and ferrites; domain theories and micromagnetics.
3 credits

ESM 619 Electric and Magnetic Polarization of Materials II

This course is a continuation of ESM 618 concentrating on the physical principles of dielectric and magnetic materials in technical applications. The course covers the semiclassical spin wave theory; para-, ferro- and antiferro-magnetic resonances; mechanisms of magnetic relaxation; dielectric loss and relaxation; magneto-acoustic effects; magnetic piezoelectric materials; flux reversal mechanisms; switching mechanisms in ferromagnets and ferroelectrics; magnetic thin film; coupled films and other forms of computer materials; materials for microwave applications.
Prerequisite: ESM 618.
3 credits

ESM 699 Research

Variable and repetitive credit

MECHANICS

Professors: BERLAD (*Chairman*), BRADFIELD,[a] CESS, IRVINE
Associate Professors: BENTWICH (*Visiting*), KRAUS, R. S. LEE, O'BRIEN,[a] TASI
Assistant Professors: CHIANG, HARRIS, VARANASI (*Visiting*), L. WANG

Requirements for the M.S. and Ph.D. degrees are listed on pages 75-77.

The Department of Mechanics offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. The Department offers a broad program emphasizing fundamental knowledge in the basic academic areas of heat transfer, thermodynamics, thermokinetic systems, solid mechanics, and fluid mechanics. Faculty research interests include convective and radiative heat transfer, magnetohydrodynamics, statistical mechanics, gas dynamics, turbulence, combustion, thermokinetics, photoelasticity, theory of structures, anelasticity, fluid mechanics, solid mechanics and experimental techniques. In each area students are encouraged to participate in research.

Courses

ESE 501, 502 Advanced Heat Transfer I and II

Thermal boundary layers in forced and free convection, heat transfer in internal flows, two-phase boundary layer flows. Thermal radiation, formulation of radiation problems in terms of integral equations, radiant transfer with absorbing-emitting gases.
3 credits per semester

ESC 511, 512 Advanced Fluid Mechanics I and II

Lagrangian and Eulerian frames, Rayleigh transport theorem and kinematic surface conditions, elementary kinetic theory, dynamical equations of motion, energy and momentum transfer, classes of constitutive relations. Fluid statics, including self-gravitation stability of floating bodies, surface tension effects and statics of the earth's atmosphere. Significant features of fluid dynamics of incompressible and barotropic perfect fluids and of the compressible perfect gas. Characteristic surfaces and shock waves. Internal and surface waves. Constitutive equations of viscous fluids. Some exact solutions of the Navier-Stokes equations. The nature of laminar instabilities.
3 credits per semester

ESC 513 Transport Phenomena

An introduction to the transport of momentum, energy, and mass in fluid media. The equations of change for isothermal systems. Interphase transport in isothermal systems. Macroscopic balances for isothermal systems. Mechanism of energy transport. The equations of change for nonisothermal systems. Interphase transport in nonisothermal systems. Mechanism for mass transport. Concentration distributions in solids and in laminar flow. Concentration distributions in turbulent flow. Interphase transport in multicomponent systems.
3 credits

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[a] Not in residence, Academic Year 1967-68.

ESC 514 Introduction to Turbulence

Introductory concepts and statistical description. Kinematics of random velocity fields. Equations of motion and their interpretation. Experimental techniques: isotropic turbulence and the closure problem. Transport processes in a turbulent media. Turbulent jets, wakes, and boundary layers.
3 credits

ESC 521 Energy Transfer in Gases

Energy transfer among the internal and translational modes of molecular motion. Spectroscopic states, interactions, lifetimes and populations. Relaxation dynamics. Sound propagation in compressible fluids. Shock wave structure. Irreversible processes and the approach to equilibrium. Nonequilibrium radiative and chemical pumping of internal modes. Applications to gasdynamic systems.
3 credits

ESC 522 Experimental Methods in Radiative Transfer

Quantitative spectroscopic measurements of absolute intensities of chemically stable and unstable species; radiative transfer measurements in isothermal and nonisothermal gas systems; radiative heat transfer studies in flow systems; determination of surface pressures on planets; effects of radiative fields on dissociation and recombination of chemical species; use of lasers for gas velocity and absorption measurements.
3 credits

ESC 541, 542 Elasticity I and II

Derivation of linear equations of elasticity. Stress equations of motion. Displacement and strain. Stress-strain relations for crystalline solids. Compatibility equations. Uniqueness theorem. Reciprocity theorem. Applications to static three-dimensional problems. Contact theory. Two-dimensional problems. Wave propagation in infinite and bounded media. Elastic lattice vibrations and theories of microstructure.
3 credits per semester

ESC 543 Plasticity

The concepts of stress and deformation of solids are reviewed. Yield criteria and flow rules for plastically deforming solids are presented. The notion of a stable inelastic material is introduced. Static and dynamic analyses of plastic bodies under mechanical and thermal loadings are illustrated. The use of load bounding theorems and the calculation of collapse loads of structures are considered.
3 credits

ESC 544 Theory of Shells

The fundamental equations that govern the behavior of thin elastic shells are derived. Solutions of static and dynamic problems of shells under mechanical and thermal loadings are considered by exact and approximate analytical procedures. The application of digital computers to the solution of the equations of the theory is discussed. Recent theoretical treatments are presented.
3 credits

ESC 551 Mechanics of Continua

An introduction to the study of continuous media. The Cartesian tensor calculus is employed in the description of the statics and kinematics of such media under the assumption that the deformations are infinitesimal. The fundamental equation of continuity, momentum and energy for a general continuum are derived. The treatment is specialized to various media by the introduction of constitutive equations for elastic, viscoplastic and viscoelastic solids and for perfect and viscous incompressible fluids.
3 credits

ESC 561 Photoelasticity

Theory of two- and three-dimensional photoelasticity, frozen stress technique, oblique incidence method, scattered light photoelasticity, birefringent coating, fringe multiplication and sharpening. Technique of absolute retardation. Dynamic photoelasticity and photothermoelasticity.
3 credits

ESC 591 Thermodynamics

And advanced course in classical thermodynamics presented from the postulation point of view. Also considered will be such topics as Pfaff differentials and Caratheodorys principle, thermodynamics of irreversible pro-

cesses, and the thermodynamics of small systems and solutions.
3 credits

ESC 599 Research

Variable and repetitive credit

ESC 611 Reactive Media I

Thermodynamics, rate processes, flow, and stability of reactive media. Fundamentals of theory and experiment for combustion, condensation, crystallization and selected other transport phenomena. Nonadiabatic theory of reaction wave structure, initiation, propagation, and extinction. Deflagration and detonation. Interaction of intense radiation with gaseous flows.
3 credits

ESC 612 Reactive Media II

Continuation of theory of reactive flows. Fundamental aspects of chemical, nuclear, and electric jet propulsion systems for aircraft and spacecraft.
3 credits

ESC 614 Equilibrium Statistical Mechanics

Determination of observable properties of macroscopic atomic and molecular systems in equilibrium from microscopic models. Microcannonical, Cannonical, and Grand Cannonical ensembles are considered for classical quantum systems. Applications for both perfect and imperfect gases.
3 credits

ESC 615 Radiative Energy Transfer

The physics of absorption, emission and scattering of thermal radiation in gaseous media. Basic equations relating to energy transfer in absorbing, emitting and scattering media. Formulation and solution of the integro-differential equations describing conservation of energy for radiative equilibrium, combined conduction and convection, and convective phenomena involving radiating media.
3 credits

ESC 621 Combustion

Experimental methods and results. Fundamentals of theory. Existence, structure, initiation, propagation and extinction of deflagrations and detonations. Radiative and thermophysical properties of combustion gases. Premixed and unpremixed combustible gases. Heterogeneous combustion. Flames in nonlaminar flow fields. Combustion instability.
3 credits

ESC 622 Time Dependent Phenomena in Two-Phase Flows

Introduction to regimes of two-phase internal and external flow with time dependent momentum, heat, and mass transport; study of self excited oscillations at the stagnation point of two-phase flows involving heat and mass transport; time dependent flows of thin liquid films in a gaseous atmosphere; shear wave instabilities in laminar film boiling; instabilities of accelerated liquid interfaces; study of selected papers from the open literature.
3 credits

ESC 623 Homogeneous Turbulence

Probability functions and generalized Fourier transforms. Kinematics. Invariance theory. Isotropic turbulence. Statistical theories. Local isotrophy. Scalar transport.
3 credits

ESC 625 Turbulent Diffusion

Eulerian description of passive contaminants in homogeneous turbulence. Closure techniques and their flaws. Lagrangian description of single particle and relative diffusion. Similarity in shear flows. The role of buoyancy forces and chemically reactive scalars.
3 credits

ESC 626 Kinetic Theory of Radiating Media

Spectral line profiles, Lambert's law of extinction, band models, infrared gas emissivities. Equation of radiative transfer, radiative equilibrium problems and Milne's integral equation, integral equation of radiative equilibrium in infrared radiating gases. Introduction to methods of solutions, eigenvalues and eigenfunctions and their determination by approximate methods, thermal radiation diffusivities, luminescence radiation diffusivities. Singular perturbation methods and the radiation predominant problems.
3 credits

ESC 631 Kinetic Theory

Theory of the Boltzmann Equation. The Hilbert, Chapman-Enskog and Grad Solutions, and the transition to fluid dynamics, determination of transport coefficients. Relationship of normal solutions to actual solutions of the Boltzmann Equation.
3 credits

ESC 632 Non-Equilibrium Statistical Mechanics

Theory of the BBGKY Equations. Derivation of the Boltzmann and generalized Boltzmann Equations. The correlation function approach to transport theory. Some explicit results for dense gases will be considered.
3 credits

ESC 641 Dynamics of High-Temperature Gases

Studies of phenomena involving mutual interaction between fluid mechanics, heat transfer, physical kinetics due to high-temperature thermodynamic effects: dissociation, ionization, and radiation.
3 credits

ESC 642 Advanced Mechanics of Continua

The curvilinear tensor calculus is reviewed. Basic equations which govern the behavior of continuous media are derived in which finite deformations are permitted. Coupling between mechanical, thermal, electromagnetic and other effects is considered. The thermodynamics of continuous media are studied. Singular surfaces and waves are examined.
3 credits

ESC 652 Viscoelasticity

Constitutive relations for linear viscoelastic media. Equations of motion. Uniqueness theorem. Reciprocity theorem. Quasi-static problems. Contact theory. Wave propagation in infinite and bounded media.
3 credits

ESC 661 Measurements System Design

Design of research instrumentation in the context of the research problem. Selection of appropriate transducers for response to a given phenomenon and design of appropriate intermediate and readout components. Specific problems may be selected, depending upon the students' interest.
3 credits

ESC 671 Interferometric Methods in Experimental Stress Analysis

Theory of moire fringes, two- and three-dimensional methods, Lightenberg technique, shadow moire, Salet-Ikeda and Mantinelli-Ronch techniques and holography. Applications to thermal stress and residual stress problems, vibration analysis, wave propagation, plastic strain, deformation of plates and shells and structural model analysis.
3 credits

ESC 696 Special Problems in Mechanics

Conducted jointly by graduate students and one or more members of the faculty.
3 credits

ESC 699 Research

Variable and repetitive credit

DIRECTORIES*

* In the listings which follow, the memberships are those effective in the academic year 1966-67, unless explicitly noted otherwise.

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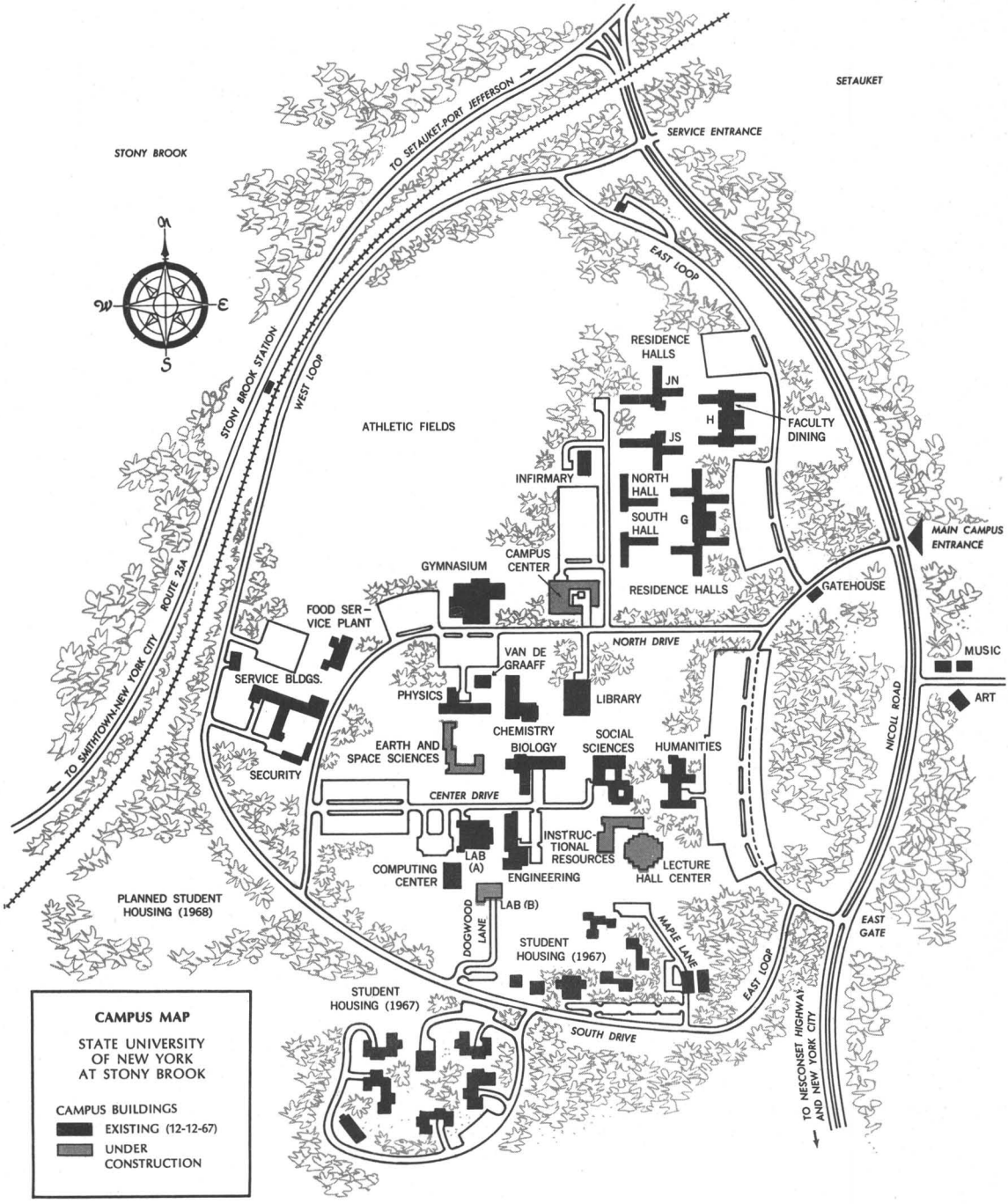
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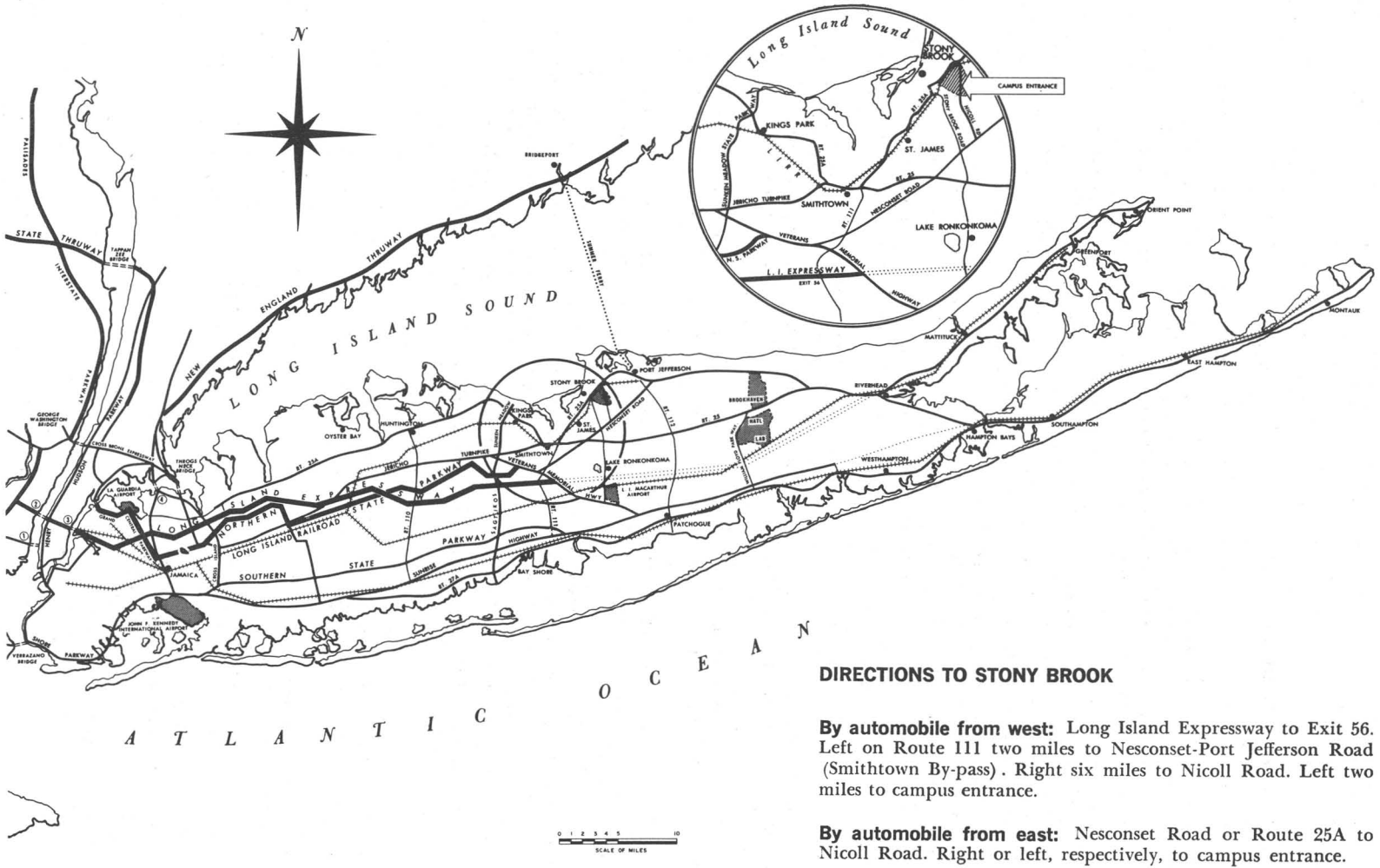
EXISTING (12-12-67)
UNDER CONSTRUCTION



DIRECTIONS TO STONY BROOK

By automobile from west: Long Island Expressway to Exit 56. Left on Route 111 two miles to Nesconset-Port Jefferson Road (Smithtown By-pass). Right six miles to Nicoll Road. Left two miles to campus entrance.

By automobile from east: Nesconset Road or Route 25A to Nicoll Road. Right or left, respectively, to campus entrance.

By Long Island Railroad: Take Port Jefferson line from Pennsylvania Station (Manhattan) or Flatbush Avenue Station (Brooklyn). Change at Jamaica for remainder of trip to Stony Brook Station.

STATE UNIVERSITY OF NEW YORK

The State University of New York, established by the State Legislature in 1948, comprises 67 colleges and centers. At present, 57 conduct classes: four University Centers, two Medical Centers, ten Colleges of Arts and Science, seven Specialized Colleges, six two-year Agricultural and Technical Colleges and 28 locally-sponsored, two-year Community Colleges.

Three additional Colleges of Arts and Science are in varying stages of development. Two four-year campuses, in Nassau and Westchester Counties are now in early planning. The third campus as proposed in an amendment to the University's 1964 Master Plan, would be upper-divisional (junior-senior years) in concept and located in the Utica-Rome-Herkimer Area. Master's level programs will be offered at all three campuses.

The Trustees also have approved the establishment of seven additional community colleges. In varying stages of development, they are sponsored by Clinton, Columbia-Greene, Cortland-Tompkins, Essex-Franklin, Genesee, Herkimer and Ontario Counties.

State University further comprises the Ranger School, a division of the College of Forestry which offers a 43-week technical forestry program at Wanakena, and the Center for International Studies and World Affairs located at Oyster Bay.

The University offers four-year programs in many fields, including agriculture, business administration, ceramics, dentistry, engineering, forestry, home economics, industrial and labor relations, law, liberal arts and sciences, maritime service, medicine, nursing, pharmacy, professional museum work, public administration, social work, teacher education and veterinary medicine.

Its two-year programs include nursing and liberal arts transfer programs and a wide variety of technical courses in such areas as agriculture, business, and the industrial and medical technologies.

Graduate study at the doctoral level is offered by the University at 12 of its campuses, and graduate work at the master's level at 24 campuses. The University is continuing to broaden and expand over-all opportunities for advanced degree study.

Governed by a Board of Trustees appointed by the Governor, State University of New York comprises all State-supported institutions of higher education, with the exception of the four-year colleges of City University of New York. Each college and center of State University is locally administered. Although separated geographically, all are united in the purpose to improve and extend opportunities for youth to continue their education beyond high school.

The State University motto is: "Let Each Become All He Is Capable of Being."

CAMPUSES OF STATE UNIVERSITY OF NEW YORK

Office of the Chancellor, 8 Thurlow Terrace, Albany, N. Y. 12201

UNIVERSITY CENTERS

State University at Albany
State University at Binghamton
State University at Buffalo
State University at Stony Brook

MEDICAL CENTERS

Downstate Medical Center at Brooklyn (New York City)
Upstate Medical Center at Syracuse

CAMPUSES OF STATE UNIVERSITY OF NEW YORK (*continued*)

COLLEGES OF ARTS AND SCIENCE

College at Brockport
College at Buffalo
College at Cortland
College at Fredonia
College at Geneseo
College at New Paltz
College at Oneonta
College at Oswego
College at Plattsburgh
College at Potsdam

(Three additional Colleges of Arts and Science are under development. Two four-year campuses, in Westchester and Nassau counties, are in early planning. A third, upper-divisional in nature, has been proposed for the Utica-Rome-Herkimer area.)

SPECIALIZED COLLEGES

College of Forestry at Syracuse
Maritime College at Fort Schuyler (Bronx)
College of Ceramics at Alfred University
College of Agriculture at Cornell University
College of Home Economics at Cornell University
School of Industrial and Labor Relations at Cornell University

AGRICULTURAL AND TECHNICAL COLLEGES (Two-year)

Agriculture and Technical Colleges at: Alfred, Canton, Cobleskill, Delhi, Farmingdale, Morrisville

COMMUNITY COLLEGES

(Locally-sponsored two-year colleges under the program of State University)

Adirondack Community College at Hudson Falls
Auburn Community College at Auburn
Borough of Manhattan Community College at New York City
Bronx Community College at New York City
Broome Technical Community College at Binghamton
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie County Technical Institute at Buffalo
Fashion Institute of Technology at New York City
Fulton-Montgomery Community College at Johnstown
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown
Kingsborough Community College at Brooklyn
Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
New York City Community College of Applied Arts and Sciences at Brooklyn
Niagara County Community College at Niagara Falls
Onondaga Community College at Syracuse
Orange County Community College at Middletown
Queensborough Community College at New York City
Rockland Community College at Suffern
Staten Island Community College at New York City
Suffolk County Community College at Selden
Sullivan County Community College at South Fallsburg
Ulster County Community College at Kingston
Westchester Community College at Valhalla

(Five additional community colleges, to be located in Clinton, Essex-Franklin, Genesee, Herkimer and Ontario Counties, have been approved by the Board of Trustees.)


STATE UNIVERSITY OF NEW YORK
LET EACH BECOME ALL HE IS CAPABLE OF BEING
1948