Graduate Bulletin 1968-69

State University of New York at

Stony Brook

CAMPUSES OF STATE UNIVERSITY OF NEW YORK

Office of the Chancellor, 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

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 in varying stages of development. Two four-year campuses, in Westchester County at Purchase and in Nassau County at Old Westbury are under development. Old Westbury will admit its first students in limited numbers in September 1968. The third campus will be upper-division (junior-senior years) in concept and located in the Utica-Rome-Herkimer area. Master's level programs will be offered at all three campuses.)

SPECIALIZED COLLEGES

College of Forestry at Syracuse University
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)

Alfred
Canton
Cobleskill
Delhi
Farmingdale
Morrisville

COMMUNITY COLLEGES

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

Adirondack Community College at Glens 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
Community College of the Finger Lakes at Canandaigua
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
Genesee Community College at Batavia
Herkimer County Community College at Ilion
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 Stone Ridge
Westchester Community College at Valhalla

Five additional community colleges to be sponsored by Clinton, Columbia-Greene, Essex-Franklin (North County), Schenectady and Tompkins-Cortland Counties have been approved by the Board of Trustees and are in varying stages of development. Clinton and North Country plan to admit students in September 1968.

STATE UNIVERSITY OF NEW YORK AT STONY BROOK

THE GRADUATE BULLETIN

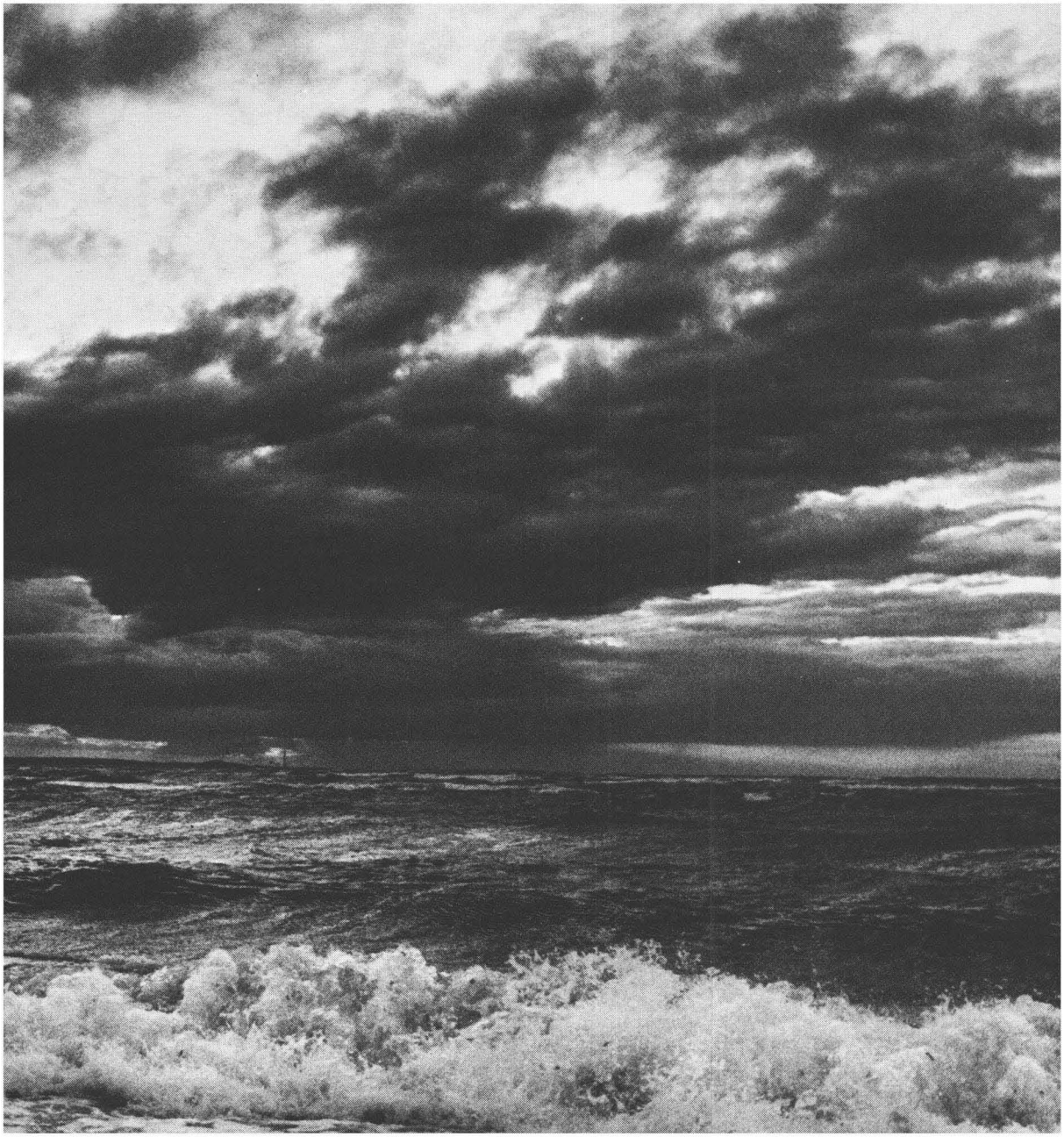
1968–1969

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

Long Island Sound near Stony Brook



ACADEMIC CALENDAR

1968—1969

Fall Semester 1968	
New Student Orientation	September 15-17
Final Registration	September 16-17
Classes Begin	September 18
End of Change of Registration Period	October 1
Last Day to Drop A Course Without Penalty	November 19
Thanksgiving Holiday	November 27-December 1, inclusive
Classes Resume	December 2
Christmas Holiday	December 22-January 5, inclusive
Classes Resume	January 6
Last Day of Classes	January 11
Semester Examinations	January 13-23
Spring Semester 1969	
Final Registration	January 30-31
Classes Begin	February 3
End of Change of Registration Period	February 14
Spring Recess	March 30-April 7, inclusive
Classes Resume	April 8
Last Day to Drop A Course Without Penalty	April 11
Last Day of Classes	May 20
Semester Examinations	May 21-31
Commencement	June 1
Summer Session 1969	
Registration	June 23
Classes Begin	June 24
Last Day of Classes	August 1

Contents

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 1968-69 academic year, graduate programs leading to the Master's and Ph.D. degrees are offered by the Departments of *Biological Sciences, Chemistry, Earth and Space Sciences, English, History, Mathematics, Physics, Psychology,* and *Sociology* 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. 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 1968-69 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 Health Sciences Center is being planned for the Stony Brook campus. The 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 Health Sciences

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 1968-69 full-time enrollment will exceed 6,000 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 1968, Stony Brook will have more than 500 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 1,000 acres of rolling, densely wooded terrain, with the central core area largely cleared for the buildings now in use.

There are nine 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, the Lecture Hall, and buildings for Earth and Space Sciences, Chemistry, Biology, and Engineering. The Physics Building houses the Departments of Physics and Mathematics. 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 Health Sciences 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 an Instructional Resources Center (early 1969) in which new methods of visual presentation of instruction will be created, a Fine Arts Center with buildings for music, art and theatre 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 contains the general-purpose graduate laboratory facilities.

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 contains conference and seminar rooms and faculty offices. Adjoining this section is the classroom-laboratory building. The two buildings are 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 are provided in the Melville Library. A special area houses the files of microfilm, microcards, microprint, and microfiche. A Xerox copier is available for student use.

The University Library is a selective government depository and receives large numbers of publications issued by the U.S. and other governments. About 4,800 periodicals are currently received covering all areas of knowledge, and the staff is processing books at the rate of 70,000 volumes per year. The total library collection now numbers 268,000 volumes and 50,000 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.

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.

During the 1968-69 academic year, a new major IBM 360 computing system will be installed, replacing the IBM 7044, with capabilities reflecting the latest state of the art. This system permits instantaneous communication to the central computer via controls located throughout the campus, thus allowing many users facilitated access to the computing system. The Computing Center building, completed this year, is located in the Engineering Quadrangle.

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 first floor of the Social Sciences Center, 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. Tuition rate for a special graduate student part-time (6 or less credits) is $20 per credit each semester.

Other Fees

College Fee: $12.50 per semester.

Special students part-time: $.85 per credit per semester.

Student Health Insurance Fee

Individual: $32.00 (payable at Fall registration for twelve months—September to September. Pro rata premium available for February admits.)

Student & Spouse: $69.00.
Student, Spouse & Dependent Child or Children: $117.00.

General University Deposit
Commuting Student: $20.00.
Resident Student: $35.00.

Graduation Fee: $15.00 (payable upon completion of all degree requirements and prior to the award of the degree).

Identification Card: $2.00.

Late Registration Fee: $15.00 (paid by students registering after the close of the official registration period).

Transcript Fee: $1.00 for each transcript (A student who obtains a degree may receive two transcripts without charge. Account with the University must be clear.)

Residence Charges

Room and board charges for students living on the Stony Brook campus are approximately $895 per academic year, of which $395 represents the rent for a double occupancy room; these charges are payable on a semester basis. A $25 advance room deposit is required, this amount being applied to the first semester payment. The advance room deposit is refundable if application is made in writing before July 1st. Board is $450 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 program should be directed to the Financial Aid Officer in the Dean of Students Office.

Graduate Assistantships and Fellowships

An applicant seeking an assistantship or fellowship is strongly advised to make sure that all his application material including letters of recommendation and transcripts have been received by the University no later than February 1.

Teaching and research assistantships carry stipends of $2,627 for the academic year and tuition exemption. For advanced students the stipend is $2,754.

University Fellowships are also available, with stipends of about $2,500 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. If a student receives a stipend from the University and also from an outside source for the academic year, the University contribution will be adjusted so that the total of these stipends will not exceed $3,000 for the academic year.

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 1967-68 academic year, approximately 90% of the graduate students at Stony Brook held fellowships or assistantships.

ADMISSION REQUIREMENTS

Applicants may be admitted to the Graduate School only as full-time students pursuing the M.A., M.S., or Ph.D. degree. Those who wish to study on a part-time basis, whether or not in pursuit of a graduate degree, may make application to

the Center for Continuing Education, whose program is described on page 22. To be admitted to the Graduate School, an applicant must have the preparation and ability which, in the judgment of the department and the Graduate School, are sufficient to enable him to progress satisfactorily in a degree program. Admission decisions are based primarly on past records and on letters of recommendation. A baccalaureate degree is required, which will ordinarily be in the chosen field of graduate study, and an average grade of B in course work in the major and related areas. In exceptional cases in which these requirements are not met, or if the undergraduate preparation is inadequate, an applicant may be admitted provisionally, if he is considered to have a reasonable probability of making satisfactory progress in graduate studies. The department may set conditions which the admitted student must satisfy during the early period of his graduate work. Departmental recommendation and Graduate School approval are required for provisional admission. Detailed admission requirements are listed in each department's section of this Bulletin.

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.)

Student Status

Students regularly admitted to the Graduate School will register as full-time students and will register for 12 or more credit hours per semester. Responsibility for certifying the full-time status of graduate students rests with the department chairmen, who must be satisfied that the student is fully committed to the academic program leading to a graduate degree. A graduate assistantship (teaching or research) is considered part of the academic program; therefore, a graduate assistant, on a regular appointment, will be a full-time student. Registration for 12 or more credit hours includes credit for supervised teaching and research.

Part-Time Status and Special Student Status

Normally part-time study is carried out in the Center for Continuing Education, where the degree sought is the M.A. (L.S.) degree. Part-time students may be accepted into a Ph.D. program upon request of the program chairman to the Graduate Dean. Part-time students who do not seek a degree enroll as Special Students (non-matriculated) in the Center for Continuing Education. Special Students and Part-time Students may enroll for no more than eight credit hours and no more than two courses per semester.

Part-time and Special students may enroll in any courses offered in the Cen-

ter for Continuing Education (courses designated CED). If such students wish to enroll in regular departmental graduate courses they must supply the documents required of applicants for regular admission to the Graduate School, including letters of recommendation from former teachers or from professional superiors.

Changes in Registration

During the first four weeks of classes, changes in registration may be accomplished by completing the request form available from the Registrar, providing the proposed change does not alter the student's status as defined above. After the fourth week of classes, no course may be added or dropped. In case it becomes impossible for a student to complete a course for a reason such as illness or accident he may petition the Dean of the Graduate School for adjustment of these regulations to his case. In rare instances of this kind the letter "W" will be used to indicate withdrawal from a course.

Grading System

The following grading system will be used for graduate students in both graduate and undergraduate courses: A (4.00) Superior, B (3.00) Good, C (2.00) Minimum Passing, F (0.00) Failing.

In addition, the following marks may be awarded at the end of the semester:

I (Incomplete). This is an interim grade. It may be given at the discretion of the instructor but only upon evidence that good cause, such as serious, protracted illness, prevented the student's completion of course requirements. The grade of "I" must be resolved by the following dates: March 15th for courses of the preceding fall semester; July 31st for courses of the preceding spring semester. In granting a grade of "I" the instructor signifies his willingness to receive student work and prepare grades in accordance with these deadlines. If final grades are not reported to the Registrar by the specified dates, the grade of "I" will automatically by changed to "F".

S (Satisfactory). Indicates passing work in those courses, so designated by the department and approved by the Graduate Council where the normal mode of evaluation is impracticable.

U (Unsatisfactory). Indicates unsatisfactory work in those courses, so designated by the department and approved by the Graduate Council, where the normal mode of evaluation is impracticable.

R (Registered). Indicated attendance during the first semester in a year-long course, the final grade for which will be assigned only after the completion of two semesters.

Auditing

Auditing is permitted by special arrangement between student and instructor. No record is kept of courses audited.

Academic Standing

A student may be dismissed if his overall average falls below B (3.0) at any time after the completion of his first two semesters of graduate work. Additional minimum grade requirements may be imposed by individual departments.

Leaves of Absence

Leave of absence may be obtained for a specified time not to exceed two years with the permission of the department chairman and the Dean of the Graduate School. Military leave of absence will be granted automatically for the duration of obligated service to students in good standing.

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.

The minimum degree requirements listed below are those of the Graduate School; a department may have additional requirements.

The Master of Arts and Master of Science Degrees

1. Minimum residence: Two consecutive semesters of full-time study.
2. Language proficiency: Though the Graduate School does not require proficiency in a foreign language for the Master's degree, most departments have such a requirement.
3. Research and thesis, or the passing of a comprehensive examination or both.
4. Departmental recommendation: When all departmental requirements are completed, the Chairman may recommend to the Dean of the Graduate School that the Master's degree be granted.
5. Time limit: All requirements for the Master's degree must be completed within three years of the student's first registration as a graduate student. In rare instances, the Dean of the Graduate School will entertain a petition for extension of time bearing the endorsement of the Chairman of the Department. In such instances the student may be required to repeat certain examinations or present evidence that he is still prepared for the thesis or the final examination.

The Ph.D. Degree

1. Minimum residence: Four semesters of full-time study beyond the baccalaureate including at lease two consecutive semesters.
2. Language proficiency: The Graduate School requires that the student demonstrate reading proficiency in a foreign language designated by the department. The department may impose additional language requirements. The proficiency examination must normally be passed before permission is given to take the Preliminary Examination.
3. Preliminary Examination: The purpose of the Preliminary Examination is to ascertain the breadth and depth of the student's preparation and to appraise his readiness to undertake a significant original investigation. At the discretion of the department the Preliminary Examination may be oral or written or both and may consist of a series of examinations. The examining committee is appointed by the Graduate Dean on recommendation of the department chairman and may include one or more members from outside the department. Results of the Preliminary Examination will be communicated to the student

as soon as possible and to the Graduate School within one week of the completion of the exam. A repetition of the Preliminary Examination, upon failure, may be scheduled at the discretion of the department. A second repeat must be approved by the Graduate Council.

4. Advancement to Candidacy: The student may be advanced to candidacy when he has completed all Graduate School and departmental requirements for the degree other than the dissertation. Advancement to candidacy is granted by the Graduate Dean upon recommendation of the department.

5. Research and Dissertation: A dissertation is required for the Ph.D. degree. It must convey in a clear and convincing manner the results of an original and significant scholarly investigation. Depending upon the character of the student's research, his department chairman will appoint an appropriate supervisor or supervisory committee, in consultation with whom the student will conduct his investigation and write his dissertation.

   The dissertation must be approved by a Dissertation Examining Committee of at least four members of the faculty, appointed by the Graduate Dean. This Committee may include the dissertation supervisor (s) and must include at least one person from outside the department. At the discretion of the department, approval of the dissertation may or may not involve a formal oral defense. If a formal defense is required, it will be conducted by the Dissertation Committee and will not be chaired by the supervisor of the dissertation. The formal defense will be open to all members of the faculty.

   In the absence of a formal defense, the student will present the results of his dissertation research at an informal dissertation colloquium convened for that purpose by his department and open to interested faculty and graduate students.

   Evauation (approval or disapproval) of the dissertation will be indicated by the Dissertation Examining Committee on a form to be submitted to the Graduate School.

6. Time limit: All requirements for the Ph.D. degree must be completed within four years after advancement to candidacy. In rare instances, the Dean of the Graduate School will entertain a petition to extend this time limit, provided it bears the endorsement of the Chairman of the Department. The Dean or the department may require evidence that the student is still properly prepared for the completion of his work. In particular, the student may be required to pass the Preliminary Examination again in order to be permitted to continue his work.

The Master of Arts (Liberal Studies) Degree

This is a terminal, non-research degree offered by the Center for Continuing Education primarily for persons interested in studying on a part-time basis. Details of the program and degree requirements are available from the Center.

Award of Degree

When all requirements have been completed the department chairman will so certify to the Graduate Dean and recommend that the degree be awarded. Degrees are awarded at the annual Commencement following the completion of requirements. Prior to Commencement a certificate in lieu of the degree may be requested.

Waiver of Regulations

Specified requirements may be waived by the Graduate Council in individual instances. A petition for such waiver must be endorsed by the Chairman of the Department, who shall append his reasons for believing that the requested waiver would not result in a breach of the spirit of the regulations.

The University reserves the right to alter these regulations without notice.

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.

INSTRUCTIONS FOR THE PREPARATION OF MASTERS THESES AND DOCTORAL DISSERTATIONS

The candidate should consult with his department or, in the case of Engineering, his College, to determine if there are additional requirements, beyond those set

forth in these instructions, which he will also be expected to follow in the preparation of his thesis or dissertation.

I. General Instructions

A. MASTERS THESIS. Two copies of the thesis must be deposited with the University Library, and one copy with the candidate's department or, in the case of Engineering, his College. The two Library copies shall be the original typewritten copy, and either the first carbon or a xerox copy. A department or the College of Engineering may, as it sees fit, require additional copies beyond the three specified here.

The requirement that two copies be deposited with the Library is to make the research they contain available for scholarly use. These Library copies may be used by qualified readers subject to reasonable rules for the protection of author's rights.

The costs of typing, reproduction and binding for required copies normally will be borne by the candidate. For purposes of uniformity, binding of the Library copies will be done by the Library for a stated fee (presently $4.00 per copy).

B. DOCTORAL DISSERTATION. Each candidate will deposit with the Graduate School the first or ribbon copy of his dissertation, the first carbon or duplicate copy for the University Library and the second carbon for the use of his Department, or in the case of Engineering, his College. The ribbon copy will be listed and indexed in University Abstracts. This will constitute publication. The publication fee is $30, and the binding fee for the remaining two copies is, at present, $4.00 per copy. If the candidate wishes to copyright his dissertation the Graduate School will advise him of the procedure to be followed and the exact additional cost which is approximately $12.

II. Typing Directions

The pages of all copies must be 8½ by 11 inches. The paper used for the original typewritten copy must be a bond of at least 16-pound substance. Paper for carbon copies should be at least of 13-pound substance and have a smooth finish. Xerox copies shall be reproduced on a standard grade of xerox paper.

All pages must have a 1½ inch margin on the left side to facilitate binding, and a 1 inch margin on each of the other three sides.

Pica or elite type may be used, with the same type employed for all pages of

the thesis or dissertation. The general text of the manuscript should be double-spaced, but tables, long quotations, and footnotes should be single-spaced.

The typing must be of a high quality, using a black ribbon, and free from ink insertions, except for characters which do not appear on standard typewriters, such as accents, brackets, scientific or mathematical symbols, etc. These exceptions may be inked in with permanent black ink. Corrections must be made by typewriting; interlinear corrections or strikeovers are not acceptable.

III. Format

A. MAIN PARTS. The thesis or dissertation falls into three main parts outlined as follows:

1. *Preliminaries*
   a. Title-page (see outline at end of these instructions).
   b. Thesis committee approval.
   c. Abstract of the thesis or dissertation, not to exceed 600 words in length, summarizing the research problem and the main results.
   d. Preface and acknowledgments.
   e. Table of contents, showing the principal divisions of the thesis or dissertation. These divisions must agree in wording and style with the divisions shown in the text.
   f. List of illustrations or figures (if necessary).
   g. List of tables (if necessary).

2. *Text.* This is the main body of the thesis or dissertation, consisting of well defined divisions such as parts, chapters, sections.

3. *Reference Matter*
   a. Appendix.
   b. Notes (where applicable).
   c. Bibliography.

B. PAGINATION. Every page shall be assigned a number, even though on the thesis or dissertation title-page and any half-title pages no numbers will appear. (A half-title page is a separate sheet within the main body of the text carrying the number and title of a major division such as a part.)

Page numbers must be typed within the prescribed margins, in the upper right hand corner, at least two spaces above the first line of text. Exceptions to this are: (1) numbers of the thesis or dissertation title-page and any half-title pages which are omitted, as noted above; and (2) the numbers of chapter title-pages, which will appear at the foot in the middle of the page.

Preliminary pages shall be assigned small Roman numbers (e.g., ii, iii, iv, etc.) beginning with the thesis or dissertation title-page and continuing consecutively through the remainder of the preliminary pages. However, the first number to appear will be the small Roman number "ii" on the page immediately following the thesis or dissertation title-page.

The remainder of the thesis or dissertation pages will be numbered consecutively with Arabic numerals (e.g., 1, 2, etc.) beginning with the first page of the text and continuing through (including any illustrations and tables) to the last page of the reference matter.

C. TEXT

Notes. Note references will follow a consistent style throughout whether they appear at the foot of the pages of text or are grouped at the end. Notes shall be numbered consecutively by chapter or other main division of the text. Where the Department prescribes a style of citation, it shall be used. If there is an accepted form of citation for the subject field, it may be used. In the absence of these, the writer should adopt one of the standard forms of style and follow it faithfully. Among these standard forms are: *The MLA Style Sheet,* compiled and published by the Modern Language Asssociation, New York City; or Kate L. Turabian, *A Manual for Writers of Dissertations,* University of Chicago Press, Chicago.

Illustrations. All illustrations used in the thesis or dissertation must appear in all copies. Illustrations, such as drawings, photographs, diagrams, photostats, etc., may be inserted wherever necessary in the text. They should be numbered consecutively throughout (e.g., Plate 1, Plate 2, etc.; or Fig. 1, Fig. 2, etc.).

Illustrations must be prepared on paper comparable to that of the copy in which they will appear. All illustrations must be designed so that plate and caption can be placed within the prescribed page margins.

Folded illustrations may be inserted if necessary. The sheet must be folded in such a way that it can be bound in the thesis and easily unfolded.

All illustrations should be firmly mounted to prevent curling of the paper. Photo mounting corners, "Scotch tape," or staples are not acceptable.

Lettering and lines which cannot be typewritten on illustrations should be inserted in permanent black ink.

Tables. Be sure tables can be read easily. They should be typed or drawn with permanent black ink. Tables larger than a half page should be placed on a separate sheet; half-page or shorter tables may be centered on the page with text above and below. Very large tables may be folded in the same manner described above for large illustrations. All tables should be consecutively numbered throughout (e.g., Table 1, Table 2, Table 3.1, etc.).

Formulas. Mathematical and chemical formulas should be carefully made by typewritting, hand lettering, or both. Complex mathematical formulas of two or more lines should not be included in text lines, but should be placed in the proper position in the center of the page between lines of text. The lines in structural chemical formulas and hand-lettered mathematical formulas must be in permanent black ink.

D. REFERENCE MATTER

Appendix. In some theses or dissertations it may be desirable to include certain materials (e.g., test forms, detailed apparatus descriptions, lengthy expansions of points treated in the text, etc.) which do not actually form a part of the text. Such materials should be made part of the thesis or dissertation as one or more appendices, designated by capital letters, and placed after the close of the main body of the text. The same marginal, pagination, and citation requirements will be followed as for the text proper.

Notes. Where note references are grouped with the reference matter at the close of the thesis or dissertation, they will follow the same regulations as to margins and pagination as the text. Notes at the end will be organized by the same divisions as appear in the text, will be single-spaced with double spacing between entries, and will be consistent in style.

Bibliography. The bibliography should be arranged in a definite order, single-spaced with double spacing between entries. All books, articles, and other material used in preparing the thesis or dissertation should be listed in the bibliography. As in the case of the notes, any Departmental style regulations will be followed. Where these are not specified, the bibliographical style will be consistent with the style forms adopted for the notes (see the references above to *The MLA Style Sheet,* and *A Manual for Writers of Dissertations*; these also contain suggested bibliographical forms).

IV. Exceptions

The student should consult his advisor if he feels that the special nature of the thesis material requires some deviation from the rules prescribed above. If the proposed change is minor and consistent with the objectives of these rules, approval of the advisor is sufficient. Major changes must be approved by both the advisor and the Graduate School.

[TITLE]

A thesis presented

by

[Full name, including middle name, of author]

to

The Graduate School

in partial fulfillment of the requirements
for the degree of

[Master of Science or of Arts; Doctor

of Philosophy]

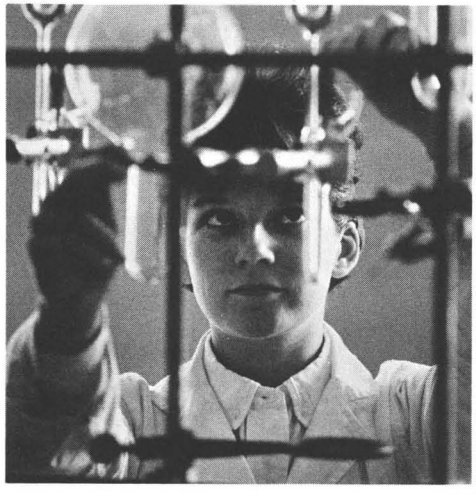
in

[Name of program]

State University of New York at Stony Brook

[Month, year of submission]

At Stony Brook, one of the newest and fastest growing universities in the country, new buildings rise at the rate of one per month. Shown on this page is a wing of the new Social Science Building. Top right are Stony Brook's three Distinguished Professors: Nobel Laureate C. N. Yang in Physics, Bentley Glass in Biology and Alfred Kazin in English. Lower right, a physics student scans bubble chamber photographs.



GRADUATE PROGRAMS IN ARTS AND SCIENCES

BIOLOGICAL SCIENCES

Professors: BAYLOR, CAIRNS, E. CARLSON, CIRILLO, ERK, GLASS, GOREAU, HIRS (*Adjunct*), SIMPSON, SLOBODKIN, SQUIRES, WILLIAMS

Associate Professors: BATTLEY,[a] JONES (*Acting Chairman*), LYMAN, MERRIAM, MOOS, RILEY, SMOLKER, TUNIK, WALCOTT

Assistant Professors: ARNHEIM, A. CARLSON, DUDOCK, EDMUNDS, EMLEN, FARRIS, FOGG, FOWLER, FREUNDLICH, GAUDET, GESTELAND, HECHTEL, KERNAGHAN, KRIKORIAN, LEICHTLING, ROSENBERG, STERNGLANZ, WURSTER

Instructor : OBREBSKI

(*Professors in Health Sciences:* KNUDSON, LEFEVRE, PELLEGRINO) [b]

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, Spring Semester 1969.

[b] Medical faculty who may supervise graduate research in 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. Language requirement: Normally a reading knowledge of two foreign languages selected usually from German, French and Russian in consultation with the Graduate Studies Committee.

C. Preliminary examination: After completing the major portion of course work, a student may apply for the preliminary examination. Normally the examination will be oral and/or written, and may be taken no later than the sixth semester after entrance. The language requirement must be completed before permission will be given to take the preliminary examination.

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. The Dissertation Examination Committee will consist of at least 4 members of the faculty appointed by the Dean of the Graduate School.

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: ALEXANDER, BONNER (*Chairman*), CHU, FRIEDMAN, HAIM, KOSOWER,[b] OKAYA, RAMIREZ, SUJISHI, WOLFSBERG[a]
Associate Professors: GOLDFARB, HIROTA, LAUTERBUR, LE NOBLE, WEISER, WHITTEN, WISHNIA
Assistant Professors: JESAITIS, JOHNSON, KERBER, KRANTZ, KWEI, LLOYD,[d] MUROV, SCHNEIDER, SPRINGER, STIEFEL
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.
[b] On leave academic year 1968-69.
[c] Director of the Center for Curriculum Development.
[d] Not in residence, Fall semester 1968.

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
Physical Chemistry of Macromolecules	(CHE 530)	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 requirements: Successful completion (3.5 average[a]) of an approved course of study.
E. Cumulative examinations and proposition: Cumulative examinations and propositions are intended to provide a means by which the student's depth of knowledge can be enhanced as well as demonstrated. The cumulative examinations will be offered at eight stated dates each year in the three major areas of physical, inorganic and organic chemistry. A student is expected to pass at least two examinations within the first two semesters after qualification to candidacy, and a total of four examinations within the three semesters following qualification. Each student will present and defend a proposition, not directly related to his thesis problem, during the four semester period following qualification. The proposition will consist of the presentation of a written research proposal which the student will defend orally before a faculty committee after completion of the cumulative examination requirement.

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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 510 Practicum in Teaching

Practice instruction in chemistry at the undergraduate level, carried out under faculty orientation and supervision. A minimum of two semesters of registration for CHE 510 is required of all candidates for graduate degrees in Chemistry, unless explicitly waived by the Chairman.
Variable and repetitive credit

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

CHE 512 Inorganic Chemistry II

Topics presented include physical properties of inorganic substances, structural effects in chemical equilibria, mechanisms of inorganic reactions and interpretation in terms of electronic structure.
Spring, 3 credits

CHE 521 Quantum Chemistry I

Elementary quantum and statistical mechanics will be applied to problems of chemical interest, including chemical bonding and molecular structure. The interpretation of ultraviolet, visible, infrared and radio-frequency spectroscopic data will be emphasized.
Fall, 3 credits

CHE 522 Quantum Chemistry II

An introduction to matrix methods in quantum mechanics, and the behavior of systems in the presence of electric and magnetic fields. The application of symmetry properties and group theory will be made to atomic and molecular systems.
Spring, 3 credits

CHE 523 Chemical Thermodynamics

A rigorous development of the fundamentals of thermodynamics and their application to a number of systems of interest to chemists. These systems include electrolytic and non-electrolytic solutions, electrochemical cells, gases, homogeneous and heterogeneous equilibrium systems. An introduction to statistical mechanics will also be included in order to relate the microscopic properties of molecules to the classical thermodynamic functions.
Fall, 3 credits

CHE 526 Chemical Kinetics

An intensive study of rates of chemical reactions and in particular the relationship of kinetic studies to the determination of reaction mechanisms. Experimental methods will be discussed with emphasis on the determination of rate laws. The theoretical treatment will include discussions of the kinetic theory and the transition-state theory approaches to chemical kinetics. Topics will include gas reactions, chain reactions, and the new approaches to the study of very rapid chemical reactions.
Spring, 3 credits

CHE 528 Statistical Mechanics

Techniques will be discussed which permit the calculation of macroscopic properties for a variety of chemical systems, given the detailed nature of the microscopic substructure of the system. The above techniques, which lead to results paralleling those of thermodynamics, will be applied to ideal and real gases, crystals and liquids. In addition, some kinetic properties of systems will be examined.
Spring, 3 credits

CHE 529 Nuclear Chemistry

Topics include the properties of radioactive substances and their use in the study of chemical problems; nuclear structure; a study of nuclear reactions; radioactive decay and growth; interations of radiation with matter; detection and measurement of radiation, including a discussion of statistics; application of radioactivity to chemical problems such as kinetics, structure and analysis; artificially produced elements; and nuclear reactions.
Fall, 3 credits

CHE 530 Physical Chemistry of Macromolecules

An investigation of the gross and fine structure of macromolecules in solution as revealed by hydrodynamic behavior (e.g., ultracentrifugation, viscosity) spectroscopic properties (e.g. ultraviolet hypochromism, circular dichroism, magnetic resonance spectra), and the thermodynamics of interaction with small molecules. Theory of conforma-

tion changes (e.g., helix-coil transitions, allosteric effects).
Spring, 3 credits

CHE 531 Seminar

Fall, No credit

CHE 532 Seminar

Spring, 1 credit

CHE 599 Research

Variable and repetitive credit

CHE 601 Special Topics in Synthetic Organic Chemistry

The subject matter varies depending on interests of students and staff. It may cover such areas as heterocyclic chemistry, organometallic chemistry and the chemistry of organic molecules containing second row elements. The emphasis is on fundamental considerations and recent developments.
Fall, 2 credits

CHE 602 Special Topics in Physical Organic Chemistry

The subject matter varies depending on interests of students and staff. It may cover such areas as photochemistry, theoretical organic chemistry and the chemistry of unstable intermediates; the emphasis is on fundamental considerations and recent developments.
Spring, 2 credits

CHE 604 Molecular Biochemistry

The application of physical-organic chemistry to biochemical reactions, including a survey of intermediary metabolism and mechanistic analysis of such reactions as decarboxylations, hydration, hydrolysis, electron-transfer reactions, hydrogen-transfer reactions and reactions of phosphates.
Spring, 2 credits

CHE 623 Molecular Spectroscopy

A detailed description of the theory and practice of rotational, vibrational, and electronic absorption spectroscopy. Topics to be covered will include energy levels, force fields, and selection rules for polyatomic molecules. Emphasis will be on the application of spectroscopic data to molecular structure and other problems of chemical interest.
Fall, 2 credits

CHE 624 Magnetic Resonance

A study of the theory of magnetic and electrostatic interactions among nuclei and electrons, and of the experimental techniques used to observe them. Applications of magnetic resonance spectroscopy to a number of topics of chemical interests, including rate processes, the electronic structures, conformations, and motions of molecules, and the structures and electronic properties of solids will be discussed.
Spring, 2 credits

CHE 625 Molecular Structure and Crystallography

Experimental methods in the determination of molecular structure. The relationship of structure to chemistry. The emphasis will be on the determination of structure in the solid state, particularly by X-ray crystallography.
Fall, 2 credits

CHE 626 Computer Controlled Experimentation in Chemistry

Basic concepts and practice in on-line data acquisition and display, interfacing techniques, feed-back control as applied to chemical instrumentation. Students will design, simulate and/or perform actual experiments with the computer.
Fall, 3 credits

CHE 682 Special Topics in Inorganic Chemistry

Subject matter varies, depending on interests of students and staff but will cover recent developments in inorganic chemistry.
2 credits

CHE 683 Special Topics in Physical Chemistry

Subject matter varies, depending on interests of students and staff but will cover recent developments and advanced topics in physical chemistry.
2 credits

CHE 699 Research

Variable and repetitive credit

EARTH AND SPACE SCIENCES

Professors: PALMER, SCHAEFFER (*Chairman*), SQUIRES,[a] STROMGREN (*Adjunct*), WEYL[b]

Associate Professors: CHIU[c], GROSS[b], KALKSTEIN, STROM

Assistant Professors: DODD, HANSON, ROSE, SHU, R. SMITH

Lecturer: S. KAYSER

Instructor: RAPP

Curator: BUDDENHAGEN

Admission to Graduate Study

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

A. A baccalaureate degree in one of the Earth or Space Sciences, or in biology, chemistry or physics.

B. A minimum average of B for all undergraduate course work and an overall B average for courses in the sciences.

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

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

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[a] Director of the Marine Sciences Center
[b] Member, Marine Sciences Center
[c] Member, NASA Goddard on part-time appointment at Stony Brook

Requirements for the M.S. Degree

A. Residence: Two consecutive semesters of full-time study.
B. Language: None
C. Formal course work: Successful completion with a B average of an approved course of study comprising at least 24 credits. This may represent either 18 academic credits and 6 research credits culminating in a thesis, or 24 credits without a thesis.
D. Final examination: This examination will be either a written comprehensive examination for students taking an M.S. degree without a thesis, or an oral examination of the student's M.S. thesis.
E. Departmental recommendation: When all departmental requirements are completed, the Chairman may recommend to the Dean of the Graduate School that the Master of Science degree be granted.
F. Time limit: All requirements for the M.S. degree must normally be completed within 3 years of the time of the student's first registration as a graduate student.

Requirements for the Ph.D. Degree

A. Residence: Two years of full-time graduate study.
B. Language: Reading proficiency in a modern foreign language. This must normally be completed before permission to take the second part of the preliminary examination is granted.
C. Formal course work: Successful completion with a B average of an approved course of study.
D. Preliminary examination: This examination will consist of two parts:
   Part 1. A written comprehensive examination usually given after one year of graduate study.
   Part 2. A written and/or oral examination to be given by an examining committee appointed by the graduate dean upon recommendation of the department chairman. The committee may include one or more members from outside the department.
E. Advancement to Candidacy: The student may be advanced to candidacy for the Ph.D. when he has completed all Graduate School and Departmental requirements for the degree other than the dissertation. Advancement to candidacy is granted by the Graduate Dean upon recommendation of the Department Graduate Committee.
F. Research and Dissertation: The dissertation must be approved by a Dissertation Examining Committee of at least four members of the faculty, including at least one from outside the department, appointed by the Graduate Dean. A formal oral defense of the thesis will be

conducted by the Dissertation Examining Committee. This will be open to all members of the faculty.

G. Time Limit: All requirements for the Ph.D. degree must normally be completed within four years after advancement to candidacy.

Courses

Advanced Undergraduate Courses

ESS 301 Optical and X-ray Mineralogy
ESS 305 Field Geology
ESS 306 Igneous and Metamorphic Petrology
ESS 307-308 Advanced General Geology
ESS 311 Advanced Paleontology
ESS 322 Principles of Geochemistry
ESS 341 Astronomy and Galactic Dynamics
ESS 342 Interstellar and Galactic Astrophysics
ESS 362 Physical Oceanography
ESS 363 Sediments and Sedimentary Processes

Graduate Courses

ESS 503 Advanced Field Geology

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

ESS 504 Sedimentary Petrology

The derivation, transportation, deposition, diagenesis and lithification of sediments. The physical, chemical, and structural properties of sedimentary rocks. Laboratory work includes chemical and microscopic studies. Two hours lecture and one 3 hour laboratory per week.
Fall, 3 credits

ESS 505 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 511 Paleoecology

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

ESS 512 Biostratigraphy

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, 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 at-

mosphere 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

ESS 600 Practicum in Teaching

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.

ESS 601 Topics in Astronomy-Astrophysics

ESS 602 Topics in Environmental Sciences

ESS 603 Topics in Geology

ESS 604 Topics in Geo-Cosmochemistry

ESS 605 Topics in Paleontology-Stratigraphy

ESS 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

ECONOMICS

Professors: HOFFMANN, LEKACHMAN[a], NEUBERGER, STEKLER

Associate Professors: JAMES, KALMAN, KANOVSKY[a], KRISTEIN, STALEY

Assistant Professors: CORNEHLS, DUSANSKY, KRAMER, TERRY, VAN ROY, ZSCHOCK, ZWEIG

The Department of Economics has submitted a proposal for a Ph.D. program in economics and is planning to initiate the program in the 1969-70 academic year. Information on the program may be obtained directly from the office of the Department of Economics.

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[a] Not in residence, Academic Year 1968-69.

ENGLISH

Professors: ALTIZER, CREED, ERDMAN, KAZIN, KRANIDAS, LEVIN, LUDWIG[a], RIBNER (*Chairman*), L. SIMPSON, WEISINGER

Associate Professors: FIESS, GOLDBERG, MARESCA, MILLER, PEQUIGNEY, ROGERS, STAMPFER, THOMPSON

Assistant Professors: ABRAMS, ANSHEN, BENNETT, BRETT, DIBBLE, DOLAN, EGLESON, FORTUNA, HALL, HARVEY[a], LORD, NELSON, PETTY, RASKIN, 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

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[a] Not in residence, Academic Year 1968-69.

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.
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.

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 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. A course entirely devoted to the writer taken while the student was an undergraduate will be accepted as fulfilling this requirement. 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.

Only one course numbered 599, Independent Studies, will be permitted to count toward the total of eight courses required for the degree of Master of Arts in English. EGL 599 cannot be elected during the student's first semester of work toward the Master's degree. EGL 599 may be elected during the second semester only if the student has a B+ average the first semester and only if he has no Incompletes at the time of registering for EGL 599. A proposal for a 599 course should be submitted in writing before the end of the first semester to that member of the faculty under whose direction the student plans to study. The proposal must be approved in writing by both the director and the Graduate Program Committee of the Department before the student registers for EGL 599.

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.

Only one course numbered 590, Master's Paper Direction, will be permitted to count toward the total of eight courses required for the

degree of Master of Arts in English. EGL 590 cannot be elected during the student's first semester of work toward the Master's degree. A synopsis or outline of the proposed paper should be submitted in writing before the end of the first semester to that member of the faculty under whose direction the student plans to write his paper. The proposal must be approved in writing by both the director and the Graduate Program Committee of the Department before the student registers for EGL 590. The student can satisfactorily complete EGL 590 only by finishing an acceptable paper. If the student does not complete his paper during the semester in which he is enrolled in EGL 590, or before the end of the period in which an "Incomplete" must be made up, he will receive "No Credit" for the course.

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.

F. Credit for work done elsewhere: A maximum of six hours of credit for work done at another institution may be allowed toward the degree of Master of Arts in English at State University of New York at Stony Brook. Such work must have been done when the student was registered at the other institution as a graduate student in English and American Literature and Language, and must have been at the graduate level, that is, the courses must be comparable to Stony Brook's 500-level courses. Stony Brook does not grant transfer credit automatically. It considers granting such credit only upon written application to the Director of Graduate Studies in English after the student has been admitted to the program.

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.

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. 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 Advisory Committee 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.

B. Residence requirements: Every student is normally expected to make a three year commitment to study toward the doctorate. Part-time study during any of these years is not normally permitted. 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 690 Thesis Research or 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.

C. 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 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 Interns and 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.

D. 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 his ability 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.

E. 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: 1890-Present and American Literature: 1870-Present
VII Language and Linguistics*
VIII A single genre, from its beginnings in English literature throughout its development.

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 dissertation and three three-hour written examinations, one 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.

F. 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 and his Advisory Committee 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.

G. Thesis Colloquium: The student will present the results of his dissertation research at an informal colloquium convened for that purpose by the Department of English and open to interested faculty and graduate students.

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.

As soon as the student is admitted to the Ph.D. program he is asked to recommend to the Graduate Program Committee the names of four or five professors he would like to serve on his Advisory Committee. The student may include the name of the advisor originally assigned to him. The Graduate Program Committee will then ask

three of the student's nominees to serve as his Advisory Committee throughout the period of the student's work toward the degree. The Graduate Program Committee will also name one of the three members of the Advisory Committee to serve as its chairman. The student's advisor or the chairman of his Advisory Committee must sign the student's course card during registration. On occasion the advisor or Advisory Committee may recommend that the student take more or fewer courses than he wishes to.

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. Incompletes: If a student wishes to request an Incomplete, he must, before getting the course instructor's approval, apply to the Graduate Program Committee for its approval. The student will be required to write a full account of his reasons for requesting an Incomplete and the course instructor will have to approve of these reasons after the Graduate Program Committee has given its approval. The Graduate Program Committee will not automatically grant a request for an Incomplete.

   The Graduate Program Committee has established as sufficient grounds for the granting of Incompletes either medical reasons on the part of the student himself or emergencies arising within the student's family.

D. 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 are members of the Colloquium. 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 sometimes 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 to study for the Ph.D. degree. All graduate courses normally carry three credits.

Each course in the 500 or 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

EGL 501 Studies in Chaucer
Variable and repetitive credit

EGL 502 Studies in Shakespeare
Variable and repetitive credit

EGL 503 Studies in Milton
Variable and repetitive credit

EGL 505 Studies in Genres
Variable and repetitive credit

EGL 506 Studies in Literary Theory
Variable and repetitive credit

EGL 509 Studies in Language and Linguistics
Variable and repetitive credit

EGL 510 Studies in Old English Language and Literature
Variable and repetitive credit

EGL 515 Studies in Middle English Language and Literature
Variable and repetitive credit

EGL 520 Studies in the Renaissance
Variable and repetitive credit

EGL 525 Studies in Mannerist Literature
Variable and repetitive credit

EGL 530 Studies in Baroque Literature
Variable and repetitive credit

EGL 535 Studies in Neoclassicism
Variable and repetitive credit

EGL 540 Studies in Romanticism
Variable and repetitive credit

EGL 545 Studies in Victorian Literature
Variable and repetitive credit

EGL 548 Studies in Late Nineteenth Century British Literature
Variable and repetitive credit

EGL 550 Studies in Twentieth Century British Literature
Variable and repetitive credit

EGL 560 Studies in Early American Literature
Variable and repetitive credit

EGL 565 Studies in Nineteenth Century American Literature

Variable and repetitive credit

EGL 570 Studies in Twentieth Century American Literature

Variable and repetitive credit

EGL 580 Studies in British and American Literature

Variable and repetitive credit

EGL 590 Master's Paper Direction

EGL 597 Practicum in Methods of Research

Variable and repetitive credit

EGL 599 Indepent Studies

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

HISTORY

Professors: CHINCHILLA AGUILAR, MAIN, SEMMEL, TAYLOR, TRASK, WHITAKER (*Visiting*)

Associate Professors: ANGRESS, BURNER, CLELAND[a], PAXTON, PRATT, ROSENTHAL, STAUDENRAUS, WELTSCH, (*Adjunct*), WILDMAN, WILLIAMS

Assistant Professors: ALIN, BOTTIGHEIMER[b], HAMNETT, KNIGHT, LEBOVICS, R. H. G. LEE, LEVINE, MARCUS

Lecturer: KAVENAGH

Admission to Graduate Study

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

A. An official transcript of undergraduate record.
B. Letters of recommendation from *three* previous instructors.
C. Results of the Graduate Record Examination, though not mandatory, are desirable to help in the selection process for admission. Applicants are strongly urged to submit them.
D. A baccalaureate degree in history, or its equivalent.
E. A minimum grade-point average of 2.75 (B—) in all undergraduate course work, and 3.00 (B) in history courses.
F. Acceptance by the Department of History and the Graduate School.

In special cases, students not meeting requirements D. and E. may be admitted on a provisional basis.

With the approval of the Dean of the Graduate School and the History Department, a student holding an M.A. degree from another accredited institution may be admitted directly to the Ph.D. program at Stony Brook.

Degree Requirements

The Master of Arts Degree

The Master's degree requires at least one year (two semesters) of residence, including a minimum of 24 hours of course work, an oral examination, and any additional work which the student may be required to take. The nature and scope of such additional work will depend on the student's state of preparation

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[a] Not in residence, Fall 1968.
[b] Not in residence, Spring 1969.

for graduate studies and will be determined by his graduate advisor. Furthermore, the candidate must prove his proficiency in one foreign language by taking an examination no later than the beginning of the second semester in residence. If he fails the examination, he will have to retake it until he passes it. Under no circumstances can the M.A. degree be awarded to any student who has not yet passed his first language examination. A student entering the program with an M.A. from another institution who has not already passed one language examination must pass such an examination within his first semester of residence at Stony Brook.

The 24 hours of course work must include the following: two research seminars, taken with two different instructors; two reading seminars, taken with two different instructors; and such advanced upper division courses as the student's training will require. Ordinarily, an M.A. candidate will be expected to work in his major field and also to begin course work in one of the minor fields required for the Ph.D. degree (see below, Ph.D. Selection of Fields and Examinations).

The M.A. oral examination committee will be composed of at least three members of the faculty appointed by the Departmental Graduate Committee in consultation with the student's advisor. The oral examination for the M.A. will be in the student's major field of concentration, to be defined and delimited by his major advisor.

The Doctor of Philosophy Degree

PH.D., PRELIMINARY REVIEW

When a student has completed his work for the M.A. degree, his record will be reviewed by the departmental Graduate Committee. Unless the student's record promises success in the more difficult and more independent work for the Ph.D., he will be discouraged from further graduate study in history.

PH.D., GENERAL REQUIREMENTS

The Ph.D. is not a degree which can be obtained by satisfying course requirements. The chief specific tasks of the student are to prepare for his preliminary examinations and to write his dissertation. However, to insure adequate preparation for the preliminary examinations, the student will ordinarily take course work in his minor fields as well as in his major dissertation field.

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. He must prove his proficiency in a second foreign language prior to taking preliminary examinations, and he must write a dissertation. The preliminary examinations will test the student's proficiency in his

major field and two minor fields (see below, *Ph.D., Selection of Fields and Examinations*).

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. preliminary examinations in his major field and his two minor fields.

All Ph.D. students will be required to take a three-hour 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 preliminary examinations until he has passed the required language examinations.

PH.D., SELECTION OF FIELDS AND EXAMINATIONS

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:

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 economic, 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

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.

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.

Preliminary Examinations

The minor fields will be passed by two written examinations, three hours each in length; the major field by a two-hour oral examination. 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. Whatever the emphasis may be, the student will be held responsible for demonstrating an overall comprehension of his entire major field (Division). 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.

Advancement to Doctoral Candidacy

A student will be considered a candidate for the doctorate after he has completed all Graduate School and departmental requirements for the degree other than the dissertation. No student will be advanced to candidacy until he has met his language requirements and has passed his preliminary examinations. Advancement to candidacy is granted by the Graduate Dean upon recommendation of the department.

Research and Dissertation

A dissertation is required for the Ph.D. degree. After advancement to candidacy, a student will register for dissertation credits in consultation with his adviser, who will be appointed by the departmental chairman. The student will select his dissertation topic from the sphere of special emphasis within the major field. At present, the department can offer dissertation fields only in U.S., Modern European and Latin American History. The department anticipates adding Early Modern and Medieval Europe as dissertation fields as soon as additional faculty appointments in this field are made.

The dissertation must upon completion be approved by a Dissertation Examining Committee of at least four members of the faculty, appointed by the Graduate Dean. This Committee may include the dissertation supervisor and must include at least one person from outside the department.

Before final approval can be granted, the student must present the results of his dissertation research at an informal dissertation colloquium convened for that purpose by the department and open to interested faculty members and graduate students.

Time Limit

All requirements for the Ph.D. Degree must be completed within four years after advancement to candidacy. In rare instances, the Dean of the Graduate School will entertain a petition to extend this time limit, provided it bears the endorsement of the Chairman of the Department. For further details see Item #6 of the Graduate School Regulations.

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.

The Department is prepared to offer the following courses, although not all of them are given in each academic year:

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 533 Reading Seminar in American Cultural 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

Variable and repetitive credit

HIS 582 Directed Reading for M.A. Candidates I

HIS 584 Directed Reading for M.A. Candidates II

HIS 585 Directed Reading for M.A. Candidates III

HIS 586 Directed Reading for M.A. Candidates IV

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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 633 Research Seminar in American Cultural 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 I

HIS 684 Directed Reading for Ph.D. Candidates II

HIS 685 Directed Reading for Ph.D. Candidates III

HIS 686 Directed Reading for Ph.D. Candidates IV

HIS 699 Research for Ph.D. Candidates

MATHEMATICS

Professors: ADLER, BARCUS,[a] DOSS, LISTER, RAPAPORT, SZUSZ

Associate Professors: FARKAS, W. FOX, PINCUS (*Adjunct*), THORPE, ZAUSTINSKY

Assistant Professors: BACHELIS, D'ALARCAO, FEINER, J. W. HELTON, KUMPEL, KRA, OH, PHILLIPS, ROITBERG, ROSENTHAL, 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 analysis, algebra and one other subject to be approved by the Department. 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 Comprehensive Examination during their second year.

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[a] Not in residence, Academic Year 1968-69.

Requirements for the Ph.D. Degree

A. Language proficiency: The student is expected to demonstrate his ability in translating technical literature in two of the following languages: French, German and Russian.
B. Preliminary examination: The examination will test mastery beyond the fundamentals in one area, and will be based on syllabi provided by the Department. Graduate students who have passed the Comprehensive Examination, and whose records are considered promising by the departmental Graduate Committee, are eligible to take the Preliminary Examination for the Ph.D.
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 dissertation: After advancement to candidacy, each graduate student will apply for departmental approval of a thesis advisor. A Dissertation Examining Committee of at least four members will be appointed in accordance with the regulations of the Graduate School.

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, 313 Introduction to Topology

Introduction to point set topology: connectedness, compactness, continuity, etc. The fundamental group and covering spaces. Simplicial complexes and introduction to homology groups. Classification of surfaces. Differential manifolds, differential forms and DeRham's theorem.
Prerequisites: MAT 202 and 232.
3 credits per semester

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

Differential manifolds and submanifolds, tensor bundles, theorems of Stokes, Froebenius, and deRham; linear connections, Riemannian manifolds and the Riemannian connection, geodesics, elements of Morse theory of 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

DEPARTMENT OF MUSIC

Professors: LAYTON (*Chairman*), NEMIROFF

Associate Professors: LESSARD, LEWIN

Assistant Professor: BONVALOT

Instructor: KRAMER
Director of Choral Music: GREGG SMITH
Performing Artists in Residence: ADELE ADDISON, SAMUEL BARON, MARTIN CANIN, RALPH FROELICH, DAVID GLAZER, BERNARD GREENHOUSE, SIMON KARASICK, JACK KREISELMAN, PAUL MAKANOWITZKY, RONALD ROSEMAN, ARTHUR WEISBERG
Performing Group in Residence: THE NEW YORK WOODWIND QUINTET
The Department of Music expects to offer graduate programs beginning 1969-70 leading to the Master of Arts degree in musicology and in composition, and the Master of Music degree in performance. Information about these programs may be obtained by writing to the Department of Music.

PHYSICS

Professors: BALAZS, G. BROWN[c], COURANT[ac], DRESDEN[c], EISENBUD *Chairman*, FEENBERG[c] (*Visiting*), FEINGOLD, FINOCCHIARO (*Visiting*), D. FOX, M. GOLDHABER[c] (*Adjunct*), M. GOOD, LAMBE, B. W. LEE[c], L. L. LEE, JR., MUETHER, POND, SILSBEE, STRASSENBURG, SWARTZ, TOLL, THOULESS[c] (*Visiting*), WILCOX, YANG[c]

Associate Professors: AMES, CHIU[b], CRAIG[a], DEZAFRA, FOSSAN, R. GRIFFITHS[c] (*Visiting*), GUNSON[c] (*Visiting*), KAHN, KAO, KIRZ, KUO, LEE-FRANZINI, MOULD, SKOLNICK, THADDEUS[b]

Director of the Physical Laboratory: EKLUND
Assistant Professors: COLE, EMMONS, FOSTER, FREEDMAN[c], A. GOLDHABER[c], GRAF, GRANNIS, GROENEVELD[c], HWA[c], INGBER, A. JACKSON, KAYSER[c], KRAMER, Y. Y. LEE, MCGRATH, NIEH[c], PAUL, TAKAHASHI (*Visiting*), WEINBERG

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[a] Physicist, Brookhaven National Laboratory, on part-time appointment at Stony Brook.
[b] Member, NASA Goddard, on part-time appointment at Stony Brook.
[c] Member, Institute for Theoretical Physics.

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.

In special cases, a student not meeting requirements A. (or, in unusual cases, requirement 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.

Qualifying Examination

Each first year student will take a Qualifying Examination in February. The examination will cover material normally studied in undergraduate physics' programs in American universities.

Requirements for the M.A. Degree

A. One year of residence, with registration in a program of courses approved by the advisor.

B. An average grade of at least "B" (3.0), and no grade of "F," in the following graduate courses: Analytical Mechanics, Electrodynamics, Mathematical Physics I, Quantum Mechanics I and II.

C. Passing of the Qualifying Examination.

Requirements for the Ph.D.

A. Two years of residence.

B. Passing of the Qualifying Examination.

C. Demonstration of proficiency in one language (French, German or Russian).

D. A grade of "A" or "B" in each of the following courses: Analytical Mechanics, Electrodynamics, Quantum Mechanics I, II, III, Mathematical Physics I, Statistical Mechanics. (With permission of the Graduate Committee, a student may satisfy this requirement in any of the above-listed courses by taking the course examination and receiving a grade of "A" or "B." A student who does not receive an "A" or "B" in a course or examination may, with permission repeat the examination the next time it is given.)
E. Passing of the Preliminary Examination: A student who begins graduate study at Stony Brook with neither advanced standing nor deficiencies will normally take this examination in September, at the beginning of his third year. The examination consists of a written and an oral part. In the written part, each student is examined in two areas of his choice. At present the list of areas includes: elementary particle physics, nuclear physics, solid state physics, statistical mechanics, astrophysics, and chemical physics. In special cases, a student may be given permission to choose an alternate area. The oral examination consists of the defense of an original proposition developed by the student.
F. Advancement to Candidacy: The Department's recommendation to the Graduate School for advancement to candidacy to the Ph.D. is based primarily on the satisfactory completion of requirements B, C, D, and E, above.
G. Teaching experience at least equivalent to that obtained in a one-year appointment as a teaching assistant.
H. Research, thesis, and the passing of the thesis examination.

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 participate in 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. One of the two areas of the written examination will be Chemical Physics; the original proposition must also be on a topic in this area.

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.

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 600 Practicum in Teaching

2 credits

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 1968-69 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 698 Colloquium

1 credit

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: BREHM, GARCIA, KALISH (*Chairman*),[a] KRASNER,[b] A. ROSS, STAMM, WYERS

Associate Professors: BRAMEL, DAVISON, GEER, GOLDFRIED, M. LEVINE, MORRISON,[c] SINGER

Assistant Professors: D'ZURILLA, EMMERICH, FEHMI, GHOLSON,[d] F. LEVINE, O'LEARY, POMERANZ,[e] SCHVANEVELDT, M. SMITH, VALINS, WEINTRAUB, 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 Ph.D. 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, which may include credits for supervised teaching and research.

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[a] Not in residence, Academic Year 1968-69.
[b] Director of Clinical Training.
[c] Associate in Instructional Resources.
[d] Visiting part-time.
[e] Director of Psychological Services.

Preliminary Examination

The Preliminary Examination ordinarily must be completed by the end of the fourth 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.

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.

Advancement to Candidacy

Upon successful completion of the Language Requirement and the Preliminary Examination, the student is recommended for advancement to candidacy for the Ph.D.

Courses

PSY 501 Quantitative Methods I

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

PSY 502 Quantitative Methods II

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

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 The Development of Behavior

A consideration of contemporary theories and research in the area of personality, deviant behavior, and the social labeling process. Emphasis will be on the developmental point of view in understanding behavior.
Fall, 3 credits

PSY 522 Behavior Deviation

Theories, data, and research methods involved in the study of deviant behavior will be covered. Emphasis will be on experimental approaches to psychopathology.
Fall, 3 credits

PSY 527, 528 Assessment of Behavior

Techniques of psychological measurement and assessment as they relate both to theoretical formulations and to specific clinical problems involving assessment and modification of behavior. Emphasis will be on the development of new assessment procedures. This course will be taught in conjunction with Practicum, PSY 531, 532.
Spring and Fall, 3 credits

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.
Spring and Fall, 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.
Spring, 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.
Fall, 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, pharmcological 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 habituation 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: L. Coser,[a] R. Coser,[a] Lang, Selvin *(Chairman)*, Weinstein[b]

Associate Professors: Gagnon, Goodman, Polsky

Assistant Professors: Berger, Cole, Collver, Farberman, Feldman, Goode, Hudson, Oestereicher, Pitts, Weitman

Lecturers: Elsbery, Tanur

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.

Applicants with a master's degree from an accredited university seeking admission to the Ph.D. program at Stony Brook must submit evidence (including a master's thesis or its equivalent) that their preparation is similar to the work demanded for that degree in this Department. Any deficiencies must be made up before they receive permission to take the preliminary examination for the Ph.D. degree.

Requirements for the Degree

A. Residence: Minimum residence is two years of full-time study includ-

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[a] Not in residence, Academic Year 1968-69.
[b] Not in residence, Fall 1968.

ing at least two consecutive semesters. Full-time study entails 12 or more credit hours per semester. Since a graduate assistantship (teaching or research) is considered part of the academic program, credit hours will be given for supervised teaching. Up to 6 credit hours per semester may be given for individual research work outside formal courses but under the supervision of a faculty member.

B. Courses: Students must successfully complete an approved program of study including two courses in sociological theory (either SOC 361 or 362 *and* SOC 506) and four courses in methods of research (SOC 501, 502, 503, and an approved course in computer programming). Apart from this, there is no minimum number of courses a student must take beyond meeting the residence requirements. The adequacy of his general preparation will be evaluated by means of a written Departmental examination, covering the four major substantive areas of Sociology:

Social Ecology (Demography, morphology of communities, role of technology, etc.); Social Psychology (socialization, social interaction, etc.); Social Structure (organizations, institutions, stratification, etc.); Social Dynamics (social change, collecive behavior, social processes, etc.).

This examination, to be taken between the end of the second and the end of the fourth semester of graduate study, must be passed at the standard set by the Department for Ph.D. level work. Only under special circumstances will a student who fails to pass this examination at the required level but whose performance is satisfactory in all other respects be permitted to take a *terminal* M.A. by completing 30 credits of graduate course work, satisfying the language proficiency requirement, and submitting an acceptable research report.

C. Language proficiency: Passing of an examination demonstrating ability to translate technical literature in either French or German will satisfy this requirement. Substitution of another language requires written permission by the Department.

D. Research report: Every student must submit a research report that demonstrates his ability to analyze empirical data and to present his findings clearly and systematically. Upon successful completion of all the above requirements, the Department will recommend to the Dean of the Graduate School that the student be awarded the M.A. degree as a sign of progress toward the Ph.D. However, recipients of the terminal M.A. will not be granted permission to continue.

E. Preliminary examination: This takes the form of an oral examination in the student's specialty to be given only after all requirements for

the M.A. degree have been met. It is designed to appraise the depth and breadth of his knowledge in a broad area from within which he will normally select his dissertation topic and where he has developed competence beyond that demanded of all graduate students. The content of the specialty is to be defined individually for each student in relation to his chosen field of interest.

F. Advancement to Candidacy: The Department's recommendation that a student be advanced to candidacy for the Ph.D. is based on his passing the preliminary examination.

G. Research and dissertation: The doctoral dissertation must be an independent piece of research and scholarship of high quality, which represents an original contribution the results of which are worthy of publication. Upon oral defense and acceptance of the dissertation, the Department will recommend to the Dean of the Graduate School that the student be awarded the Ph.D. degree.

The progress of every student will be evaluated by the Department at the end of the first full year of graduate study. Those whose performance and ability as judged by their course work and Departmental examination are clearly below the standard for Ph.D. established by the Department will be asked to withdraw before they have made a costly investment of time. If more than four years should elapse between a student's *advancement to candidacy* and the submission of the finished dissertation, his Ph.D. candidacy may lapse and he can be required to take a second set of examinations.

After the first year, a progressively larger proportion of a student's time will be spent as a participant in research activities, under the supervision of faculty members. Ordinarily, a student with adequate preparation and involved in full-time study should be able to earn his Ph.D. within four years from the time he begins graduate work.

Courses

Advanced Undergraduate Courses

SOC 341 Historical Sociology

Sociological theories and methods applied to the study of historical phenomena, such as revolutions, migration, and industrialization.
Mr. Weitman
Prerequisite: SOC 103 *and* permission of instructor.
Fall, 3 credits

SOC 351 Sociology of Literature

Literature as a symbolic expression of social structure; the relations between literary movements and other forms of social activity.
Mr. Oestereicher
Prerequisite: SOC 103 *and* permission of instructor.
Fall, 3 credits

SOC 358 War and Military Institutions

The role of violence in social affairs; military organizations; civil-military relations.
Mr. Lang
Prerequisite: SOC 103 *and* senior standing.
Fall, 3 credits

SOC 361 Historical Development of Contemporary Sociology

Main currents in the development of theories and empirical studies of society, culture, and personality.
Mr. Oestereicher
Prerequisite: SOC 103 or permission of instructor.
Fall and Spring, 3 credits each semester

SOC 362 Sociology Today

Recent advances in research, theory, and method in the field of sociology.
Messrs. Farberman, Weitman
Prerequisite: SOC 103 or permission of instructor.
Fall and Spring, 3 credits each semester

Graduate Courses

SOC 501 Sociological Analysis

Problems in the analysis and interpretation of data.
Mr. Cole
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.
Mrs. Tanur
Prerequisite: One course in statistics.
Spring, 3 credits

SOC 503 Research Design

Decisions in the design of research, including choice of population, techniques of sampling, and methods of gathering and processing data.
Mr. Weinstein
Prerequisite: SOC 501.
Fall, 3 credits

SOC 506 Sociological Theory

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

SOC 508 Experimental Methods

The design, conduct, analysis of laboratory and field experiments.
Mr. Weinstein
3 credits

SOC 509 Field Work

Practicum in field interviews and observations; problems of rapport, reliability, and validity.
Mr. Gagnon
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.
Mr. Collver
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.
Messrs. Feldman, Goodman
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.
Messrs. Feldman, Goodman
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.
Mr. Goode
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.
Mr. Hudson
3 credits

SOC 541 Conflict and Violence

Conflict and violence as related to social change. Examination of community controversies, social movements, uprisings, and war.
Messrs. Coser, Lang
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.
Messrs. Gagnon, Polsky
3 credits

SOC 561 Sociology of Intellectual Life

A comparative and historical analysis of the social conditions leading to the development of intellectual professionals.
Mr. Coser
3 credits

SOC 562 Sociology of the Arts

The relations between social structure, social change, and the development of major art forms.
Mr. Polsky
3 credits

SOC 563 Sociology of Science

The relations between science and society; social influences on the choice of problems and methods; the social organization of scientific research.
Mr. Cole
3 credits

SOC 564 Communications

The social organization of the communications industry; the effects of mass communication.
Mr. Lang
3 credits

SOC 571 Sociology of Health and Medicine

Social factors in health and illness; the socialization of health practitioners; the social organization of hospitals, clinics, and other facilities.
Mrs. Coser
3 credits

SOC 590 Independent Study

Intensive reading under supervision of one or more instructors of material not covered in the formal curriculum.
Staff
Each Semester

SOC 591, 595 Special Seminars

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

SOC 598 Research

Staff
Each semester, credit to be arranged

SOC 603 Advanced Topics in Quantitative Analysis

Mathematical and statistical methods in the

analysis of quantitative data.
Mr. Selvin
Prerequisite: SOC 501 and SOC 502
3 credits

SOC 604 Advanced Topics in Qualitative Analysis

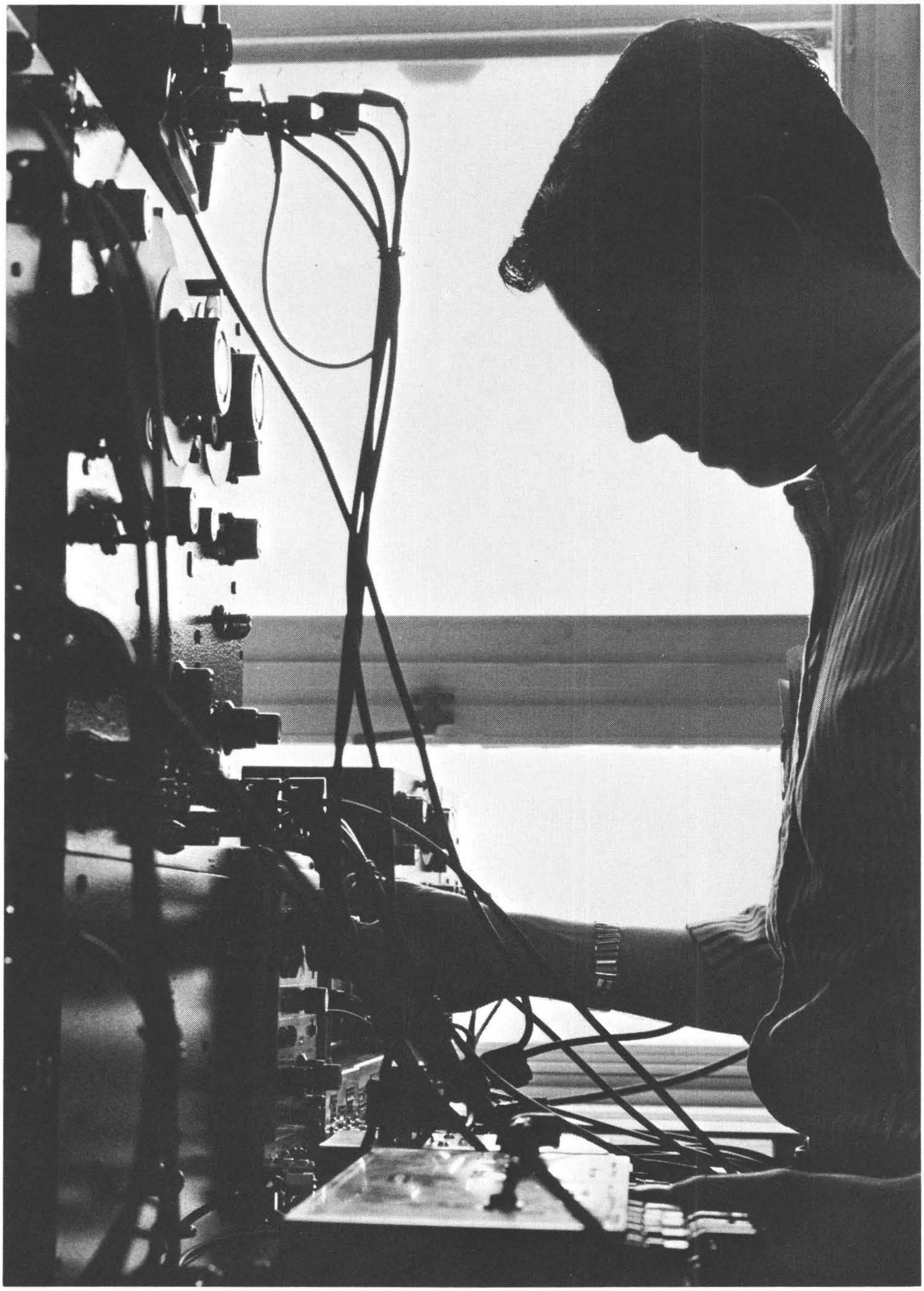
The use of personal documents, official records, field observations, and interviews.
Mr. Berger
3 credits

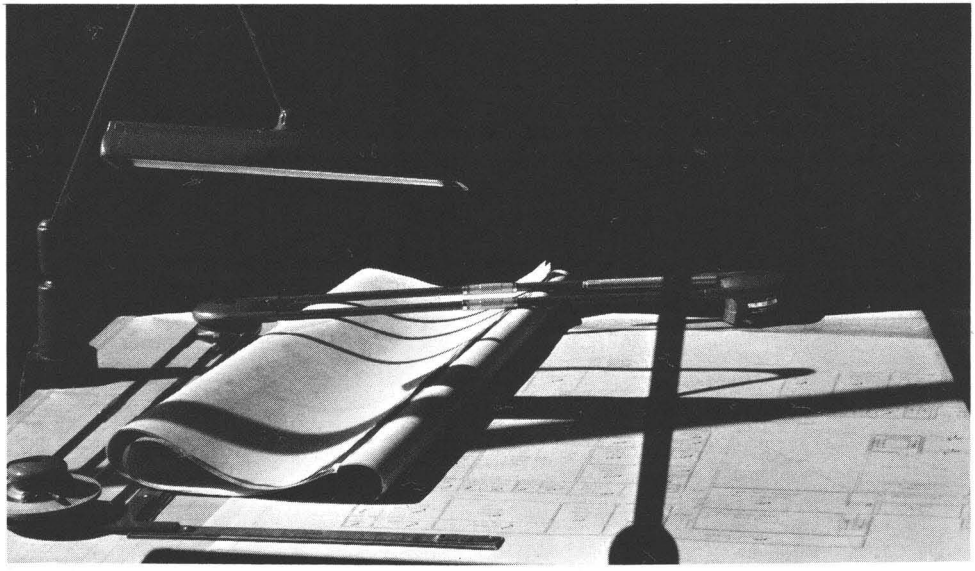
SOC 691 Practicum in the Teaching of Sociology

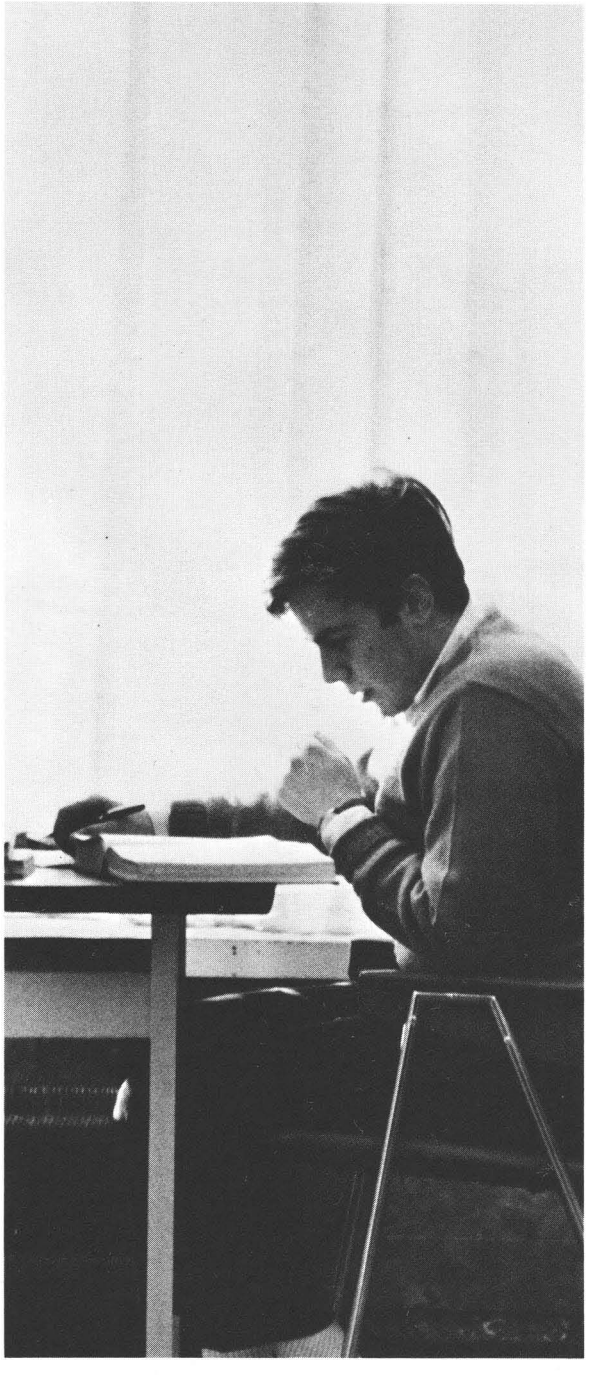
Lectures, discussions, and case studies of effective teaching. Designed especially for graduate teaching assistants.
Staff

SOC 698 Research for Ph.D.

Staff
Each semester, credit to be arranged







Lower left, part of the Engineering Quadrangle as viewed from Roth Quad. New graduate engineering facilities—a light laboratory building and a heavy engineering lab—are scheduled for completion this academic year.

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 Bachelor'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.

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

Requirements for the M.S. Degree

A. Residence: Two consecutive semesters of full-time study.

B. Formal course requirements: At least twenty-four credits (exclusive of credits for Research or Practicum in Teaching), eighteen of which must be graduate courses, while six credits may be 300-level courses in engineering, science or mathematics, at the discretion of the advisor. 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. 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.

E. Time limit: All requirements for the Master of Science degree must be completed within three years of the student's first registration as a graduate student.

Requirements for the Ph.D. Degree

A. Residence: Four semesters of full-time study beyond the baccalaureate including at least two consecutive semesters.

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. Advancement to candidacy: After the student has successfully completed all requirements for the degree other than the dissertation, he is eligible to be recommended for advancement to candidacy. This status is conferred by the Dean of the Graduate School upon recommendation of the Chairman of the graduate program.

G. Dissertation: The most important requirement of the Doctor of Philosophy degree is the completion of a dissertation which must be an original scholarly investigation. The dissertation 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 dissertation before an examining committee. On the basis of the recommendation of this committee, the Graduate Executive Committee will recommend acceptance or rejection of the dissertation to the Dean of the Graduate School. All requirements for the degree will have been satisfied upon the successful defense of the dissertation.

I. Time limit: All requirements for the Doctor of Philosophy degree must be completed within four years after advancement to candidacy.

APPLIED ANALYSIS

Professors: CHANG, DICKER, DOLEZAL *(Visiting)*, FINERMAN,[a] GELERNTER, GERST *(Chairman)*, ZEMANIAN[a]

Associate Professors: BELTRAMI, Y. CHEN, DOLLARD, LEIBOWITZ, D. LEVINE, SRIVASTAV, TEWARSON, THAMPURAN, TYCKO

Assistant Professor: JOSEPH

Requirements for the M.S. and Ph.D. degrees are listed on pages 91-93.

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.

In addition, the department sponsors a joint interdepartmental graduate program in computing science with the Department of Electrical Sciences, as described on page 101.

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 Courses

ESA 316 Special Functions of Applied Analysis

3 credits

ESA 335 Computer Organization and Programming

3 credits

ESA 340 Introduction to the Theory and Applications of Computers

3 credits

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[a] Not in residence, Academic Year 1968-69.

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

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 513 Linear Algebra, with Applications

Topics in linear algebra and matrix theory including matrix inequalities, systems of linear differential equations, and stability matrices. The Perron-Frobenius theorem with application to Markov chains and to economic models. Introduction to Hilbert space and to self-adjoint boundary value problems.
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 techniqu
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 positive-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. Multicommodity 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 555 Mixed Boundary Value Problems in the Mathematical Theory of Elasticity

Occurrence of mixed boundary value problems, preliminary mathematics, the problem of a disc, dual integral equations, Peter's solution, Titchmarsh's solution, Noble's solution, a distributional approach, dual series equations, dual equations involving Fourier-Bessel series, Dini series and trigonometric series. Tranter's solution, method of fractional integration, methods based on integral representation, applications to axisymonetric and plane problems of elastostatics.
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, Schwartz-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 579, 580 Algorithmic Languages and Compilers I and II

The first half of this course is dedicated to the development of a conventional compiler for a limited algorithmic language. The second half is used to explore advanced algorithmic languages, such as ALGOL, PL/I and the techniques used in their compilation. Study of syntax, semantics, ambiguities, procedures, and recursion in these languages.
Prerequisite: ESA 335, 340, or permission of instructor.
3 credits per semester

ESA 583 Simulation and Modelling

Statistical aspects of systems modelling. Syntax and usage of General Purpose Systems Simulator (GPSS). Mathematical-analytic tools of systems modelling. Analogue computer as a modelling guide. Construction of GPSS working models in engineering, biology, and the social sciences. The inverse simulation problem, black-box modelling. Simulation using the FORTRAN language, in physics, chemistry, and engineering. Prerequisites: ESG 162, elements of statistics, linear algebra, and ordinary differential equations, or permission of instructor.
3 credits

ESA 587, 588 Theoretical Foundations of Computing I and II

This course covers at an advanced level the mathematical and logical foundations of computing. Topics covered include: general syntax of formal languages, formal logistic systems, proof theory, the propositional and functional calculi, Turing machines, computability and unsolvability, Post canonical systems, recursively enumerable and recursive sets, recursive functions theory, heuristic programming and theorem proving machines.
3 credits per semester

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 Processes 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 651 Non-Linear Analysis and Optimization

The direct method of Liapunov for stability. Fixed point arguments and their use in establishing the convergence of iterative methods for non-linear operator equations. Frechet differentials. The Newton-Raphson method in function space and non-linear boundary value problems. The Courant penalty concept and constrained optimization. Gradient techniques and non-linear programming.
Prerequisite: ESA 503.
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, repetitive

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, repetitive

ESA 691 Seminar in Applied Analysis

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

ESA 695 Seminar in Numerical Analysis

Discussion of recent and current research in numerical analysis, along with supervised reading of journal articles.
Prerequisites: ESA 526, ESA 527, or permission of instructor.
3 credits

ESA 698 Practicum in Teaching

Variable and repetitive credit

ESA 699 Research

Variable and repetitive credit

INTERDEPARTMENTAL GRADUATE PROGRAM IN COMPUTING SCIENCE

Students enrolled in the Department of Applied Analysis or in the Department of Electrical Sciences may elect to participate in a joint program sponsored by both these departments leading to an advanced degree in Applied Analysis or Electrical Sciences with a designated option in Computing Science. The Computing Science Program faculty consists of members of the parent departments whose major research and teaching interests center in the computer related sciences. This joint faculty includes Professors Chang, Dollard, and Smith of Electrical Sciences and Professors Finerman, Gelernter, Levine, Tewarson and Tycko of Applied Analysis. Professors Smith and Tycko are Co-Chairmen of the Program.

A student participating in this program will follow the qualifying procedures of his own department, but will select his course of study from the offerings of both departments. His thesis research may be pursued under the direction of any member of the Computing Science Program faculty, regardless of parent department.

Suggested core sequence for the M.S. degree in Computing Science:

	Credits
ESA 335 Computer Organization and Programming	3
ESE 317 Digital Logic and Systems	3
ESE 550 Combinational Switching Theory	3
ESA 587 Theoretical Foundations of Computing I	3
ESA 526 Numerical Analysis I	3
ESA 580 Algorithmic Languages and Compilers	3
	18

If a student's background is sufficiently strong, he would not be required to take ESA 335 and/or ESE 317.

The remainder of the required 24 credits would be selected from the following elective courses:

	Credits
ESA 340 Introduction to the Theory and Applications of Computers	3
ESE 316 Digital Devices and Circuits	3
ESE 551 Sequential Networks and Automata Theory	3
ESA 588 Theoretical Foundations of Computing II	3
ESA 583 Simulation and Modelling	3
ESA 527 Numerical Analysis II	3
ESE 531 Theory of Digital Communications I	3
ESE 532 Theory of Digital Communications II	3

ESE 541 Feedback Control Systems I	3
ESE 542 Feedback Control Systems II	3

The areas of faculty research in computing science in which a student may elect to pursue his thesis research are expanding rapidly as the faculty associated with the program is augmented. Presently, research is being conducted in the following subdisciplines of computing science:

Abstract Languages and Machines
Biomedical Computer Applications Research
Digital Communications
Digital Control
Graphic Information Processing
Numerical Analysis
Pattern Recognition
Simulation and Modelling
Simulation of Intelligent Behavior by Machine
Switching Theory and Digital Circuits

ELECTRICAL SCIENCES

Professors: CHANG (*Chairman*), GABOR (*Visiting*), KIEBURTZ,[a] MARSOCCI, STROKE

Associate Professors: DOLLARD, D. SMITH, TRAUTMAN

Assistant Professors: C. CHEN, THOMAS, TUAN

Requirements for the M.S. and Ph.D. degrees are listed on pages 91-93.

The Department of Electrical Sciences offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. These programs are designed to provide the student with a firm background in fundamental principles of analysis and synthesis on which to base further independent study. Ample opportunities exist for students to become involved in both experimental and theoretical research.

In addition, the department sponsors a joint interdepartmental graduate program in computing science with the Department of Applied Analysis, as described on page 101.

Some of the research areas currently being investigated by faculty members and graduate students include: optimal control theory, systems theory, digital communications techniques, pattern recognition by computers, synthesis of logic networks, electronic transport phenomena in solids, frequency-independent antennas, wave propagation in random media, and electromagnetic waves in gaseous plasmas, quantum electronics, coherent optics, holography.

Courses

ESE 510 Physical Electronics

The theory of electronic processes and devices. Electron ballistics, applications to vacuum and microwave devices. Elements of solid-state electronics, conduction in solids; solid-state devices, diodes and transistors. Magnetism, dielectrics, ferroelectrics; introduction to superconductivity and cryotrons. Elementary theory of masers and lasers.
3 credits

ESE 511 Solid-State Electronics I

A study of the electron transport processes in solids leading to the analysis and design of solid-state devices. Electrical and thermal conductivities, scattering mechanisms, diffusion, galvanomagnetic, thermomagnetic and thermoelectric effects. Hall-effect and magnetoresistive devices. Conductivity in thin films. Ferroelectrics, piezoelectrics, theory of magnetism and of magnetic devices.
3 credits

ESE 512 Solid-State Electronics II

Resonance phenomena in solids; para- and ferromagnetic resonance, cyclotron resonance, electron spin resonance; applications to microwave devices and to measurements of

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[a] Not in residence, Academic Year 1968-69.

electronic parameters. Optical properties of solids, direct and indirect transitions, luminescence, photoelectric devices, photomagnetic effects. Elements of superconductivity, the macroscopic and the microscopic theories, tunnelling effects, application to the design of superconducting devices.
3 credits

ESE 513 Introduction to Electronic Processes in Solids

The fundamentals of the electronic energy-band structure of solids; a description of the direct and the reciprocal lattice, Bragg scattering. The one-electron model, the nearly free electron, interaction with lattice waves. Brillouin zones, the Fermi surface, electron dynamics.
3 credits

ESE 514 Semiconductor Electronics

The theory of semiconductor electronics and related devices. Conduction mechanisms in semiconductors; trapping centers, recombination centers, surface states. The continuity equation, p-n junction theory of the junction transistor, transistor characterization. Metal to semiconductor contacts, theory of metal-oxide-semiconductor transistors. Introduction to integrated-circuit devices.
3 credits

ESE 515 Quantum Electronics

An advanced course of the fundamental theories and the applications of quantum electronics. Introduction to quantum radiation theory, transition probabilities, perturbation theory. Solid-state masers, travelling-wave masers; principles of gaseous, liquid and solid lasers. Coherence, requirements for stimulated emission; laser modulation and detection techniques; quantum noise in amplifiers.
3 credits

ESE 520 Wave Propagation I

Theory of propagation of vector and scalar waves in bounded and unbounded regions. Equivalence theorems of field theory. Development of methods of geometrical optics. Propagation in inhomogeneous and in anisotropic media. Green's function for boundary-value problems.
3 credits

ESE 521 Wave Propagation II

Mode theory of guided waves. Expansion of wave functions in eigen-function series. Applications to propagation of electromagnetic waves in waveguides and around the earth. Propagation on periodic structures, and consequences of higher order symmetries. Operators with a continuous spectrum. Evaluation of radiation integrals by the method of steepest descent.
Prerequisite: ESE 520.
3 credits

ESE 522 Wave Propagation in Plasma

The course includes the following topics: introduction to the magnetoionic theory and plasma kinetic theory, wave propagation in unbounded plasma, guided waves at a plane plasma interface and its application to terrestrial propagation, radiation from antennas in plasma.
3 credits

ESE 523 Antenna Theory

This course gives a systematical analysis of circuit and field properties of radiating and receiving antennas. Both physical concepts and mathematical techniques are emphasized. The following topics are included: basic concepts of antenna theory, cylindrical antennas, Hallen's integral equation, current distribution by iteration, by Fourier series methods. Fourier transform technique applied to an infinitely long antenna, antenna admittance, impedance and fields, coupled antennas, linear arrays, wave theory and array theory approach to a long linear array, theory of receiving antennas, loop antennas, antennas in a dissipative medium, aperture antennas, horn and reflector antennas.
3 credits

ESE 530 Introduction to Communications Principles

The basic model of communications systems. Modulation and detection. AM, FM, PM; DSB, SSB and vestigial sideband modulation. FM with feedback. Gaussian noise, signal to noise ratio, and threshold effects in continuous wave systems. The sampling theorem. PAM, PPM, and PCM systems. Quantization noise. Statistical properties of signals. Compandors, vocoders and TASI. Space-, time- and frequency-division multiplexing. Inter-

ference. Distortion. Subjective versus objective criteria of quality. The course emphasizes the underlying theory of the various communications techniques, rather than specific implementation. A major objective is to establish the relative importance of digital techniques in current communications practice, and to indicate some of the reasons why direct application of the more sophisticated theory has been most successful in digital systems.
3 credits

ESE 531 Theory of Digital Communications I
This is the first course of a two-course sequence. It begins with a brief review of probability theory leading to derivation of the Chernoff bound and the central limit theorem. There follows a review of random variables, random processes, and vector (multivariate) random variables and processes. The concepts of entropy and the measure of information, and the basic theorem of noiseless coding are introduced to justify the restriction of subsequent development of the theory to the case of independent equiprobable sources. Further topics include the vector model of digital communications systems, waveforms as vectors, time-bandwidth and dimensionality, the correlation receiver, matched filtering, probability of error and bounds thereon, and efficient signalling schemes. A course in basic probability theory or demonstration of familiarity with the basic concepts of probability is required. ESE 530 and/or ESA 507 are desirable but not prerequisite.
3 credits

ESE 532 Theory of Digital Communications II
The course is a direct continuation of Theory of Digital Communications I. It begins with a proof of the theorem of channel capacity. The concept of encoding for error protection is introduced as a special case of vector signals. Further topics include the basic algebraic structure of linear codes, 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
Basic system concepts. External (input-output) and internal (state variables) descriptions of linear systems. Controllability and observability. Canonical structure of dynamical equation. Realization of irreducible dynamical equation. Equivalence of internal and external descriptions. Stability and passivity.
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 560 Coherent Optics and Holography
Elective subject introducing the field of modern optics and electro-optical science. Topics include a review of the properties of light (quantum, electromagnetic, relativistic) and of basic geometrical and physical optics; coherence properties of light and coherent light generation, amplification and control with optical masers; operational Fourier-transform and convolution theory treatment of optical image-forming processes in coherent and in incoherent light, diffraction, interferometry, wavefront-reconstruction imaging and holography. Particular emphasis is placed on generally applicable fundamentals, as well as on similarities and relations with microwave and electronic systems techniques. The theory is developed and illustrated with examples drawn from the most recent ramifications, including applications of holography, such as optical computing, holographic interferometry (stress and vibration analysis), radar, microwave and acoustical imaging, character recognition, synthesized holograms and optical correlators.
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.
3 credits

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 698 Practicum in Teaching
Variable and repetitive credit

ESE 699 Research
Variable and repetitive credit

MATERIALS SCIENCE

Professors: S. LEVINE, SEIGLE, THOMSON *(Chairman)*

Associate Professors: CARLETON, JACH, F. WANG

Assistant Professors: BILELLO, SIEGEL

Requirements for the M.S. and Ph.D. degrees are listed on pages 91-93.

The Department of Materials Science 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 science 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 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-

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 applied 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 616 Advanced Topics in Solids

Selection is made from topics such as: shape of the Fermi surface in metals, theory of de Haas van Alphen effect, cyclotron resonance, anomalous skin effect, magnetoplasma wave propagation, acoustic attenuation. Energy bands in semiconductors and spin resonance, impurity states, optical absorption and ex-

citons. Theory of alloys, neutron diffraction by crystals, Mossbauer effect.
3 credits

ESM 618 Electric and Magnetic Polarization of Materials I

This course is designed to teach the student 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 696 Special Problems in Materials Science

Supervised reading and discussion of selected publications in particular fields of materials science. This course is designed primarily for advanced graduate students who are, or expect to be, involved in research in these areas, although other students may enroll with permission of the instructor.
3 credits, repetitive

ESM 698 Practicum in Teaching

Variable and repetitive credit

ESM 699 Research

Variable and repetitive credit

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Assistant Professors: CARROLL, CHIANG, HARRIS, VARANASI, L. WANG

Requirements for the M.S. and Ph.D. degrees are listed on pages 91-93.

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

ESC 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

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[a] Not in residence, Fall Semester 1968-69.

flow. Concentration distributions in turbulent flow. Interphase transport in multicomponent systems.
3 credits

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 medium. 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

An advanced course in classical thermodynamics presented from the postulational point of view. Also considered will be such topics as Pfaff differentials and Caratheodorys principle, thermodynamics of irreversible processes, 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 isotropy. 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 ex-

tinction, 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 627 Special Topics of Combustion in Propulsion

Burning of fuel droplets in an oxidizing atmosphere. Flames and detonations in fuel sprays. Steady state combustion in rockets. Mixing and injection dynamics. Non-linear oscillations. Chugging and screaming modes of instability in liquid engines. Combustion processes and stability of solid rockets.
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

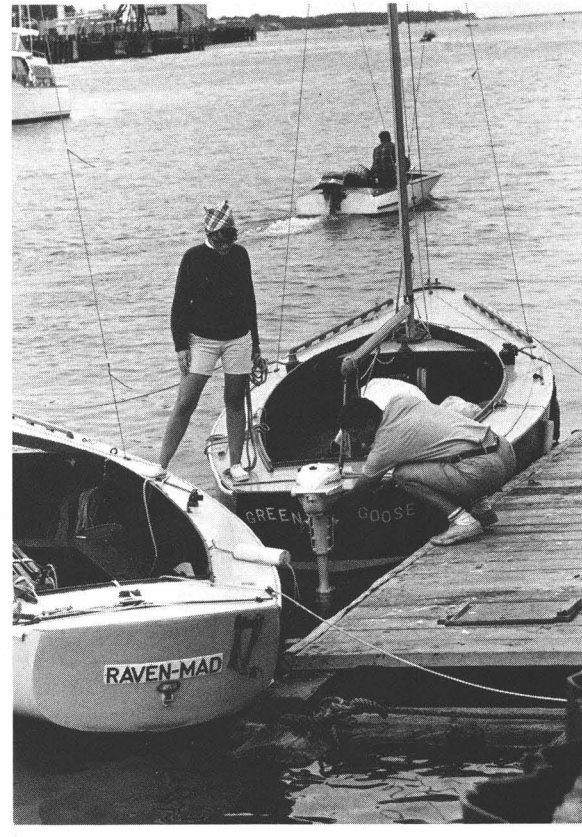
ESC 698 Practicum in Teaching

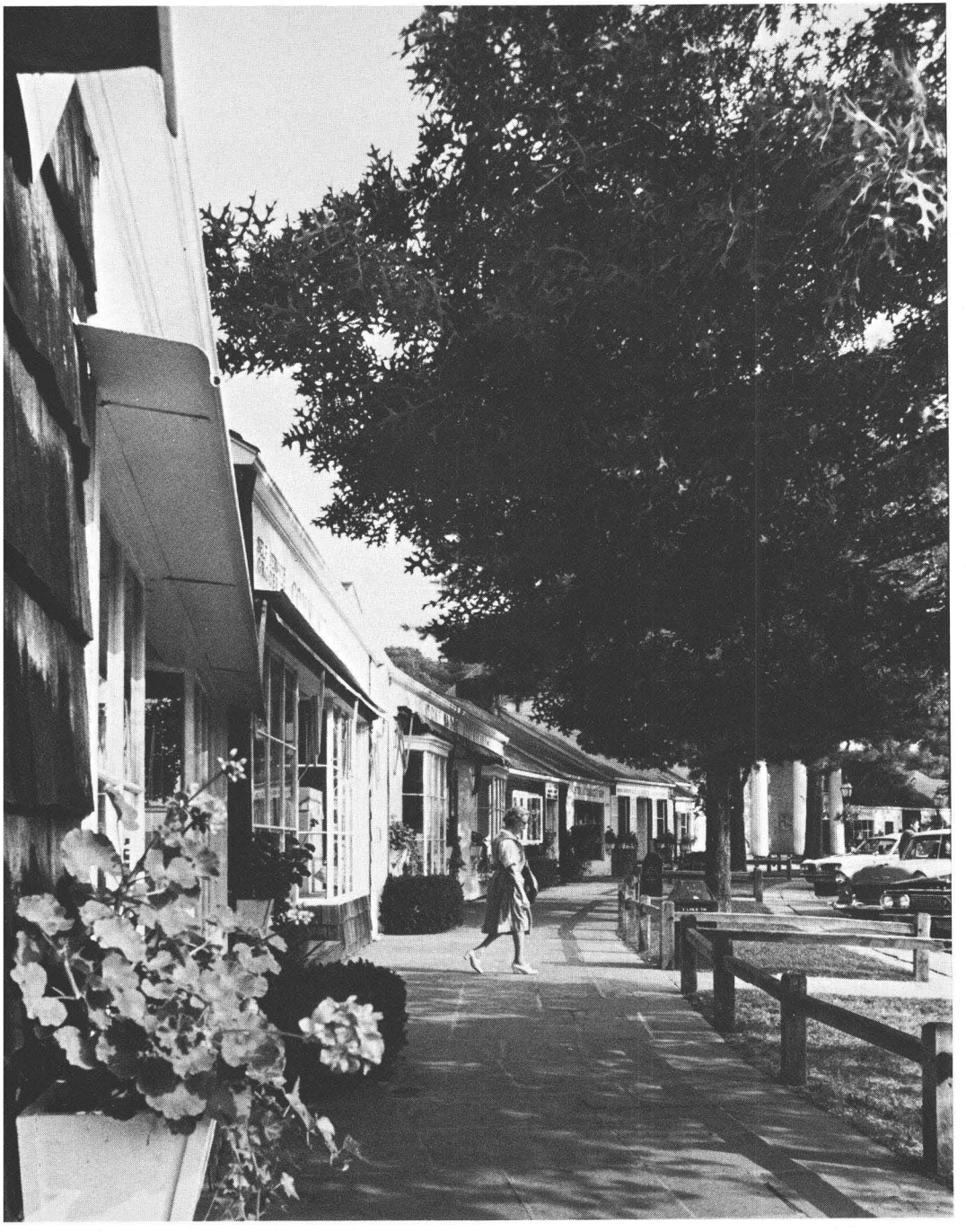
Variable and repetitive credit

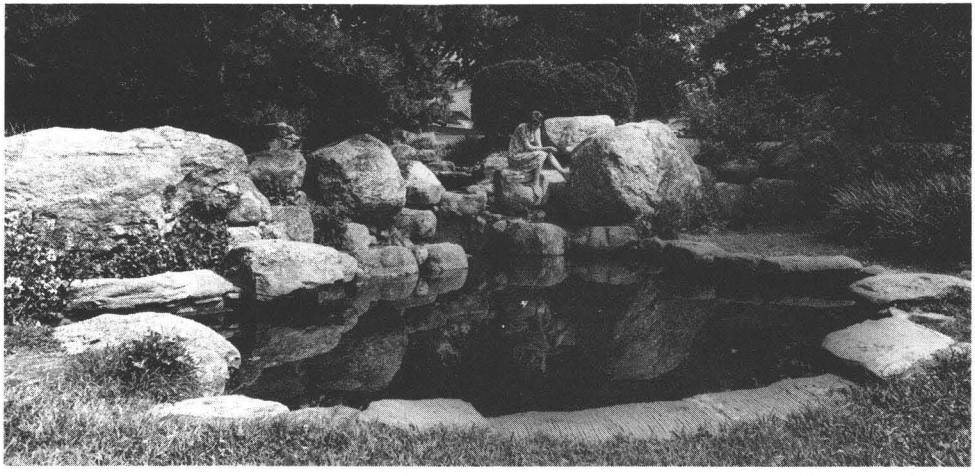
ESC 699 Research

Variable and repetitive credit

The 1,000 acre Stony Brook campus is located on a rolling, wooded site in the picturesque Three Village area, 50 miles northeast of Manhattan on Long Island's north shore. Shown here are scenes from the surrounding communities. The area has a distinctive New England flavor, having been settled more than three centuries ago by colonials who sailed across Long Island Sound from what is now Connecticut and Rhode Island.





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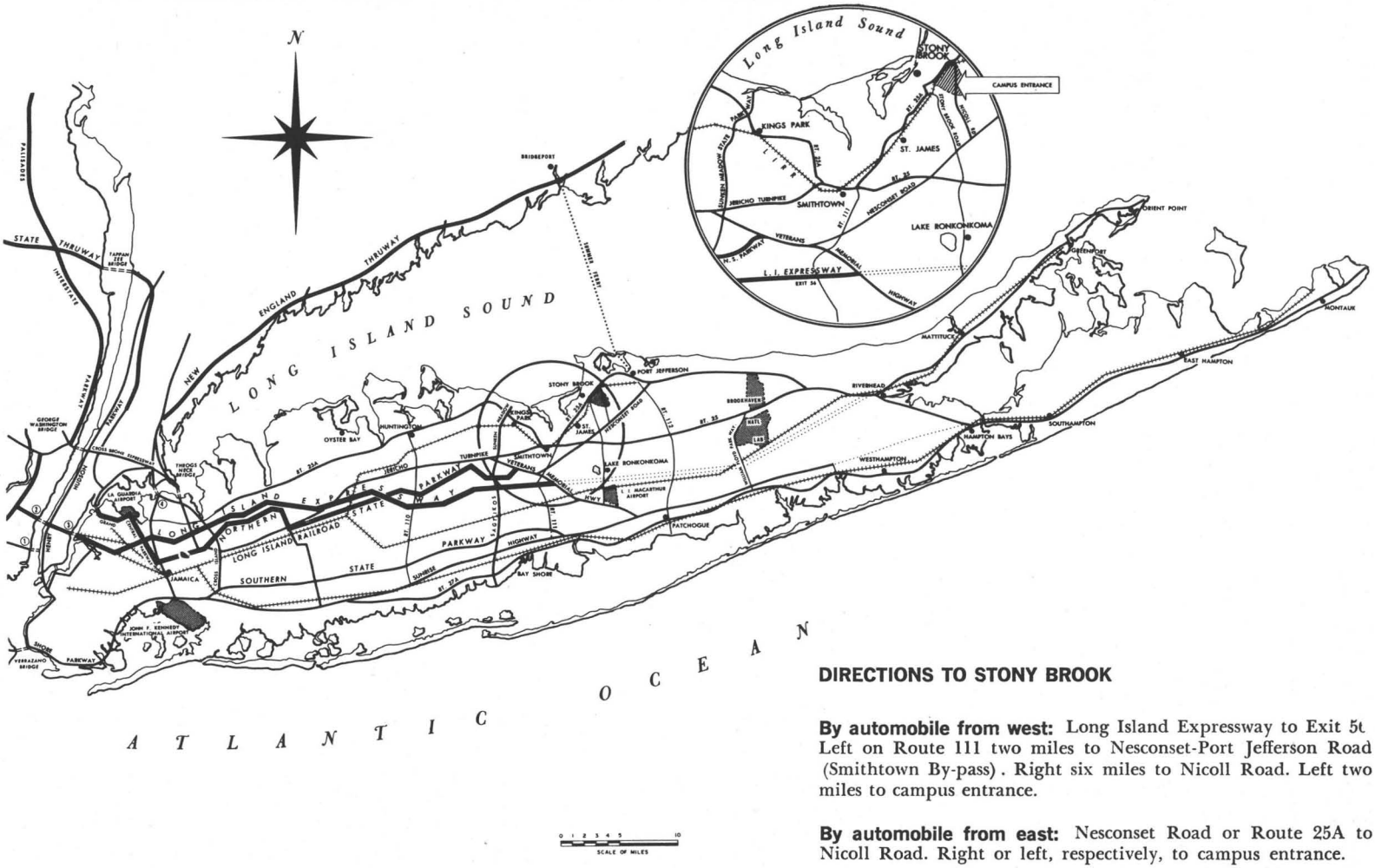

DIRECTIONS TO STONY BROOK

By automobile from west: Long Island Expressway to Exit 5t 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.

CAMPUSES OF STATE UNIVERSITY OF NEW YORK

Office of the Chancellor, 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

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 in varying stages of development. Two four-year campuses, in Westchester County at Purchase and in Nassau County at Old Westbury are under development. Old Westbury will admit its first students in limited numbers in September 1968. The third campus will be upper-division (junior-senior years) in concept and located in the Utica-Rome-Herkimer area. Master's level programs will be offered at all three campuses.)

SPECIALIZED COLLEGES

College of Forestry at Syracuse University
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)

Alfred
Canton
Cobleskill
Delhi
Farmingdale
Morrisville

COMMUNITY COLLEGES

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

Adirondack Community College at Glens 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
Community College of the Finger Lakes at Canandaigua
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
Genesee Community College at Batavia
Herkimer County Community College at Ilion
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 Stone Ridge
Westchester Community College at Valhalla

Five additional community colleges to be sponsored by Clinton, Columbia-Greene, Essex-Franklin (North County), Schenectady and Tompkins-Cortland Counties have been approved by the Board of Trustees and are in varying stages of development. Clinton and North Country plan to admit students in September 1968.


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